

CRANFIELD UNIVERSITY

School of Management
International Executive Doctorate

DBA

Academic Year 2014 - 2018

Frédéric Delley

**The Integration of Exploration and Exploitation in the Context
of Innovation Teams: Fostering and Leveraging Paradoxical
Tensions**

Supervisor: Prof. Patrick Reinmoeller

September 2018

This thesis is submitted in partial fulfilment of the requirements for
the degree of Doctor of Business Administration

© Cranfield University 2018. All rights reserved. No part of this
publication may be reproduced without the written permission of the
copyright owner.

ABSTRACT

This doctoral research was conducted in the context of Cranfield's Executive DBA program. The central theme running through each of the three papers that constitute the core of this thesis is the integration of exploration and exploitation in the context of innovation teams.

The first paper is a systematic literature review of the mechanisms used to integrate exploration and exploitation at multiple levels of the organization. Based on the findings from this review, the concept of "integrative capacity" is introduced and related propositions are developed. The second and third papers are empirical studies that examine different parts of Smith and Lewis's (2011) dynamic equilibrium model of tension management. The first is a quantitative study of 42 innovation teams. Its primary objective is to develop and validate hypotheses about optimal team configurations. Specifically, the study looks at the distribution of paradox mindsets within teams and its impact on the innovativeness of project outputs. The second is an exploratory, qualitative study of 16 senior innovation leaders working in large multinational organizations across different industries. It identifies the types of tensions that surface in the process of developing new products or services, describes the resolution strategies used to deal with these tensions, and infers causal relationships between the use of particular resolution strategies and their propensity to embed tensions in the context of new product development projects.

Together, these papers contribute primarily to paradox theory and, more specifically, to our understanding of how exploration and exploitation can be brought together in valuable ways in the context of innovation teams. Importantly, despite their unique perspectives and different methodologies, all three papers suggest that the synergistic integration of exploration and exploitation rests on two distinct and complementary sets of factors: those that foster and those that leverage paradoxical tensions.

Keywords: Paradox, innovation teams, integration, exploration, exploitation.

ACKNOWLEDGEMENTS

No one goes through four years of doctoral research without some valuable help, support, and guidance along the way. I would like to express my deepest gratitude to Prof. Patrick Reinmoeller, my thesis supervisor, who has given me the freedom to explore my interests while gently guiding the course of my research toward more promising paths than I could have imagined alone. I also feel privileged to have had two insightful members on my DBA panel – Prof. Emma MacDonald and Dr. Neil Turner – who have challenged my ways of thinking and writing yet left my motivation to plow ahead intact. Thank you also to Prof. Emma Parry and Dr. Elmar Kutsch, who have led our DBA cohort with a sense of humor while videotaping us mercilessly year after year. To my DBA companions of the 2014-2018 cohort, I shall not forget the time spent commiserating together. Closer to home, I am thankful for the help of Prof. Jamil Hebali and Mr. Ian Millar for handing out those surveys week after week to their teams, as well as for running daily checks on my mental well-being. While it pains me to do so in writing, I would be remiss if I did not acknowledge my good friend and colleague, Prof. Demian Hodari, who threatened to stop reading my papers if I did not make a more extensive use of paragraphs. And, of course, my love goes to Barbara, Leo, and Elliott who keep delighting me with the paradoxes they bring into our home every day.

TABLE OF CONTENTS

ABSTRACT	i
ACKNOWLEDGEMENTS.....	ii
LIST OF FIGURES.....	vi
LIST OF TABLES	vii
LIST OF ABBREVIATIONS.....	viii
LIST OF KEY DEFINITIONS	viii
1 INTRODUCTION.....	1
1.1 Empirical Context.....	3
1.1.1 A Practical Problem as the Starting Point.....	3
1.1.2 A Focus on Innovation Projects and Teams.....	4
1.1.3 Innovation Projects: A Context Filled with Tensions.....	5
1.2 Theoretical Perspectives.....	6
1.2.1 The Exploration versus Exploitation Duality	6
1.2.2 Ambidexterity Theory	7
1.2.3 Paradox Theory.....	9
1.3 Research Papers	12
1.3.1 Paper #1: A Systematic Review of Integration Mechanisms in the Context of the Exploration-Exploitation Duality	14
1.3.2 Paper #2: The Effect of Paradox Mindset Diversity on the Innovativeness of Project Teams	15
1.3.3 Paper #3: The Role of Paradox Resolution Strategies in Embedding Tensions – An Exploratory Study in the Context of New Product Development.....	17
2 A SYSTEMATIC REVIEW OF INTEGRATION MECHANISMS IN THE CONTEXT OF THE EXPLORATION-EXPLOITATION DUALITY	19
2.1 Abstract.....	19
2.2 Introduction	19
2.2.1 Management Strategies	20
2.2.2 The Growing Importance of Integration.....	22
2.3 Methods	25
2.3.1 Stage 1: Formulation of the Review Question	28
2.3.2 Stage 2: Search Strategy	29
2.3.3 Stage 3: Relevance and Quality Assessment	30
2.3.4 Stage 4: Analysis and Synthesis of Findings.....	33
2.4 Thematic Synthesis.....	34
2.4.1 Unifying Capability	38
2.4.2 Enabling Capability.....	39
2.4.3 Connecting Capability	43
2.4.4 Combinative Capability.....	45
2.5 The Nature and Effectiveness of Integration Mechanisms.....	48

2.5.1 The Nature of Integration Mechanisms	48
2.5.2 The Effectiveness of Integration Mechanisms	53
2.6 Discussion	56
2.7 Further Research and Limitations	58
2.8 Conclusion	59
2.9 References	61
2.10 Appendices	70
3 THE EFFECT OF PARADOX MINDSET DIVERSITY ON TEAM INNOVATIVENESS	72
3.1 Abstract	72
3.2 Introduction	72
3.3 Literature Review and Hypothesis Development	75
3.4 Methods	84
3.4.1 Sample	84
3.4.2 Measures	86
3.5 Results	91
3.5.1 Descriptive Statistics	91
3.5.2 Hypothesis Testing	91
3.6 Discussion	102
3.7 Future Research and Limitations	107
3.8 Practical Implications	109
3.9 References	110
3.10 Appendices	122
4 THE ROLE OF PARADOX RESOLUTION STRATEGIES IN EMBEDDING TENSIONS: AN EXPLORATORY STUDY IN THE CONTEXT OF NEW PRODUCT DEVELOPMENT	123
4.1 Abstract	123
4.2 Introduction	123
4.3 Literature Review	125
4.4 Methods	129
4.4.1 Research Context and Participants Selection	130
4.4.2 Data Collection	131
4.4.3 Data Analysis	134
4.5 Findings	137
4.5.1 Main Types of NPD Tensions	137
4.5.2 Approach to the Exploration-vs.-Exploitation Tension	147
4.5.3 Approach to the Plurality-vs.-Alignment Tension	153
4.5.4 Approach to the Novelty-vs.-Feasibility Tension	157
4.6 Characterization of Resolution Strategies	159
4.7 Preliminary Conceptual Model	169
4.8 Discussion	173
4.8.1 Implications for Theory	173

4.8.2 Implications for Practice	175
4.9 Limitations and Future Research	176
4.10 Conclusion	177
4.11 References	178
4.12 Appendices	188
5 RESEARCH IMPACT ASSESSMENT	192
5.1 Engagement with Practitioners during the Research Process	192
5.1.1 Problem Formulation	193
5.1.2 Study Design and Data Collection.....	195
5.2 Key Learnings and Impact on Practice	196
5.2.1 Key Learnings	196
5.2.2 Impact on My Own Practice	198
5.3 Dissemination and Exploitation.....	200
5.3.1 Beneficiaries and Opportunities for Impact.....	200
5.3.2 Ecole Hôtelière de Lausanne	201
5.3.3 Industry	206
5.4 Impact of the Doctoral Process.....	209
5.4.1 Impact on My Own Practice	209
5.4.2 Impact on My Organization	210
5.5 Appendices	212
6 Conclusion.....	216
6.1 Research Theme	216
6.2 Key Findings	216
6.3 Integrating Paradoxical Elements	219
6.4 Relevance to Other Fields of Research	220
6.5 Limitations.....	221
6.6 Main Contributions.....	222
REFERENCES.....	224

LIST OF FIGURES

Figure 1-1: Key Components and Structure of the Doctoral Project.....	2
Figure 1-2: Areas of Focus by Paper.....	13
Figure 2-1: Review Objective and Approach	25
Figure 2-2: Relevance and Quality Filtering Process	26
Figure 3-1: Conceptual Model	74
Figure 3-2: Statistical Model	91
Figure 3-3: Moderation Effect of Paradox Mindset Diversity	94
Figure 3-4: Conditional Effect of Perceived Paradoxical Tensions on Innovativeness with Regions of Significance at the 5% Confidence Level	95
Figure 3-5: Conditional Effect of Perceived Paradoxical Tensions on Innovativeness with Regions of Significance at the 10% Confidence Level	96
Figure 3-6: Indirect Effect (through Perceived Paradoxical Tensions) of Exploration-Exploitation Activity Overlap on Innovativeness	97
Figure 3-7: Innovativeness Means and Confidence Intervals Across Team Categories	102
Figure 4-1: Practice-Enabled Resolution Strategies.....	160
Figure 4-2: Temporal Differentiation Spectrum.....	168
Figure 4-3: Preliminary Conceptual Model	172
Figure 5-1: Team Paradox Mindset (PM) Profiles	203
Figure 5-2: Feedback on Paradox Management Discussion.....	205
Figure 6-1: Conceptual Model for the Integration of Paradoxical Elements....	220

LIST OF TABLES

Table 2-1: Core Articles Selected for this Review	27
Table 2-2: Search Strings.....	29
Table 2-3: From Integration Mechanisms to Organizational Capability	36
Table 2-4: Classification of Integration Mechanisms by Level of Analysis and Associated Capability	51
Table 2-5: Summary of Quantitative Studies.....	55
Table 3-1: Sample Characteristics	84
Table 3-2: Project Types and Client Industries.....	85
Table 3-3: Examples of Consulting Assignments	86
Table 3-4: Means, Standard Deviations, and Correlations	91
Table 3-5: Regression Results	93
Table 3-6: Hypothesis Support Summary.....	98
Table 3-7: Descriptives for Homogeneously Low, Heterogeneous, and Homogeneously High Teams	101
Table 3-8: Independent t-tests of Innovativeness Means	101
Table 4-1: Sample of Informants	133
Table 4-2: Number of References to Specific Tensions	138
Table 4-3: Representative Data of Clustered Practices that Support Distinct Approaches to Tensions	144
Table 4-4: Characterization of Resolution Strategies	167
Table 6-1: Summary of Findings	217

LIST OF ABBREVIATIONS

ACAP	Absorptive Capacity
FMCG	Fast-Moving Consumer Goods
NPD	New Product Development

LIST OF KEY DEFINITIONS

Tensions	Opposing demands or sources of contradictions and paradoxes that arise from complex and ambiguous systems (Lewis, 2000; Lewis, Andriopoulos and Smith, 2014; Smith and Lewis, 2011)
Dualities	Opposites that exist within a unified whole; internal boundary creates distinction and highlights opposition; external boundary encourages synergies by constructing the unified whole (Smith and Lewis, 2011). Note: In line with Smith and Lewis's use of the word, the term "pole" refers to one of the two opposites of a given duality.
Paradox	Contradictory yet interrelated elements (dualities) that exist simultaneously and persist over time; such elements seem logical when considered in isolation, but irrational, inconsistent, and absurd when juxtaposed (Smith and Lewis, 2011).

1 INTRODUCTION

This doctoral project sits at the intersection of two influential theories concerned with the management of conflicting objectives, and one empirical context of personal interest and broad business relevance. The theories are those of ambidexterity and paradox management; the empirical context is innovation teams. This introductory chapter aims to provide justifications for the choices that led to this positioning and follows a structure that reflects that positioning as illustrated in **Figure 1-1**. This chapter also briefly introduces the three papers at the heart of this doctoral project and discusses their respective contributions and collective coherence. The second, third, and fourth chapters are the three papers in question.

As is required for DBA projects, the fifth chapter discusses my engagement with practitioners over the course of the research and details a plan for the continuation of this engagement over the coming months. The final chapter ends with a few concluding remarks about the main contributions of this work and potential avenues for further research.

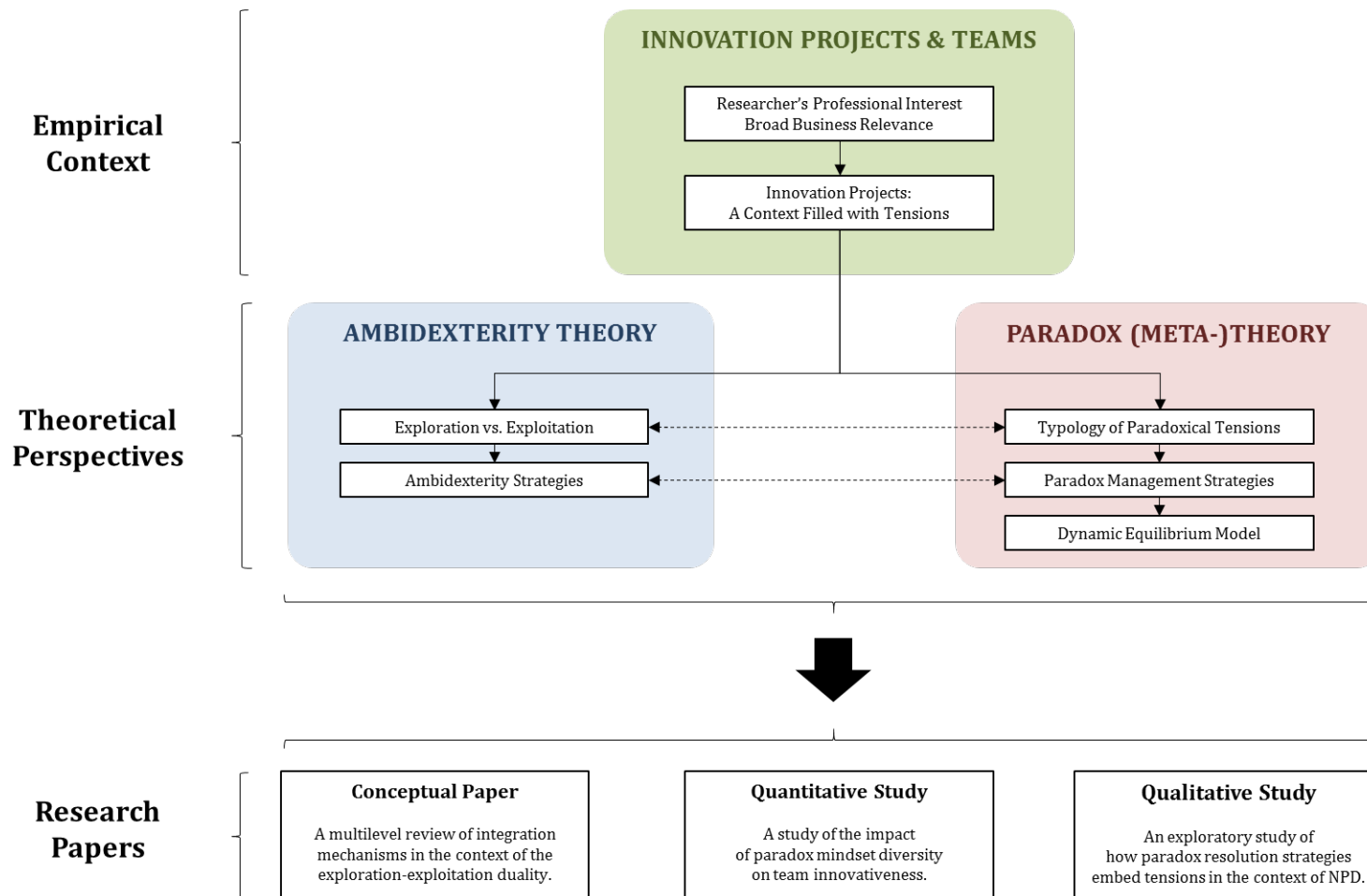


Figure 1-1: Key Components and Structure of the Doctoral Project

1.1 Empirical Context

1.1.1 A Practical Problem as the Starting Point

Theses conducted in the context of a Doctorate of Business Administration (DBA) are typically anchored in concrete business problems with which the researchers have first-hand experience. Because my professional background is in software engineering and brand management, innovation and new product development have always been central themes of my work. Beyond my personal interest, these themes matter on a much broader scale. According to a 2017 innovation report from the UNESCO Institute of Statistics, global investments in R&D reached a record high of almost US\$ 1.7 trillion in 2015, thus making product and process innovation a highly relevant topic of investigation across a wide variety of businesses and industries.

I am now a senior lecturer at the Ecole hôtelière of Lausanne – a leading hospitality management school located in Switzerland – where I teach an elective course on innovation management, coach student-industry project teams, and take part in consulting assignments for companies in the hospitality sector. While contemplating various innovation-related topics for my DBA thesis, I started engaging with the academic literature and came across the notions of exploration-versus-exploitation and ambidexterity. These conceptual lenses seemed to provide exciting opportunities for the investigation of what I initially believed would be the focus of my research: innovation in franchise organizations. In addition to being relevant to my consulting work at the time, franchising as an organizational form has interesting features for innovation researchers, such as a clear structural separation of corporate brands and operational units, recurring tensions between uniformity and adaptation, and conflicting objectives between franchisors and franchisees locked in a relationship of mutual dependence.

The second candidate topic was innovation in the context of teams. Every year, I supervise and coach about 25 student teams, who are commissioned by companies, public institutions, and entrepreneurs, to work full-time on forward-

looking projects such as the development of new concepts, the design of creative commercialization plans, or the planning of innovative growth strategies. Because the organizations commissioning these projects each pay a fee of US\$ 10,000 and have correspondingly high expectations, I have a vested interest in developing a deeper understanding of the factors that contribute to greater team innovativeness.

1.1.2 A Focus on Innovation Projects and Teams

After careful consideration of these two candidate topics, I chose to focus my DBA thesis on innovation projects and teams based on the following rationale: first, project teams have become the primary locus of innovation in organizations (Ancona and Caldwell, 1992; Olson et al., 2001; Post, 2012), thus making them a highly relevant unit of analysis for innovation researchers; second, innovation projects require both the exploration and exploitation of new knowledge (Turner et al., 2016), a central theme in organizational research as well as an area of personal interest; finally, a focus on innovation teams provided clear guidance for the identification of potential empirical contexts as well as allowed me to leverage a significant body of existing literature.

Innovation is the process of generating novel ideas and implementing them in useful ways in new products or procedures (Amabile, 2000; West and Anderson, 1996). New product development (NPD) projects are one of the primary ways in which organizations innovate to fulfill customers' changing needs and expectations (Amabile, 1988; Van de Ven, 1986). Because both studies in this doctoral thesis focus on innovation projects whose primary aim is the development of new concepts or products, it is helpful to examine the NPD literature for some theoretical background. I will now briefly discuss how this literature describes the innovation process, and also explain why this area of research deserves further attention.

1.1.3 Innovation Projects: A Context Filled with Tensions

NPD is a process typically defined as a sequence of distinct stages of activities that include concept development, product design, testing and validation, production and market launch (Cooper, 1990). The inputs to the NPD process are new ideas or consumer needs that engineers and marketers transform into novel and useful outputs in the form of new products (Clark and Wheelwright, 1993). Effective NPD processes have been shown to be causally linked to long-term success (Cooper, 1993; Ulrich and Eppinger, 1995; Wheelwright and Clark, 1995), to the development of core competencies that support competitive advantage (Prahalad and Hamel, 1990), and to higher chances of survival for organizations operating in changing environments (McCarthy et al., 2006).

Yet, despite being central to organizational success NPD efforts meet with high failure rates, setbacks and dead-ends (Cooper, 1990; Van de Ven et al., 1999). In addition, while the literature highlights the critical role played by teams in the success of NPD initiatives, the focus of scholarly investigations has mostly been on the market environment, the characteristics of the product, and the firm strategy, thus offering relatively few insights as to what makes for high-performing teams (Sivasubramaniam, Liebowitz and Lackman, 2012). Together, the high failure rate of NPD projects and the underemphasis on team-level studies warrant further research into the team-level factors that may contribute to greater NPD success. One such factor of particular relevance to this doctoral thesis is the ability of project teams to cope with the tensions that arise in the course of developing new products.

Tensions are inherent in product development activities (Dougherty, 1996) as teams must collaborate across business functions to produce innovative outcomes in the face of resource constraints and high ambiguity (Sivasubramaniam, Liebowitz and Lackman, 2012). Conflicts may also arise from the juxtaposition of internal capabilities and external demands, structure and spontaneity, and stability and change (Dougherty, 1996; Jelinek and Schoonhoven, 1990). Project teams experience tensions as a result of not only having to develop new knowledge and reach commercial objectives but also to

do so on time and on budget (Lewis et al., 2002). Similarly, project managers are expected to achieve both innovation and efficiency targets in an environment of fluctuating and potentially conflicting demands (Lewis et al., 2002). Both radical and incremental innovation processes create tensions because of the challenges they pose to existing mental models across the different organizational levels (Bledow et al., 2009). While NPD research is flourishing, scholars have been calling for further investigations into the cognitive drivers that shape behavioral team processes as well as into the factors that enable NPD teams to manage innovation-related tensions (e.g., Liu, Chen and Tao, 2015; Nakata and Im, 2010).

This brief overview points to the importance of innovation projects to the long-term success of firms, highlights the tension-rich nature of the innovation process, and emphasizes the vital role that teams play in the management of these tensions. Along with my initial professional interest in the topic, these insights provided the impetus for researching innovation project teams from a tension-informed perspective.

Having clarified the empirical context and the broad focus of the investigation, I now introduce the two main theoretical perspectives that have informed my research. The next section begins by discussing the fundamental duality at the center of the innovation process, thus providing the rationale for the subsequent choice of theoretical lenses that underpin this doctoral work.

1.2 Theoretical Perspectives

1.2.1 The Exploration versus Exploitation Duality

The ability of firms to successfully explore and exploit knowledge for the purpose of developing new products is a critical factor for firm survival (Thongpapanl, de Clercq and Dimov, 2012; Zahra, Ireland and Hitt, 2000). In his seminal paper on organizational learning, March (1991) defines exploration as a process that emphasizes search, experimentation, and variation, while exploitation emphasizes choice, execution, and consistency. The exploration-

versus-exploitation duality has been studied in a wide variety of literatures and across different levels of analysis (Lavie, Stettner and Tushman, 2010).

In the context of product innovation, exploration relates to the search for value-creating opportunities through fundamental research, invention, and experimentation, with the aim of developing new knowledge that the organization can then exploit by leveraging existing competencies to seize commercial opportunities (Holmqvist, 2004; Shane, 2000; Tsai and Ghoshal, 1998; Zahra, Ireland and Hitt, 2000). Therefore, from a product innovation perspective, there is a temporal dependency between exploration and exploitation as the latter cannot take place before the former (Rothaermel and Deeds, 2004). This dependency is often masked at the organizational level of analysis insofar as firms engage in exploration and exploitation simultaneously as a result of concurrently managing a collection of projects at various stages of development (Rothaermel and Deeds, 2004).

While necessary for the success of firms, the learning processes associated with exploration and exploitation are inherently conflicting and, therefore, need to be actively managed (Tushman and O'Reilly, 1996). Because product innovation embeds this contradiction deep within project-level activities, the teams involved often bear the burden of managing the resulting tensions. Based on these findings, two streams of research seemed particularly suited to serve as the key theoretical frameworks for my upcoming investigations: ambidexterity theory and paradox theory.

1.2.2 Ambidexterity Theory

The centrality of the exploration-exploitation duality to product innovation led to a closer examination of the ambidexterity literature. Notwithstanding definitional issues (Turner, Swart and Maylor, 2013), ambidexterity primarily concerns itself with the simultaneous pursuit of exploration and exploitation. While challenging to achieve, ambidexterity has been shown to have a positive impact on organizational performance (He and Wong, 2004; Jansen et al., 2009; Junni et al., 2013; Tushman and O'Reilly, 1996). There are three main approaches to developing organizational ambidexterity. First, contextual ambidexterity

(Birkinshaw and Gibson, 2004) advocates that the role of management is to provide a *context* of support, trust, stretch, and discipline, in which individuals and groups can make their own decisions as to how best to divide their time between exploration and exploitation. Second, structural ambidexterity (Tushman and O'Reilly, 1996) seeks to achieve balance through the creation of distinct exploration and exploitation units that exhibit internally-consistent activities, cultures, and incentives (O'Reilly and Tushman, 2008). These loosely integrated exploration and exploitation units are thus able to perform both types of activities independently, while balance is achieved through targeted integration by senior-management teams (Jansen et al., 2009). Finally, temporal ambidexterity (Gersick, 1991; Tushman and Romanelli, 1985) achieves balance over time by transitioning from periods of exploration to periods of exploitation. This balancing act through temporal separation rests on thoughtful consideration and efficient procedures for managing the transitions from one set of activities to the other (Brown and Eisenhardt, 1997).

Irrespective of the approach used, achieving the “proper” balance remains challenging as contradictions need to be managed either within or across units, or during periods of transition (Lavie, Stettner and Tushman, 2010). Indeed, exploration and exploitation have mutually contradictory requirements in terms of processes, structures, and capabilities (Benner and Tushman, 2003; Chang, Yang and Chen, 2009; McGrath, 2001; Siggelkow and Levinthal, 2003), while also being locked in a relationship of interdependence: exploitation requires that something has been explored first; exploration, in turn, relies on the financial resources generated by exploitation (Lavie, Stettner and Tushman, 2010). The inherent contradictions and mutual relatedness that characterize the exploration and exploitation duality have led scholars to view the relationship between these opposing poles as paradoxical (e.g., Andriopoulos and Lewis, 2010; Raisch and Zimmermann, 2017; Smith and Lewis, 2011).

Except for contextual ambidexterity studies, ambidexterity research has primarily focused on the organization as the primary unit of analysis and has left both the team and project levels of analysis under-researched (Stadler, Rajwani

and Karaba, 2014; Turner, Swart and Maylor, 2013). This gap is somewhat surprising as projects are an important contemporary organizational form (Eisenhardt and Tabrizi, 1995; Söderlund, 2011) where exploration and exploitation co-occur, making innovation projects a prime locus of ambidexterity (Turner, Swart and Maylor, 2013). Similarly, investigations of ambidexterity-related tensions have focused on the organizational and business unit levels, leaving questions of how these tensions are interpreted, managed, and sustained at lower levels of analysis relatively unexplored (Birkinshaw and Gupta, 2013; Raisch and Birkinshaw, 2008). There have also been recent calls for further research into team composition and team processes (e.g., Luger, Raisch and Schimmer, 2018), both of which enable ambidexterity (Lubatkin et al., 2006).

Together, the paradoxical nature of the exploration-exploitation duality and the opportunity for further research at the team and project level suggested that paradox theory could be a useful lens through which to investigate how tensions arise in the course of innovation projects, and how teams can best manage these tensions.

1.2.3 Paradox Theory

Historically, organizational research has primarily looked at the management of tensions related to the exploration-exploitation duality through the lens of ambidexterity. More recently, however, the prescriptive guidance emphasizing the separation – through time or space – of conflicting activities has given way to more integrated and synergistic approaches which are informed, in large part, by the paradox perspective (e.g., Andriopoulos and Lewis, 2009; Raisch et al., 2009). Indeed, studies have shown that the direct engagement with tensions can create beneficial, reinforcing cycles as organizations face the contradictions inherent to the innovation process (Smith, 2014; Smith and Tushman, 2005).

This shift in perspective motivated the selection of paradox theory as the dominant theoretical framework in which to situate this doctoral project. In other words, while the insights from ambidexterity theory remained valuable, that research stream became secondary to the meta-theory of paradox to which the

present work aims to contribute. The rationale supporting this change in relative emphasis is the following. First, paradox theory could help make sense of the greater variety of tensions likely to surface in my empirical studies. Second, while ambidexterity theory has achieved maturity and a peak of scholarly interest in 2010 (Birkinshaw and Gupta, 2013), paradox theory is still very much in development (Schad et al., 2016), thus offering more opportunities for theoretical contributions. Finally, by being a meta-theory of tension management (Lewis and Smith, 2014), any theoretical contribution made by this doctoral thesis could potentially find broader applicability across multiple management theories.

I will now briefly discuss a few key ideas of paradox theory and introduce the main theoretical model that guided the design of the two empirical studies conducted in the context of this research project.

In organizational theory, paradoxes refer to “contradictory yet interrelated elements that exist simultaneously and persist over time” (Smith and Lewis, 2011:p.82). Actors experience organizational paradoxes through the tensions that arise from the contradictions embedded in those paradoxes (Lewis, 2000). As a meta-theory, paradox theory aims to inform the management of a broad variety of organizational tensions. Smith and Lewis (2011) proposed a typology of paradoxical tensions which includes those related to innovation, change, renewal (paradoxes of learning), social identities and values (paradoxes of belonging), multiple and competing goals (paradoxes of performing), and structure and leadership (paradoxes of organizing).

According to Smith and Lewis (2011), the experience of paradoxical tensions intensifies in proportion to the diversity of views and demands of stakeholders (plurality), the need for creating a future that is different from the present (change), and the limited availability of resources (scarcity). It is worth noting that each of these factors is highly relevant to my empirical context, insofar as innovation projects must bring together a varied set of stakeholders and contributors to produce something new in the face of limited time and resources.

Several strategies have been identified for managing paradoxical tensions. A strategy of acceptance incites actors to reconsider their expectations for rationality and, instead, learn to embrace and live with paradoxes (Clegg, Vieira Da Cunha and Pina E Cunha, 2002; Lewis, 2000). By engaging in paradoxical inquiry, actors face the anxiety that is fueled by tensions and seek to find a “workable certainty” (Lüscher and Lewis, 2008:p.230) that allows them to move forward without resolution. Other strategies based on structural separation (e.g., Tushman et al., 2010) and temporal separation (e.g., Chung and Beamish, 2010; Klarner and Raisch, 2013) have been proposed as alternative approaches to addressing paradoxical tensions. Still, other studies (e.g., Adler, Goldoftas and Levine, 1999; Schmitt and Raisch, 2013) have discussed synthesis strategies whereby the aim is to develop novel solutions that integrate the needs of both paradoxical elements.

Common across these strategies is the idea that the management of paradoxical tensions requires the implementation of both differentiation and integration tactics. Without differentiation, the unique contributions of each element remain unexplored; without integration, the potential synergies between opposing poles are not unlocked (Smith and Tushman, 2005). Importantly, the interdependence of paradoxical elements prevents a permanent resolution of the underlying contradiction, and requires, instead, alternating, cyclical approaches to the management of tensions. Smith and Lewis (2011) have proposed a dynamic equilibrium model for managing organizational tensions. In their model, the authors discuss the mechanisms that explain how tensions become salient to the actors involved, how individual and organizational factors may lead to vicious cycles of defensiveness or virtuous cycles of acceptance, and how resolution strategies that alternate between differentiation and integration lead to superior organizational performance. To my knowledge, Smith and Lewis’ dynamic equilibrium model still represents the most general and complete conceptual framework of organizational tensions and their management. As such, it constitutes the key theoretical model to which the three papers of this doctoral project aim to contribute.

1.3 Research Papers

As will be explained below, the three papers in this thesis are connected not only by the themes that they share (i.e., exploration-exploitation duality, paradox management) but also by the fact that each paper informed the conception of the one that followed. Together, these papers aim to make the majority of their contributions to the field of paradox management. More specifically, each paper seeks to clarify or test distinct parts of Smith and Lewis's (2011) dynamic equilibrium model as illustrated in **Figure 1-2**.

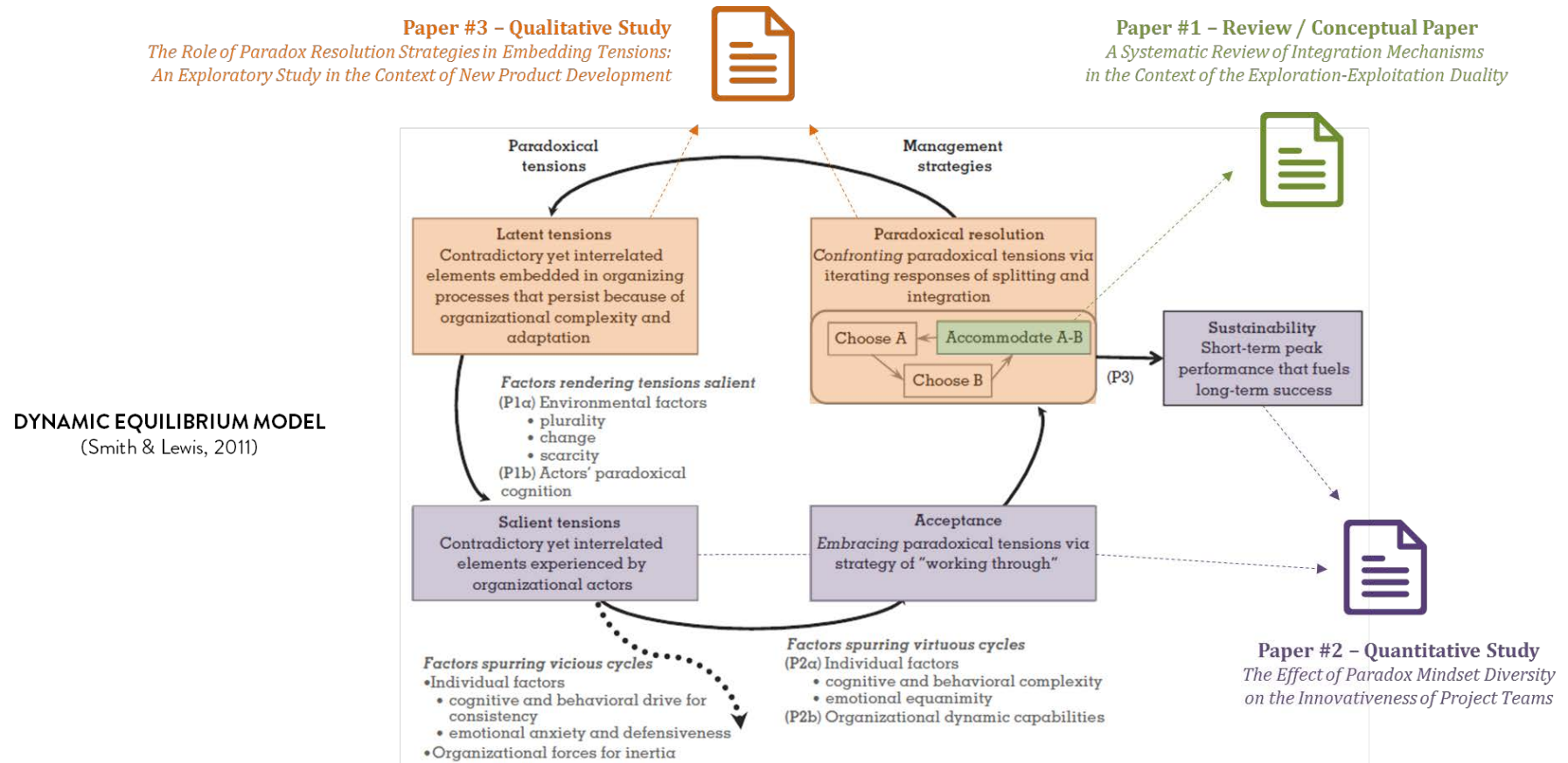


Figure 1-2: Areas of Focus by Paper

1.3.1 Paper #1: A Systematic Review of Integration Mechanisms in the Context of the Exploration-Exploitation Duality

Objective of the paper. This paper was motivated by the outcome of a preliminary scoping study I had conducted in the early days of this doctoral project. As I was familiarizing myself with the literature on exploration and exploitation, it became apparent that the effective management of this duality necessitates the use of both differentiation and integration approaches. Yet the ways to achieve differentiation always seemed, at least to me, more straightforward, more intuitive, and probably easier for organizations to implement. Conversely, the ways to achieve integration, as opposed to differentiation, consistently appeared to be more mysterious and complex, and to pose a greater challenge to organizations. This perception, reflected in O'Reilly and Tushman's (2008) comment that "the crucial task here is not the simple organizational structural decision in which the exploratory and exploitative sub-units are separated, but the processes by which these units are integrated in a value-enhancing way" (p.191), was the impetus for a systematic investigation of the literature into the nature and effectiveness of these integration mechanisms.

Type of paper. This paper is a multi-level, systematic review of the literature on integration mechanisms in the context of the exploration-exploitation duality. Based on a thematic synthesis of the literature, the review goes on to argue that operational integration mechanisms form the basis of a strategic organizational capability. The concept of "integrative capacity" is introduced and propositions about its nature are developed. As such, this review also reads like a conceptual piece.

Contributions. The paper makes three main contributions. First, it identifies and organizes more than one hundred integration mechanisms discussed in the literature. Second, it offers a strategic perspective on integration that goes beyond traditional investigations of single mechanisms. Third, it draws attention to the multilevel and four-dimensional nature of integration, thus offering new opportunities for further research.

Impact on DBA project. This review was instrumental to the rest of my doctoral research although not in the way originally intended. While I was expecting this review to lead to precise research questions to be investigated further in my empirical work, it instead emphasized the need to better specify the “theoretical home” in which to anchor my studies. Indeed, in the process of conducting this review of integration mechanisms, I came across a wide variety of theories and perspectives such as ambidexterity, absorptive capacity, dynamic capabilities, and paradox theory. Of those, paradox theory seemed the most appropriate literature in which to situate my research on innovation teams and the tensions they face in the process of developing new projects.

1.3.2 Paper #2: The Effect of Paradox Mindset Diversity on the Innovativeness of Project Teams

A short version of this paper was accepted at the 2017 SMS Conference in Houston. The full version of this paper was accepted at the 2018 AOM Conference in Chicago

Objective of the paper. As stated in the introduction, I have a professional interest in the factors that make teams more innovative. One of the integration mechanisms identified in the literature review (Paper #1) is the ability of individuals to think paradoxically. Miron-Spektor and colleagues (2018) have recently conceptualized this ability in their paradox mindset construct which they define as the “tendency to value, accept and feel comfortable with tensions” (p.37). Prior studies that had investigated closely related concepts such as paradoxical cognition, paradoxical thinking, or paradoxical framing, had done so primarily at the individual level of analysis. In contrast, this first empirical study examines the impact of paradox mindset on innovativeness in the context of teams.

Type of paper. This paper is a quantitative study of 42 student teams (250 individuals) commissioned by companies and organizations to develop innovative projects over a period of nine weeks. Individual team members reported weekly on their activities (exploratory or exploitative) as well as the level of paradoxical tensions they had experienced that week. Data were also collected about the paradox mindset of each team member and the level of

innovativeness of the outputs delivered at the end of the project. Using conditional process analysis, I proceeded to test various hypotheses of a moderated mediation model developed for the purpose of the study. In this work, I made use of the newly created paradox mindset and paradoxical tensions scales developed by Miron-Spektor et al. (2018), which the authors had graciously shared with me prior to publication. Consequently, this empirical study is also among the first to make use of these scales.

Contributions. This paper provides a number of insights into the relationship between the simultaneous engagement in exploratory and exploitative activities, paradoxical tensions, and innovativeness. The results confirm the dual nature of paradoxical tensions and point to the important role that diversity of paradox mindset plays in leveraging those tensions. Importantly, this study contributes to the still sparse body of paradox research at the team level.

Impact on DBA project. This paper investigates several notions and relationships contained in Smith and Lewis's (2011) dynamic equilibrium model. For instance, the factors that increase the salience of tensions – in my case, the simultaneous engagement in conflicting activities – or the importance of paradoxical cognition for unlocking the innovative potential of paradoxical tensions. However, this study also raised new questions. In particular, the results indicated that while most teams underperform in climates of high tensions, some teams do become more innovative. This finding suggested that the ability to regulate the level of tension in a given task environment could be a valuable managerial tool. It was this insight that provided the impetus behind Paper #3 whose aim is to explore the main tensions that arise in the context of innovation projects, the type of resolution strategies used to manage them, and the role played by these strategies in embedding tensions in the task environment.

1.3.3 Paper #3: The Role of Paradox Resolution Strategies in Embedding Tensions – An Exploratory Study in the Context of New Product Development

A short version of this paper was accepted at the 2018 EGOS Conference in Tallinn. The full version of this paper was accepted at the 2018 SMS Conference in Paris.

Objective of the paper. This study is a first exploratory step toward answering Fairhurst and colleagues's (2016) call for paradox researchers to investigate “how tensions emerge, change and reproduce over time” (p.179) and how the actors' “responses [to these tensions] contribute to the ongoing persistence of them” (p.179). Indeed, while empirical studies typically focus on the analysis of strategies in response to paradoxical tensions, few have investigated how these strategies may, in turn, play a role in embedding these tensions in a given organizational context. Smith and Lewis's (2011) dynamic equilibrium model does suggest that such a link between the use of resolution strategies and paradoxical tensions exists; however, the authors offer limited theorization of this relationship. Consequently, the second study of this doctoral project explores the mechanisms through which resolution strategies embed tensions in the task environment of new product development projects.

Type of paper. This paper is an exploratory qualitative study based on semi-structured interviews with senior innovation leaders from various industries. This study is deeply anchored in paradox theory and aims to explicate a specific relationship in the dynamic equilibrium model of paradox management. As such, this paper seeks to clarify existing theory (rather than build new theory) and does so by combining its empirical findings with extant research to infer a set of causal relationships.

Contributions. This study identifies three main categories of paradoxical tensions that arise in the process of developing new products and analyzes the various resolution strategies used to address them. By conceptualizing these resolution strategies and by providing a rationale for how they might embed tensions in the context of projects, this paper clarifies a, heretofore, unexplained link in the dynamic equilibrium model. Beyond paradox theory, this paper also

contributes to ambidexterity research by suggesting that traditional ambidexterity approaches discussed in the literature can be interpreted as variants of temporal differentiation when viewed at the project level.

Impact on DBA project. As this study was conducted last, its impact on the remainder of the doctoral process was minimal.

2 A SYSTEMATIC REVIEW OF INTEGRATION MECHANISMS IN THE CONTEXT OF THE EXPLORATION-EXPLOITATION DUALITY

2.1 Abstract

When it comes to the management of organizational tensions, researchers have been calling for greater focus on integration rather than separation. This review heeds these calls and presents a thematic synthesis of research on integration mechanisms in the context of the exploration-exploitation duality. The process begins with the identification and categorization of more than one hundred integration mechanisms identified from 61 core articles. From the resulting analysis, the concept of *integrative capacity* is developed. The findings suggest that integrative capacity is a dynamic capability built upon four complementary sub-capabilities: the ability to unify, enable, connect and combine. The concept of integrative capacity is a step toward explaining what lies behind the ability of firms to bring together knowledge from conflicting domains in value-adding ways.

2.2 Introduction

The rationale for why organizations should engage in both exploration and exploitation is clear and well established (Benner and Tushman, 2003; Eisenhardt and Martin, 2000; Levinthal and March, 1993; March, 1991). Organizations must explore new knowledge to fuel their innovation efforts and avoid getting stuck in suboptimal equilibria; they must also ensure sufficient exploitation of that new knowledge to reap the rewards of experimentation (March, 1991). Maintaining balance between exploration and exploitation is a considerable challenge insofar as these two processes compete for scarce resources and are fundamentally incompatible (March, 1991). Furthermore, these processes exhibit self-reinforcing tendencies that may lead organizations toward too much exploration – the “failure trap” – or, more commonly, toward too much exploitation – the “success trap” (Levinthal and March, 1993). These challenges are worth addressing, however, as the successful management of the exploration-exploitation duality is associated with superior performance

(Junni et al., 2013; Raisch and Birkinshaw, 2008; Tushman and O'Reilly, 1996). Not surprisingly, therefore, the management of the exploration-exploitation duality has enjoyed significant scholarly interest, and several approaches – spatial, temporal, contextual, and paradoxical – have been suggested.

2.2.1 Management Strategies

Spatial separation approaches. The ambidexterity literature has predominantly focused on the use of structural separation to achieve a balance between exploration and exploitation (Lavie, Stettner and Tushman, 2010). Structural ambidexterity is achieved through the creation of highly differentiated units focusing either on exploration or exploitation and targeted integration at the senior team level (Tushman and O'Reilly, 1996). The purported benefit of this approach is to allow for the effective pursuit of conflicting agendas due to internally coherent, non-interfering structures designed to fit different change expectations (Duncan, 1976; Tushman and O'Reilly, 1996). Thus, large, centralized, process-driven units can efficiently exploit, while small, decentralized, autonomous ones can flexibly explore (Benner and Tushman, 2003). The structural approach can be extended beyond the boundaries of the firm, for example, through the creation of independent spinouts (Christensen, 1997) or exploratory or exploitative alliances (Lavie and Rosenkopf, 2006; Rothaermel and Deeds, 2004).

Temporal separation approaches. The “punctuated equilibrium” model posits that organizations adapt by cycling through long periods of stable, continuous change and short episodes of radical realignment (Tushman and Romanelli, 1985). This process is either internally induced, when existing structures and processes can no longer accommodate growth, or externally driven, when changes in the environment require significant adjustments to the current strategic orientation (Gersick, 1991). The punctuated equilibrium view, therefore, suggests that organizations adapt through a prolonged engagement in exploitation that is occasionally interrupted by short, potentially unforeseen, bursts of exploration.

Unlike punctuated equilibrium, “organizational vacillation” seeks to achieve high levels of both exploration and exploitation by alternating between organizational structures that emphasize one or the other (Gulati and Puranam, 2009; Siggelkow and Levinthal, 2003). Boumgarden and colleagues (2012) argue that vacillation can yield higher performance than structural separation approaches because it avoids the negative externalities associated with the maintenance of mutually inconsistent structures. In contrast to punctuated equilibrium, organizational vacillation implies a more purposeful and balanced, yet still alternating, engagement in exploration and exploitation.

Brown and Eisenhardt (1997) argue that firms adapt, change, and ultimately transform themselves through a process of continuous change – rather than through rare and episodic reorientations – driven primarily by product innovation. Importantly, the success of this process rests on the proper pacing of new product introductions, the frequent probing of potential futures, and the choreographing of transitions between projects. This “rhythmic switching” links the present and the future through the seamless interweaving of conventional and experimental product development efforts, thus offering a meso-level explanation of how firms both explore and exploit.

Contextual approach. Gibson and Birkinshaw (2004) suggest that a more effective way for organizations to become ambidextrous is not through structural or temporal separation but through the design of an organizational context that encourages individuals to make their own decisions about how to manage conflicting objectives. To develop *contextual ambidexterity*, the authors argue that, rather than rely on high-level separation of these capacities, organizations must develop systems and processes that foster a “behavioral orientation toward dual capacities” (p.211).

Paradoxical approaches. Paradoxes arise from the juxtaposition of contradictory yet interrelated elements (Lewis, 2000) such as exploration and exploitation. In the same vein of keeping opposing elements proximate, paradox theorists describe various approaches to the management of organizational paradoxes (e.g., Smith and Lewis, 2011). In particular, these scholars (e.g., Andriopoulos

and Lewis, 2009; Lewis, 2000; Lüscher and Lewis, 2008; Smith and Tushman, 2005) emphasize the importance of cognition, specifically the ability to recognize and embrace contradictions (i.e., paradoxical thinking), and advocate for such strategies as “*acceptance*” (i.e., learning to live with paradoxes without seeking resolution), “*accommodation*” (i.e., actively searching for novel synergies through the juxtaposition of contradictions), or “*differentiating/integrating*” (i.e., implementing sets of practices that, together, leverage the uniqueness of opposing poles and stress their complementarity). In their dynamic equilibrium model, Smith and Lewis (2011) suggest that these strategies are linked in a somewhat complex way that implies sequence, iteration, and circularity.

2.2.2 The Growing Importance of Integration

The approaches I have just summarized all rely on some mix of differentiation and integration strategies (Raisch et al., 2009). Differentiating implies separating distinct elements and valuing their unique contributions while integrating emphasizes their mutual relatedness and potential for synergies (Smith and Tushman, 2005). Even in the highly integrated case of contextual ambidexterity, individuals must still develop differentiated capacities for alignment and adaptability (Gibson and Birkinshaw, 2004), while in the highly differentiated case of structural ambidexterity senior teams bear the responsibility of integrating conflicting elements (Tushman and O'Reilly, 1999). The complementary role of these mechanisms, and their importance in achieving positive organizational outcomes, has been well understood since the work of Lawrence and Lorsch (1967).

Notwithstanding this complementarity, the present review focuses exclusively on integration mechanisms for the following reasons. First, research into the management of the exploitation-exploitation duality has gradually shifted its focus from differentiation to integration (e.g., Gibson and Birkinshaw, 2004; Smith and Tushman, 2005). Increasingly, scholars recognize the need to shift from an “either/or” mindset that seeks to maintain consistency and avoid tensions, to a “both/and” mindset that acknowledges the complexity, diversity,

and dynamism of organizations, and embraces any resulting tensions (Lewis, 2000). This increased focus on integration is also apparent in the calls for further research made in recent reviews of the ambidexterity literature (e.g., Benner and Tushman, 2015; Birkinshaw and Gupta, 2013; Lavie, Stettner and Tushman, 2010). Seldom do these reviews call for deeper investigations into differentiation mechanisms; instead, they invite scholars to answer integration-minded questions related to the level at which activities are integrated (e.g., Lavie, Stettner and Tushman, 2010), the way integrative decisions are made (e.g., Birkinshaw and Gupta, 2013), and the types of integrative mechanisms that complement organizational design decisions (e.g., Benner and Tushman, 2015).

A second reason is that integration lies at the heart of the dynamic capability to balance exploration and exploitation (O'Reilly and Tushman, 2008). Teece and colleagues (1997) define a dynamic capability as the "firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments" (p.516). The ability to integrate, therefore, plays an important role in adaptation and the establishment of long-term competitive advantage. Differentiation leads to the development of distinct competencies, however, to be useful, these competencies must be effectively "integrated to generate new combinations of exploratory and exploitative innovation" (Jansen et al., 2009:p.799). Integration is therefore vital to unlocking the value embedded in differentiated activities (Sirmon, Hitt and Ireland, 2007), and its generative nature contributes to the ability of firms to overcome inertia and path dependence through the reconfiguration of new and existing resources (O'Reilly and Tushman, 2008).

Finally, a scholarly focus on integration is warranted because, in the words of Tushman and O'Reilly (1999), "Differentiating units is easy, achieving integration is not" (p.22). One of the reasons why integration is difficult has to do with the multiplicity of settings in which it takes place. Each of the approaches discussed earlier has a different locus of integration: senior team level for structural ambidexterity, business unit level for contextual ambidexterity,

corporate level for spin-outs and alliances. As organizations transition between (e.g., Raisch and Tushman, 2016) or implement a mix of (e.g., Andriopoulos and Lewis, 2009; Jansen et al., 2009; Turner, Swart and Maylor, 2013), ambidextrous designs, these different loci and transitions need to be managed effectively. Furthermore, the locus of exploratory and exploitative activities itself is shifting, which has implications for how and where integration will happen in the future. The decrease in communication and information costs (Altman, Nagle and Tushman, 2013) and the increase in digitization and product modularization (Baldwin and Clark, 2000), have enabled communities rather than firms to take a greater role in the innovation process (Baldwin and von Hippel, 2011). These trends have resulted in greater exploratory and exploitative knowledge dispersion (Benner and Tushman, 2015), which makes the capacity for integration even more crucial to firm survival.

To summarize, the strategies to manage the exploration-exploitation duality all rely on the organization's dual abilities to differentiate and integrate effectively. This common feature of resolution strategies allows researchers to investigate the management of the exploration-exploitation duality from the more general perspective of differentiation and integration, rather than from the lens of any single strategy. For the reasons discussed earlier, the ability to effectively integrate is particularly deserving of further investigation owing to its strategic importance, inherent difficulty, and relevance to new, more open modes of innovation. Consequently, this review addresses the following question:

When it comes to the management of the exploration-exploitation duality, what is the nature and effectiveness of the integration mechanisms used at various organizational levels?

Beyond answering this question, the purpose of this paper is also to contribute to theory, first, by reviewing systematically the integration mechanisms discussed in the literature, and, second, by conceptualizing these mechanisms as a broader organizational capability through a process of induction. This two-step approach is illustrated in **Figure 2-1**.

The rest of this paper is structured as follows. First, I describe and justify the analysis and synthesis process guiding this review. Second, I present the findings in the form of a thematic synthesis of the integration mechanisms identified in this review. Third, I conceptualize the organization's ability to integrate exploratory and exploitative knowledge based on the results of the thematic synthesis. Finally, I discuss the main theoretical contribution of this paper and suggest potential avenues for further research.

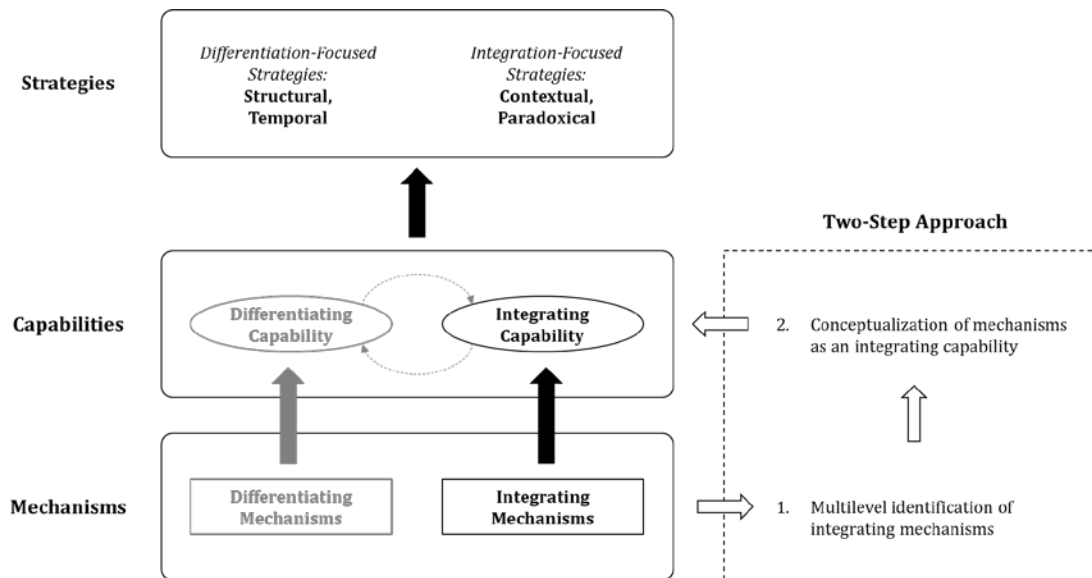


Figure 2-1: Review Objective and Approach

2.3 Methods

The objective of this systematic configurative review is to seek a *qualitative* understanding of integration mechanisms as well as a *quantitative* assessment of their impact on the management of the exploration-exploitation duality. This review is *configurative* in the sense that its primary aim is to arrange (configure) findings rather than add up (aggregate) findings (Gough, Oliver and Thomas, 2012); it is *systematic* in the sense that it follows a predetermined protocol (Denyer and Tranfield, 2009; Tranfield, Denyer and Smart, 2003) that typically includes the following stages:

1. Formulation of a review question
2. Search strategy
3. Relevance and quality assessment

4. Analysis and synthesis of findings

The purpose of this section is to provide a transparent account of the process I have followed in each of these four stages. The full sequence of steps related to the search and selection process is illustrated in **Figure 2-2**. This process resulted in the selection of 61 articles (see **Table 2-1** for the complete list).

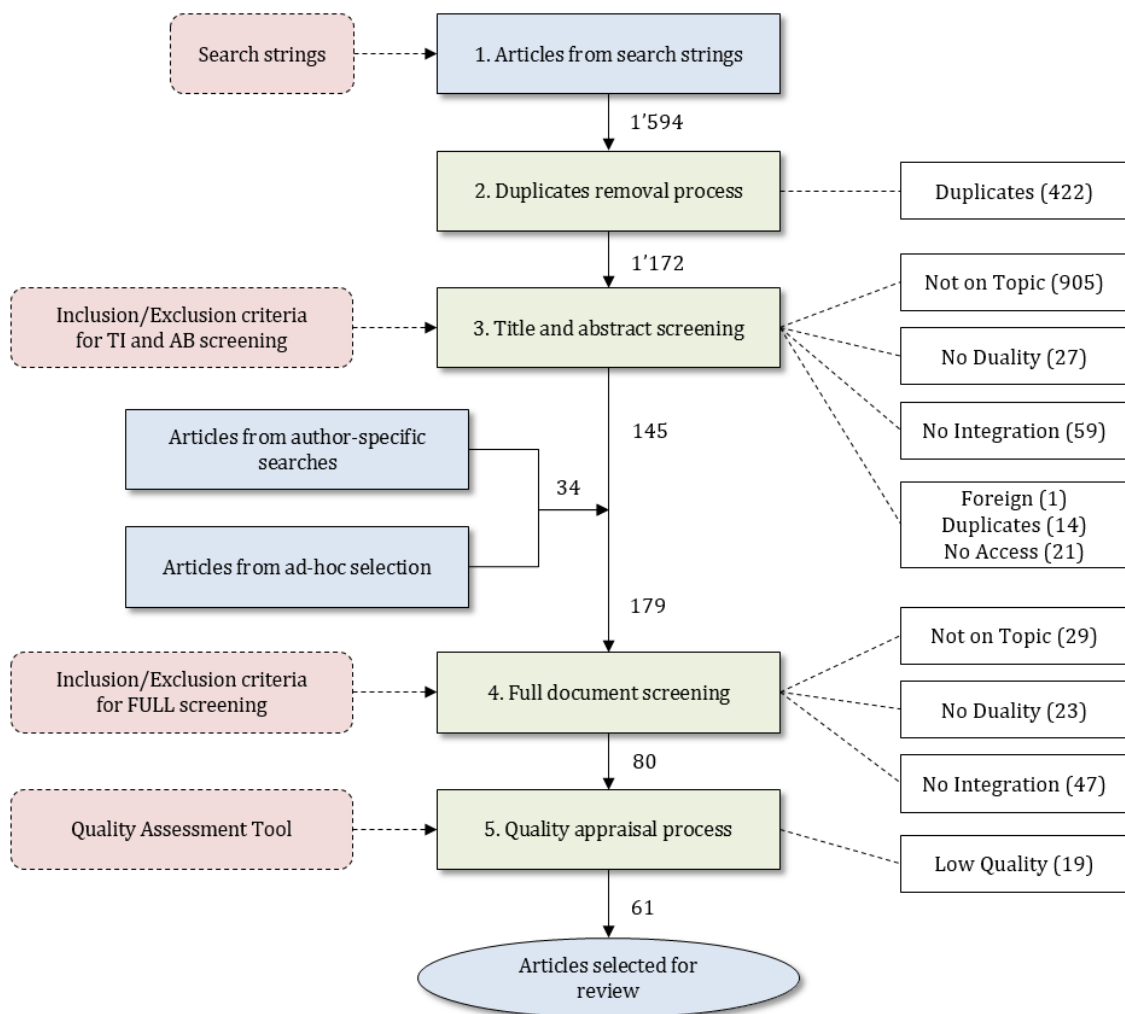


Figure 2-2: Relevance and Quality Filtering Process

Table 2-1: Core Articles Selected for this Review

Publication	Rating	Count	References
Organization Science	4*	11	Adler, Goldoftas, Levine (1999); D'Adderion (2014); Andriopoulos, Lewis (2009) ; Jansen, Tempelaar, van den Bosch, Volberda (2009); Mom, van den Bosch, Volberda (2009); Raisch, Birkinshaw, Probst, Tushman (2009); Smith, Tushman (2005); Taylor, Helfat (2009) ; van den Bosch, Volberda, de Boer (1999) ; Zollo, Winter (2002) ; Winter, Szulanski (2001)
Journal of Product Innovation Management	4	4	Lin, McDonough (2014); Lin, McDonough, Lin, Lin (2013); Maniak, Midler, Beaume, von Pechmann (2014); Rubera, Ordanini, Calantone (2012)
R and D Management	3	3	Chen, Kannan-Narasimha (2015); Harryson (2008); Gassmann, Widenmayer, Zeschky (2012)
Academy of Management Review	4*	3	Sheremata (2000); Crossan, Lane, White (1999) ; Farjoun (2010)
European Journal of Innovation Management	1	3	Sun, Lo (2014); Wang, Rafiq (2009); Bröring, Herzog (2008)
Academy of Management Journal	4*	2	Smith (2014); Jansen, van den Bosch, Volberda (2005)
Strategic Management Journal	4*	2	Tiwana (2008); Crossan, Berdrow (2003)
Long Range Planning	3	2	Andriopoulos, Lewis (2010); Dixon, Meyer, Day (2014)
Strategic Organization	3	2	Kauppila (2010); Litchfield, Gentry (2010)
European Management Journal	2	2	Gebauer, Worch, Truffer (2012); Nonaka, Kodama, Hirose, Kohlbacher (2014)
International Journal of Project Management	2	2	Eriksson (2013); Turner, Maylor, Swart (2015)
Journal of Management	4*	1	Phene, Tallman, Almeida (2012)
Journal of Marketing	4*	1	Sivadas, Dwyer (2000)
Entrepreneurship Theory and Practice	4	1	Heller (1999)
International Journal of Research in Marketing	4	1	Kyriakopoulos, Moorman (2004)
Journal of the Association of Information Systems	4	1	Nazir, Pinsonneault (2012)
Journal of World Business	4	1	Patriotta, Castellano, Wright (2013)
Organization Studies	4	1	Nooteboom (2000)
Research Policy	4	1	Gilsing, Nooteboom (2006)
Leadership Quarterly	4	1	Rosing, Frese, Bausch (2011)
California Management Review	3	1	O'Reilly, Tushman (2011)
Harvard Business Review	3	1	O'Reilly, Tushman (2004)
Industrial Marketing Management	3	1	Menguc, Auh (2008)
Information Technology & People	3	1	Lyytinen, Rose, Yoo (2010)
International Journal of Management Reviews	3	1	Turner, Swart, Maylor (2013)
International Journal of Production Research	3	1	Revilla, Saenz, Knoppen (2013)
Journal of Strategic Information Systems	3	1	Montazemi, Pittaway, Saremi, Wei (2012)
Management International Review	3	1	Régner, Zander (2011)
MIT Sloan Management Review	3	1	Burgelman, Doz (2001)
Employee Relations	2	1	Mayrhofer (1997)
International Journal of Manpower	2	1	Gil-Marques, Moreno-Luzon (2013)
Management Decision	2	1	Knight, Harvey (2015)
Industrial and Organizational Psychology	1	1	Bledow, Frese, Anderson, Erez, Farr (2009)
Journal of Information and Knowledge Management Systems	not rated	1	Sherif, Tsado, Zheng, Airhia (2013)
Journal of Management and Organization	not rated	1	Hayes, Fitzgerald (2009)
Schmalenbach Business Review	not rated	1	Güttel, Konlechner, Müller, Trede, Lehrer (2012)

61

Note 1: The publication ratings are based on the *Academic Journal Guide 2015* from the Association of Business Schools.

Note 2: The articles in bold were not found via search strings, but were added in the **ad-hoc selection stage**.

2.3.1 Stage 1: Formulation of the Review Question

While the review question – and the rationale that led to it – has already been presented in the introduction, it is helpful to clarify the meaning of its constituent parts. Indeed, in order to craft effective database search strings and to be able to assess the relevance of the resulting search hits (both aspects will be discussed in the description of stage 2), clear definitions of the key terms contained in the review question are essential.

Exploration and *exploitation* are understood in their broadest sense as initially defined by March's (1991) seminal paper on organizational learning: “Exploration includes things captured by terms such as search, variation, risk-taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution” (p.71).

The word *duality* refers to the twofold nature of an object of study (Jackson, 1999) that allows for the compatible, interdependent, and potentially synergistic interactions between its distinct poles (Farjoun, 2010).

In the context of this review, *integration mechanism* refers to any formal or informal method, process, routine, or practice that fosters greater interaction and/or collaboration between the exploratory and exploitative knowledge domains (Jansen et al., 2009; Kahn, 1996) with the aim of overcoming potential conflicts and achieving synergistic outcomes (Smith and Tushman, 2005). Accordingly, the shortened, more generic term *integration* will denote the use of these mechanisms to bring together exploration and exploitation activities in a value-enhancing way (O'Reilly and Tushman, 2008).

Finally, the review question contains generic terms which are defined as follows. The *nature* of a specific integration mechanism refers to its key characteristics (e.g., degree of formalization, relatedness to interaction or collaboration, intended purpose, etc.), whereas its *effectiveness* relates to any quantitative measures of whether that particular mechanism produced the desired or expected result.

2.3.2 Stage 2: Search Strategy

The search process begins with the creation of database search strings that are based on the definitions of the key terms in the review question. I will now describe the rationale leading to the specific search strings used in this review (see **Table 2-2**). While these search strings originated from the definitions and meanings presented above, they were also refined so as to generate a manageable number of search hits. Given the time and resources at hand, it was decided that 1,500 hits (including duplicates) would be a sufficiently large yet manageable number of articles for this review.

Table 2-2: Search Strings

Code	Concepts	Search Strings
S1	Exploration-Exploitation Duality	(explor* AND exploit*) OR (innovat* AND replicat*) OR (replicat* AND adapt*) OR (align* AND adapt*) OR ambidext*
S2	Integration	integrat* OR assimilat* OR combinat* OR transfer*
S3	Mechanism	process* OR mechanism* OR routine* OR practice* OR rule* OR technique* OR capabilit*
S4	Integration Mechanism	S2 AND S3
S5	Full Search String	S1 AND S4

A first search string was created to capture the notion of *exploration-exploitation duality*. As discussed earlier, exploration and exploitation are defined in broad terms which justifies the use of a correspondingly broad search string (i.e., “explor* AND exploit*”). The logical operator “AND” reflects the notion of duality as it requires that both terms be present in the articles considered for inclusion. A preliminary scoping study of the exploration-exploitation literature revealed that some articles discuss the duality but without explicit references to exploration and exploitation in their abstract (for example, using the term “ambidexterity” instead). Also, other articles discuss different types of dualities closely related to exploration-exploitation such as adaptability-alignment (e.g.,

Gibson and Birkinshaw, 2004), innovation-replication (e.g., Peeters and Martin, 2017), or adaptation-replication (e.g., Winter et al., 2012). So as to not overlook these potentially relevant sources, I have extended the exploration-exploitation duality search string to include “ambidext*,” “adapt* AND align*,” “innovate* AND replicat*,” and “adapt* AND replicat*.”

A second search string – itself composed of two substrings – was created to capture the notion of “integration mechanism.” The “integration” and “mechanism” substrings include the terms themselves as well as synonyms commonly used in the literature. These substrings were then joined together through the “AND” operator to increase the likelihood that the resulting articles would address integration issues through the lens of, at least, one specific mechanism.

Finally, these two main search strings were combined into one single search string, thus capturing the notion of integration mechanism in the context of the exploration-exploitation duality. It was this final search string that was then used to run searches against the following databases: Business Source Complete (via EBSCOhost), ABI/INFORM (via PROQUEST), and SCOPUS. These databases were selected because of their extensive coverage of the business management literature and their inclusion of all major journals discussing the topics of interest (e.g., Organization Science, Journal of Product Innovation Management, R and D Management).

2.3.3 Stage 3: Relevance and Quality Assessment

I proceeded to filter the set of articles identified through string-based searches using a three-step process that consisted of two consecutive screening phases for relevance (the first based on title and abstract only, the second based on the full content of the article), and one screening phase for quality.

Relevance Assessment. The following relevance criteria were used for both the *Title & Abstract* and *Full-Text* screening phases:

1. The study must be in the English language.
2. Exploitation, exploration, and synonyms, should be “on topic” (i.e., the meaning and use of the terms must relate to the subject matter). Non-compliant articles were tagged as “Not on Topic.”
3. The study must make at least one explicit reference to a duality related to exploration and exploitation. Non-compliant articles were tagged as “No Duality.”
4. The integration mechanisms must be described in sufficient details so that their inner workings, their application context, as well as their potential or realized impacts can be understood. Non-compliant articles were tagged as “No Integration.”

No specific exclusion criteria were defined for this review. Finally, 34 articles were added between the *Title & Abstract* and *Full-Text* screening stages through “snowballing.” For the most part, these were articles that did not come up in the string-based searches but were frequently cited as seminal references by those that did.

Quality Assessment. To facilitate the quality assessment of articles as well as their subsequent analysis, the review question was intentionally crafted to fit the Context-Intervention-Mechanism-Outcome (CIMO) format (Denyer, Tranfield and van Aken, 2008). The CIMO logic is to be interpreted as follows: for a given context (C), by using a particular intervention (I), one can activate a particular generative mechanism (M) to achieve a desired outcome (O). When applied to our review question, the mapping is as follows:

When it comes to the management of the exploration-exploitation duality (O), what is the nature and effectiveness (M) of the integration mechanisms (I) used at various organizational levels (C)?

The previous formulation helped clarify the key sub-questions that were to guide the review process and, subsequently, structure its findings. Specifically, for

each article under review, I aimed to answer the following CIMO-related questions and coded the relevant passages accordingly to facilitate the subsequent retrieval of this specific information:

C=Context. What is the application context (i.e., level of analysis, boundary conditions, etc.) associated with this integration mechanism?

I=Intervention. What are the key features of this integration mechanism?

M=Mechanism. How does this integration mechanism work to achieve its intended outcome?

O=Outcome. What is the intended outcome that this integration mechanism seeks to achieve?

Given that the articles identified in Stage 2 had gone through the peer-review process of highly selective publications (77% of selected articles were published in 3 or 4-star journals), I created a quality assessment tool tailored to the particular needs and objectives of this review, rather than a tool that attempted to assess conventional criteria of academic rigor. Specifically, the tool was designed to evaluate how each study contributed to the four CIMO components of the review question. Two criteria – associated with either *clarity*, *richness*, *credibility*, or *generalizability* – were assessed for each component, leading to the eight assessment criteria and grading levels shown in **Appendix 2-1**. To be included in the review, an article needed to score eight points or above (out of the possible 16 points). The threshold of eight was deemed appropriate as it ensured that a selected article would make valuable contributions to at least two or more CIMO dimensions. All types of articles (i.e., qualitative and quantitative studies, reviews, etc.) were evaluated using the same assessment tool based on the following rationale. First, it is often difficult to classify studies as either “qualitative” or “quantitative” since much research contains aspects of both (Thomas and Harden, 2008). Second, because each of the eight assessment dimensions was equally important in the context of this review, it made sense to evaluate articles based on their overall contribution to the same set of criteria rather than on the type of research method used. A few articles with scores

lower than eight were still included if, and only if, they approached the topic with a unique theoretical lens not commonly used in already selected articles. This ad-hoc inclusion is justified as configurative reviews should favor a greater diversity of perspectives over strict adherence to a pre-specified set of inclusion criteria (Gough, Oliver and Thomas, 2012). Articles that did not meet the quality criteria were tagged as “Low Quality.”

2.3.4 Stage 4: Analysis and Synthesis of Findings

One of the objectives of this review was to move beyond primary studies to produce interpretive constructs and formulate new hypotheses. To fulfill this purpose, I conducted a *thematic synthesis* of the literature, which is a method that can be applied within a review to bring together findings from many different types of research (Thomas and Harden, 2008). Specifically, Thomas and Harden propose the following three-stage process for the production of thematic syntheses in the context of literature reviews:

1. Coding of text
2. Development of *descriptive themes* that remain close to the primary studies
3. Development of *analytical themes* based on the interpretation of the reviewer(s)

All studies included in this review were coded using the NVivo software. The primary purpose of the coding process was to identify integration mechanisms along with related information pertaining to other CIMO components of the review question (e.g., type of duality, level of analysis, intended outcome, etc.). This identification stage was followed by an analysis stage which consisted of two steps: the development of descriptive themes through aggregation, and the development of analytical themes through interpretation.

Descriptive themes are higher-level groupings of coded items based on some shared attributes or commonality. To keep close to the studies and avoid interpretation at this stage, similar integration mechanisms were grouped under descriptive themes that, to the extent possible, could readily be associated with

existing theoretical concepts. For example, integration mechanisms like “distributed gate-keeping,” “boundary crossers,” and “high-level intermediaries” were grouped under the descriptive theme “boundary roles,” a known concept in the literature. The process of grouping integration mechanisms under descriptive themes is not purely mechanical, however, and some level of interpretation is still needed in the decision to create, combine, or remove themes, as well as in the classification of certain idiosyncratic integration mechanisms.

The definition of analytical themes relies on the interpretation of the reviewer(s), and are, therefore, potentially more controversial. In the case of this review, analytical themes were developed by grouping bundles of integration mechanisms (i.e., descriptive themes) that, together, aimed to achieve the same overarching objective. For example, descriptive themes like “boundary objects,” “boundary roles,” and “boundary networks” were associated with the ability to connect distinct knowledge domains. Consequently, I grouped these descriptive themes under the broader analytical theme of “connecting capability.” This association of bundles of mechanisms to shared objectives is justified given that the aim of this paper is to understand the nature of a specific organizational capability, namely, the “ability of an organization to perform a coordinated set of tasks [...] for the purpose of achieving a particular end result” (Helfat and Peteraf, 2003:999).

2.4 Thematic Synthesis

This section presents the outputs of this review’s thematic synthesis. While findings were synthesized through an inductive process that started at the level of individual integration mechanisms and gradually moved to higher levels of abstraction, I will present the outputs of this process in a reverse, top-down fashion, starting from the level of capabilities, then describing the bundles of individual integration mechanisms that underpin each capability.

The thematic synthesis of the literature suggests that four capabilities underlie a firm’s ability to integrate exploratory and exploitative knowledge. Two of those capabilities – namely, *unifying* and *enabling* – do not deal directly with the

knowledge in need of integration, but rather help create the proper environment for knowledge integration to take place. The other two capabilities – *connecting* and *combinative* – imply a direct interaction between the exploration and exploitation knowledge domains. At this stage, the assumption is that each of these four capabilities contributes equally to the successful integration of knowledge; therefore, the order in which they are discussed is mostly arbitrary and in no way reflects their degree of importance. To help with the narrative that follows, **Table 2-3** shows the full list of integration mechanisms identified in the course of this review, as well as their aggregation into descriptive themes (i.e., bundles of related integration mechanisms) and analytical themes (i.e., capabilities). Additionally, the reader can turn to **Appendix 2-2** to get information about the specific exploration-exploitation duality being addressed by each study.

Table 2-3: From Integration Mechanisms to Organizational Capability

Analytical Themes (in bold) / Descriptive Themes (in italics) / Integration Mechanisms	References
UNIFYING Capability	
<i>Paradoxical Cognition</i>	
Complex Strategic Integration Skills	Burgelman and Doz (2001)
Ambidextrous Cognitive Styles	Lin and McDonough (2014)
Perspective-Taking Capability	Litchfield and Gentry (2010); Parker and Axtell (2001)
TMT's Ability to Resolve Tensions/Paradoxes	O'Reilly and Tushman (2011)
Ambidextrous Leadership: Opening Behaviors, Closing Behaviors, Temporal Flexibility	Rosing, Frese, and Bausch (2011)
Integrative Roles	Smith (2014)
<i>Unifying Vision</i>	
Paradoxical Vision	Andriopoulos and Lewis (2010); Andriopoulos and Lewis (2009)
Common Vision of the Future	Crossan and Berdrow (2003)
Compelling Strategic Intent	O'Reilly and Tushman (2011)
Shared Vision	Wang and Rafiq (2009)
Common Vision and Values	O'Reilly and Tushman (2011)
Unifying Frame of Reference	Kyriakopoulos and Moorman (2004)
<i>Socially Integrated Senior Teams</i>	
Tight Top Management Integration in Steering Committee	Bröring and Herzog (2008)
Senior Team Social Integration	Jansen, Tempelaar, van den Bosch, and Volberda (2009)
Tightly-Integrated TMTs	O'Reilly and Tushman (2004)
ENABLING Capability	
<i>Organizational Design</i>	
Intermediary Units (NBD Units) between Pure EX (BU) and Pure OR (Creavis)	Bröring and Herzog (2008)
Organizational Structure (new venture group, integrators, dual responsibilities)	Burgelman and Doz (2001)
Tension-Nurturing Organizational Structure	Régner and Zander (2011)
Matrix Organizational Structure	Kaupplla (2010)
Physical Proximity	Kaupplla (2010)
Ambidextrous Organizational Architecture	Sherif, Tsado, Zheng, and Airhia (2013)
Structural Integration / Modularity	Sun and Lo (2014)
<i>Incentive Alignment</i>	
Joint Accountability	Crossan and Berdrow (2003)
Venture Bonus Plan (Startup Creation to Enrich Portfolio)	Bröring and Herzog (2008)
Possibility of Gradual Transitions Between NBD Units	Bröring and Herzog (2008)
Managerial Incentives	Burgelman and Doz (2001)
Administrative Accountability	Chen and Kannan-Narasimha (2015)
Resources Invested	Chen and Kannan-Narasimha (2015)
Incentive-Based Payment	Eriksson (2013)
Senior Team Contingency Rewards	Jansen, Tempelaar, van den Bosch, and Volberda (2009)
Motivational Disposition	Montazemi, Pittaway, Saremi, and Wei (2012)
Senior Team with Common Fate Reward Systems	O'Reilly and Tushman (2011)
Ownership Control	Phene, Tallman, and Almeida (2012)
Overarching Goals	Smith (2014)
Mutual Self-Interest	Nooteboom (2000)
Economic Incentives (salary bonus, commissions, profit sharing, promotions)	Taylor and Helfat (2009)
Paradoxical Definitions of Success	Andriopoulos and Lewis (2010)
Market Orientation	Kyriakopoulos and Moorman (2004)
<i>Controlled Empowerment</i>	
Project Manager Influence	Sheremata (2000)
Managerial Control Systems (cross-unit contributions, belief systems, boundary-setting systems)	Burgelman and Doz (2001)
Administrative Mechanisms	Sivadas and Dwyer (2000)
Improvisation	Andriopoulos and Lewis (2010)
Experimentation	Farjoun (2010)
Iteration Freedom/Boundaries	Andriopoulos and Lewis (2010)
Purposeful Improvisation	Andriopoulos and Lewis (2009)
Power (discipline, force, influence, domination)	Litchfield and Gentry (2010)
Decision-Making Authority	Mom, van den Bosch, Volberda (2009)
Multifunctional shared governance at the project level	Maniak, Midler, Beaume, and von Pechmann (2014)
Employee Involvement and Empowerment	Gil-Marques and Moreno-Luzon (2013)
Mindfulness	Farjoun (2010)
<i>Sense of Identity</i>	
Corporate Social Identity Frame	Régner and Zander (2011)
Pragmatic Artist' Identity	Andriopoulos and Lewis (2010)
Social Context (status, recognition, visibility, responsibility)	Taylor and Helfat (2009)
Public Recognition	Hayes and Fitzgerald (2009)
Socialization of Practical Artists	Andriopoulos and Lewis (2009)

Table 2-1 (continued): From Integration Mechanisms to Organizational Capability

Analytical Themes (in bold) / Descriptive Themes (in italics) / Integration Mechanisms		References
CONNECTING Capability		
<i>Boundary Objects</i>		
Joint Project Specification between Design and Construction		Eriksson (2013)
Multi-Criteria Partner Selection		Eriksson (2013)
Contracts / Trust		Sun and Lo (2014)
Formal Contracting / Trust		Nooteboom (2000)
Codified Rules and Knowledge (rulebook, artifact)		Güttel, Konlechner, Müller, Trede, and Lehrer (2012)
Boundary Objects (Stage-Gate Process)		Hayes and Fitzgerald (2009)
Showcasing Innovation		Gassman, Widenmayer, and Zeschky (2012)
<i>Boundary Roles</i>		
Distributed Gate-Keeping		Lyytinen, Rose, and Yoo (2010)
Brokering External Knowledge		Lyytinen, Rose, and Yoo (2010)
High-Level Intermediaries (Managers)		Patriotta, Castellano, and Wright (2013)
Knowledge Brokering Roles		Sherif, Tsado, Zheng, and Airhia (2013)
BU Employees used in Exploratory Units		Bröring and Herzog (2008)
Boundary Crossers (people with dual background/expertise)		Hayes and Fitzgerald (2009)
Manager's Connectedness to other Organization Members		Mom, van den Bosch, Volberda (2009); Sheramata (2000)
Liaison Channeling		Gassman, Widenmayer, and Zeschky (2012)
<i>Boundary Networks</i>		
Knowledge Hubs		Bröring and Herzog (2008)
Common Technological and Geographical Bases		Phene, Tallman, and Almeida (2012)
Peer Networks Building		Lyytinen, Rose, and Yoo (2010)
Network Building		Gassman, Widenmayer, and Zeschky (2012)
Favorable Position in Network Structure		Nooteboom (2000)
Learning Capability: Open Organizational Culture, Intra/Inter-organizational Learning		Lin, McDonough, Lin, and Lin (2013)
External Validation		Gassman, Widenmayer, and Zeschky (2012)
Transformation Network		Harryson (2008)
COMBINING Capability		
<i>Systems</i>		
Task Formalization		Mom, van den Bosch, Volberda (2009)
Formal Development Process		Kaupilla (2010)
Organization-Wide Information Processes		Kyriakopoulos and Moorman (2004)
External / Internal Electronic Integration		Nazir and Pinsonneault (2012)
Supporting Information Systems		Sherif, Tsado, Zheng, and Airhia (2013)
Dynamic Capability to Replicate through Templates		Winter and Szulanski (2001)
Simple Design Rules and Artifacts Use		Lyytinen, Rose, and Yoo (2010)
Interactive Systems		Crossan, Lane, and White (1999)
Goal Orientation through Routine Transfer		D'Adderio (2014)
<i>Coordination</i>		
Collaborative Tools		Eriksson (2013)
Participation in Cross-Functional Interfaces		Mom, van den Bosch, Volberda (2009)
Cross-Functional Interfaces		Jansen, Tempelaar, van den Bosch, and Volberda (2009)
Temporal Pacing		Sheremata (2000)
Participative Activities		Crossan and Berdrow (2003)
Cross-Functional Team Influence		Sheremata (2000)
Mutual Adjustment		Crossan, Lane, and White (1999)
Integrative Innovation Planning		Gassman, Widenmayer, and Zeschky (2012)
Peer Support		Revilla, Saenz, and Knoppen (2013)
Tight links between OR and NPD		Maniak, Midler, Beaume, and von Pechmann (2014)
Strong linkages with upstream activities (advanced product planning, marketing, etc.)		Maniak, Midler, Beaume, and von Pechmann (2014)
Resource sharing between OR and NPD		Maniak, Midler, Beaume, and von Pechmann (2014)
Communication Programs		Crossan and Berdrow (2003)
Vertical and Horizontal Communication		Revilla, Saenz, and Knoppen (2013); Sivasdas and Dwyer (2000)
<i>Socialization</i>		
Teamwork and Collective Confidence		Gil-Marques and Moreno-Luzon (2013)
Shared Customer-Oriented Culture		Kaupilla (2010)
Open Exchange of Ideas		Revilla, Saenz, and Knoppen (2013)
Organizational Cognition (shared assumptions, prior experience, values)		Taylor and Helfat (2009)
Shared Understanding		Crossan, Lane, and White (1999)
Communities of Practice (Helping, Best Practice, Innovation, Knowledge-Stewarding)		Hayes and Fitzgerald (2009)
Openness to Change		Revilla, Saenz, and Knoppen (2013)

2.4.1 Unifying Capability

The ability to rally constituencies from the exploration and exploitation domains around shared objectives appears to be an important prerequisite for knowledge integration. The findings suggest that this ability to recognize and reconcile the conflicting needs of exploration and exploitation is supported primarily by (1) paradoxical cognition, (2) a unifying vision, and (3) socially integrated senior teams.

Paradoxical Cognition. Before tensions can be managed, they must first become salient to the actors involved (Smith and Lewis, 2011). This process is dependent, in part, on the degree to which these actors have adopted paradoxical cognitive frames (Lin and McDonough, 2014; Smith and Lewis, 2011). Actors with an ability to think paradoxically tend to view contradictions as fundamental elements of their jobs, thus allowing them to embrace, rather than avoid, tensions (Kauppila, 2010; Lin and McDonough, 2014). This “ambidextrous mindset” will, in turn, enable the active management of tensions associated with the simultaneous pursuit of exploration and exploitation (Andriopoulos and Lewis, 2009; Smith and Tushman, 2005). The process of shifting between opposing frames of mind and related activities is not confined to top management, but can be found in ambidextrous managers (Gibson and Birkinshaw, 2004; Smith and Tushman, 2005), as well as teams and individuals (Bledow et al., 2009; Mom, van den Bosch and Volberda, 2009). Consequently, the development of paradoxical cognitive frames at all hierarchical levels of the organization acts as an important prerequisite for the development and implementation of integration strategies.

Unifying Vision. The integration of opposing goals benefits from the cultivation of a paradoxical vision that allows for the pursuit of dual objectives (Andriopoulos and Lewis, 2009). A clearly communicated vision facilitates the integration of convergent (i.e., conformity-seeking) and divergent (i.e., diversity-seeking) outputs from differentiated units (Bledow et al., 2009) by helping to address the “knowledge stickiness” problem (i.e., the difficulty of transferring know-how within organizations (Jensen and Szulanski, 2004)) through

productive dialogs across diverse contexts and knowledge bases (Montazemi et al., 2012). The combination of a compelling strategy and a shared vision that, respectively, justifies and unifies exploration and exploitation efforts facilitates future collaboration, trust, and sharing of resources across exploratory and exploitative units (O'Reilly and Tushman, 2011). In short, a common vision acts as a key bonding mechanism for the organization by imbuing its members with a sense of purpose and direction (Orton and Weick, 1990) while paving the way for integration and combination of resources (Tsai and Ghoshal, 1998).

Socially Integrated Senior Teams. Linkages between the exploratory and exploitative knowledge domains can be strengthened through the creation of senior-level teams that include members from each domain (Bröring et al., 2008). Such hybrid teams will be better able to identify conflicting objectives and reconcile them into coherent strategies (Jansen et al., 2009), thus potentially unlocking synergies between exploratory and exploitative efforts in the process (Teece, 2007). The degree of social integration – defined as the “attraction to the group, satisfaction with other members of the group, and social interaction among the group members” (O'Reilly, Caldwell and Barnett, 1989: p. 22) – between the members of such teams will determine their capacity for collaboration and negotiation (Barkema and Shvyrkov, 2007), as well as their ability to recognize and seize opportunities (Jansen et al., 2009). Socially integrated senior teams are, therefore, an important prerequisite driving the differentiated pursuit, and subsequent integration, of exploratory and exploitative knowledge (O'Reilly and Tushman, 2011).

2.4.2 Enabling Capability

Each organization needs to manage its learning activities in its unique context (Crossan and Bedrow, 2003). Firms that succeed in providing an enabling environment for the simultaneous pursuit of adaptation and alignment may uncover a powerful source of sustainable advantage (Simsek, 2009). Adler, Goldoftas, and Levine (1999) refer to organizations that have been able to routinize adaptation and alignment processes as “enabling bureaucracies.” Ambidextrous contexts, and the extent to which they enable firms to capture the

benefits of exploration and exploitation, rest principally on the firm's ability to balance and integrate the outputs of these opposing activities (Kauppila, 2010). Beyond vision and control, leaders and managers must strive to create socially rich and supportive environments throughout all stages of the innovation process (Rosing, Frese and Bausch, 2011). Such environments will ensure that proper knowledge integration routines can be enacted (D'Adderio, 2014), ambidextrous behaviors are encouraged (Raisch et al., 2009), and paradoxical decision-making can take place (Smith, 2014). This study's findings suggest that four factors play a role in enabling integration: organizational design, incentive alignment, controlled empowerment, and a sense of identity.

Organizational Design. Leaders make choices regarding the optimal organizational structure for the simultaneous pursuit of exploratory and exploitative knowledge (Smith and Tushman, 2005). These choices have a significant impact not only on the ability of firms to absorb new knowledge (Van den Bosch, Volberda and de Boer, 1999) but also on their subsequent ability to integrate that knowledge (Boer, Van Den Bosch and Volberda, 1999). A potential solution to the integration problem is to provide different structural design options for innovative projects (Burgelman and Doz, 2001) and to allow for these structures to evolve as the innovation matures so as to facilitate their integration into mainstream activities when needed (Bröring et al., 2008). More generally, changes in the internal and external environment of the firm require organizational designs to evolve (Raisch and Birkinshaw, 2008). The question of whether a chosen organizational structure will allow for the effective management of shifting interdependencies between existing business units and new ventures is one that impacts the firm's overall entrepreneurial capability (Burgelman and Doz, 2001). Consequently, it appears that the ability to provide the appropriate organizational design and do so over time is likely to play a significant role in enabling actors not only to pursue exploration and exploitation activities independently but also to integrate these activities at the opportune juncture.

Incentive Alignment. Exploratory and exploitative units often operate under different organizational structures, incentives, and beliefs (Levinthal and March, 1993). Therefore, one of the main roles of leadership is to accommodate and resolve the tensions inherent in this separate arrangement, both at the strategic and tactical levels (O'Reilly and Tushman, 2011). Several mechanisms designed to align the interests of exploration and exploitation factions have been investigated, such as establishing paradoxical definitions of success by simultaneously promoting cohesiveness and diversity (Andriopoulos and Lewis, 2010), or by simultaneous rewarding and structuring creativity (Bledow et al., 2009). Other mechanisms include tying the financial rewards of exploration unit employees to the successful exploitation of the knowledge they have produced (Bröring et al., 2008). Artifacts (such as "golden rules," templates, exception lists, and change requests process) and communities (such as change review boards and engineering forums) can also be adapted to steer groups and individuals toward either alignment or improvement objectives according to current business needs (D'Adderio, 2014). Senior teams can be incentivized through contingency rewards to encourage novel combinations of exploitative groups and exploratory units (Smith and Tushman, 2005). Finally, a focus on addressing customer needs (i.e., market orientation) also facilitates integration by providing a shared lens through which to assess and evaluate exploration and exploitation activities (Kyriakopoulos and Moorman, 2004). To summarize, integration can be enabled through a variety of incentive alignment mechanisms that, while not dealing with knowledge integration directly, aim to provide a context in which actors are encouraged to bridge the gaps between the exploration and exploitation domains.

Controlled Empowerment. Organizations can unlock the complementarities between change and stability through hybrid environments that simultaneously promote variation and control (Farjoun, 2010). Formal procedures and control systems enable employees to more effectively engage in non-routine tasks (Adler, Goldoftas and Levine, 1999), while standardized processes and codification provide a stable context that guides the individual's sensemaking process (Zollo and Singh, 2004). In the context of new product development – a prime context where exploration meets exploitation (Rothaermel and Deeds, 2004) – Miner and colleagues (2001) suggest that the proper balance between freedom and structure enables improvisation or “the deliberate and *substantive fusion* of design and execution”(p.314). Integrative approaches to innovation work often mix an adherence to established routines with the freedom to explore beyond project boundaries (Andriopoulos and Lewis, 2009). In short, a context in which the proper balance of autonomy and control is achieved will signal trust and, therefore, contribute positively to the motivation and ability of individuals to reconcile conflicting objectives (Adler, Goldoftas and Levine, 1999).

Sense of Identity. When diverse groups collide, as is the case during knowledge integration, preserving and valuing each member's identity is a concern. Managers must implement techniques to attend to the varying motivations and norms of groups with distinct identities such as those working in different business functions (Hayes and Fitzgerald, 2009). Public recognition of successful collaborations, as well as social rewards that boost self-esteem and social status, are useful devices to preemptively defuse rivalries and encourage collaboration (Hayes and Fitzgerald, 2009). At times, the individual's identity itself must become paradoxical as is the case when discipline and passion must co-exist within the person who seeks creativity in full awareness of existing limitations (Andriopoulos and Lewis, 2009). While conflicting social identity frames may lead to temporary tensions between organizational subgroups, these tensions may also lead to knowledge creation through integration (Regnér and Zander, 2011). These findings suggest that the way social identities form and evolve have an impact on the effectiveness of integration strategies.

2.4.3 Connecting Capability

The success of innovation projects hinges on two fundamental capabilities: (1) the ability to reach a diverse set of knowledge and expertise, followed by (2) the ability to combine that knowledge and expertise at the operational level (Tiwana, 2008). This section on connecting capability discusses the former while the following section on combinative capability will address the latter.

Boundary Objects. Formalization through the use of rules, rulebooks and other artifacts, can be designed to sit at the interface between exploration and exploitation units to establish a common language and framework of understanding in order to facilitate communication and knowledge exchange between those units (Güttel et al., 2012). Boundary objects – be they of material, spatial, or procedural form – can thus provide a means to facilitate the reconciliation of conflicting concerns (Star and Griesemer, 1989) such as those associated with exploration and exploitation. Perhaps, one of the most emblematic embodiments of an innovation boundary object is the formalized product development process or Stage-Gate® process (Cooper, 1990). These processes are designed to move an idea forward to commercialization with clearly defined collaboration (bridging) points between exploration and exploitation-minded groups (Hayes and Fitzgerald, 2009). Formal contracts are another type of boundary objects that help connect the future of alliance partners by specifying whether and how complementary knowledge will be shared, integrated, and used in the downstream stages of the collaboration (Sun and Lo, 2014). Various other artifacts, such as prototypes of innovative products, for example, allow for the effective dissemination of cutting-edge concepts and ideas, thus contributing to greater acceptance by more operationally-driven constituencies (Gassmann, Widenmayer and Zeschky, 2012). Boundary objects of all kinds, therefore, act as a *tertius iungens*, “introducing disconnected individuals or facilitating new coordination between connected individuals” (Obstfeld, 2005, p. 102).

Boundary Roles. Beyond objects, individuals play a fundamental role in connecting disparate groups within and without the organization. This is particularly true of high-level managers who can leverage their organization-wide knowledge of on-going initiatives to identify, transfer, and leverage relevant information across units (Patriotta, Castellano and Wright, 2013). Burgelman and Doz (2001) have suggested that boundary spanners can be created at the most senior level, for example by entrusting executives with the dual objectives of leading new business development initiatives while simultaneously managing major established businesses. Middle-managers have also been shown to be critical to the success of innovations thanks to their primary function as connectors (Taylor and Helfat, 2009). Researcher-managers, in particular, play this role by shifting their cultural frames back-and-forth according to the needs of science and practice (Steiner, 2000). More generally, boundary spanning capabilities can be found in those key individuals endowed with in-depth knowledge of distinct disciplines who act as translators of behaviors, knowledge systems and social values between one group and another (Hayes and Fitzgerald, 2009). Cohen and Levinthal (1990) identified “gatekeepers” as those individuals whose main responsibilities include scanning the environment for new business and technical knowledge which they will then reformulate for later transfer and assimilation. The practice of job rotation can help embed individuals experienced in exploration within exploitation-focused teams, thus positioning them as *de facto* boundary spanners across these two worlds (Gassmann, Widenmayer and Zeschky, 2012). In short, individuals, in all sorts of formal and informal capacity, play an important role as living bridges between disjointed groups and competence realms.

Boundary Networks. At a higher level of analysis, networks of individuals and organizations can provide the necessary platforms for integration. When the main goal of networks is the integration of new and existing knowledge, they are referred to as “transformative networks,” in contrast to the exploration-focused “creativity networks,” and exploitation-focused “process networks” (Harryson, 2006). These networks take many shapes and names, such as “knowledge hubs” (Bröring et al., 2008), “innovation communities of practice” (Wenger,

McDermott and Snyder, 2002), or “peer networks” (Lyytinen, Rose and Yoo, 2010). Beyond the typical mix of profiles and expertise contained in these networks, what is equally important is the types of links that bind the various parties. Weak ties favor the pursuit of creative ideas but may hamper their implementation, whereas strong ties tend to impact the exploitation of new ideas positively but may prevent their emergence (Tiwana, 2008). In summary, networks that are semi-open and neither too tightly nor too loosely coupled can serve as effective bridges between new and existing knowledge.

2.4.4 Combinative Capability

Combinative capabilities are a necessary addition to boundary-spanning mechanisms (Henderson and Cockburn, 1994). Kogut and Zander (1992) introduced the concept of combinative capability and defined it as the ability to synthesize and apply new and existing knowledge. These authors posit that, in times of rapid change, rearranging knowledge components may be an attractive way for the firm to generate novel applications, thus foreshadowing Obstfeld's (2005) notion of “combinatorial innovations.” Other scholars point to the importance of combinative capabilities by arguing that, beyond the quantity of knowledge, what matters is the firm's ability to recombine and exploit that knowledge (Spender and Grant, 1996), and that this ability leads to competitive advantage (Regnér and Zander, 2011). This review has identified a variety of integration mechanisms that cohere well with Van den Bosch, Volberda and de Boer's (1999) sub-categorizations of combinative capabilities into systems, coordination, and socialization capabilities.

Systems. Systems capabilities refer to the extent to which processes, rules, and instructions are formalized into written documents and systems (Van den Bosch, Volberda and de Boer, 1999). This formalization is the result of the organization growing beyond its ability to rely on ad-hoc mechanisms to coordinate actions (Crossan, Lane and White, 1999). Through systems capabilities, knowledge is made explicit, which facilitates its transfer (Crossan, Lane and White, 1999), as well as enables non-routine, innovative work (Adler, Goldoftas and Levine, 1999; Van den Bosch, Volberda and de Boer, 1999).

Templates that capture best practices have been shown to positively impact a firm's growth and profitability (Winter and Szulanski, 2001). Information technology tools allow for the coupling of business processes resulting in improved reactivity (Nazir and Pinsonneault, 2012), and an increased ability to reconfigure and reassign resources (Setia, Sambamurthy and Closs, 2008). Formalized routines at the managerial level have also been shown to have a beneficial impact on information flows to managers, thus enhancing their decision-making ability (Robert Baum and Wally, 2003) without hampering their ambidexterity (Mom, van den Bosch and Volberda, 2009). Formalization may also include rules and procedures to effect change (Mom, van den Bosch and Volberda, 2009), which is akin to Adler, Goldoftas and Levine's (1999) concept of "metaroutines." In short, far from preventing innovation, systems and their bureaucratic properties provide the necessary structure to avoid the trappings of "flexible only" organizations (Mayrhofer, 1997).

Coordination. Coordination capabilities improve the exchange of knowledge across functional and hierarchical boundaries (Henderson and Cockburn, 1994). These capabilities rely on mechanisms that help bring different expertise and viewpoints closer together, as well as facilitate communication between functional or component knowledge (Jansen, Van Den Bosch and Volberda, 2005). However, bringing different knowledge domains together, such as exploration and exploitation, may result in differences in perspectives that may impede organizational learning and innovation (Litchfield and Gentry, 2010). In those cases, the ability to take another person's viewpoint – "perspective taking" as defined by Parker and Axtell (2001) – can lead to greater social coordination which, in turn, will enhance knowledge integration (Galinsky, Ku and Wang, 2005; Litchfield and Gentry, 2010). Additionally, regular and reinforcing communication helps address misinterpretations of paradoxical visions, such as simultaneously balancing long-term and short-term objectives, thus facilitating their integration (Andriopoulos and Lewis, 2010). Beyond communication programs, participative activities facilitate the acceptance of managerial decisions by lower-level employees, thereby enhancing the ability to integrate differing views (Crossan and Bedrow, 2003). Also, coordination, through formal

group meetings and early draft agreements, helps the development of shared norms as well as the resolution of differences (Bettenhausen and Murnighan, 1985). Some boundary-spanning mechanisms discussed earlier, such as job rotation and cross-functional interfaces (Gupta and Govindarajan, 2000), also contribute to greater coordination and sharing of resources across exploration and exploitation units (Maniak et al., 2014). In short, coordination capabilities facilitate integration across knowledge domains through regular communication and interactions across hierarchical and functional boundaries.

Socialization. Socialization capabilities allow firms to create a shared ideology and provide their employees with an appealing identity and collective understanding of reality (Van den Bosch, Volberda and de Boer, 1999). At their core, socialization mechanisms address one of two aspects of socialization: connectedness (i.e., the density of linkages) and shared experiences (Jansen, Van Den Bosch and Volberda, 2005). Connectedness plays a fundamental role in the development of shared codes and language, which allows people of different backgrounds and experience to more efficiently communicate and integrate new knowledge (Hansen, 2002). A culture that promotes knowledge sharing will enhance both exploration and exploitation activities (Lin et al., 2013). Equally important is the development of a culture of trust because knowledge flows more easily between units and groups that feel they can rely on each other (Almeida, Song and Grant, 2002), and is also more likely to be integrated into existing practices (Szulanski and Jensen, 2004). Finally, a shared ideology contributes to reducing the “cognitive distance” between individuals, allowing them to put their complementary skills to the pursuit of common goals (Nooteboom, 2000). In sum, beyond fostering the development of a common identity (an outcome related to creating an *enabling* environment as discussed earlier), socialization also has a direct impact on the ability of individuals, teams, and organizational units to integrate knowledge.

2.5 The Nature and Effectiveness of Integration Mechanisms

This section answers the review question about the *nature* and *effectiveness* of integration mechanisms. When discussing the nature of integration mechanisms, I will also conceptualize the ability of firms to integrate across conflicting knowledge domains and will put forward four propositions to motivate further research. Finally, I will present the findings related to the effectiveness of specific integration mechanisms by reviewing the quantitative studies identified in the context of this review.

2.5.1 The Nature of Integration Mechanisms

The thematic synthesis described in the previous section contributes three key insights into the nature of integration mechanisms.

Mechanisms Foster Integration in Four Distinct Ways. While the identification of analytical themes is subject to interpretation, the integration mechanisms identified in this review seemed to converge naturally toward distinct emergent categories. These categories reflect the four different ways in which mechanisms foster integration. The first set of mechanisms provides unity to the integration process while the second facilitates and enables it; the third set of mechanisms helps connect the exploratory and exploitative knowledge domains while the fourth ensures that these domains can be combined in novel and value-adding ways. This purpose-based classification hints at the multidimensional nature of integration, thus providing a first valuable insight upon which to build new theory. More formally, the outputs of the thematic synthesis suggest that the ability of firms to integrate exploratory and exploitative knowledge in value-adding ways depends on four distinct capabilities that can be defined as follows:

Unifying capability refers to the ability to recognize and reconcile the needs of conflicting knowledge domains.

Enabling capability refers to the ability to create an environment in which individuals, groups, and organizations can successfully connect and combine knowledge from conflicting domains.

Connecting capability refers to the ability to establish knowledge flows between conflicting knowledge domains.

Combinative capability refers to the ability to synthesize knowledge from conflicting domains in value-adding ways.

Each of these capabilities contributes to the overall objective of integration which was initially defined as the process of fostering greater interaction and collaboration between conflicting knowledge domains with the aim of achieving synergistic outcomes. Consequently, it can be argued that the capabilities that emerged from the thematic synthesis are four distinct and complementary dimensions of a higher-level capability which I will call *integrative capacity*.

Proposition 1: *The unifying, enabling, connecting, and combinative capabilities play distinct and complementary roles in developing integrative capacity – i.e., the ability of organizations to integrate knowledge across conflicting domains.*

Integration Mechanisms Operate at Multiple Levels of the Organization. Although not emphasized in the thematic synthesis, this section brings to light another important aspect of integration mechanisms, namely, their relevance at multiple levels of the organization. To illustrate this point, I used Turner, Swart and Maylor's (2013) multilevel categorization scheme to relate bundles of integration mechanisms to the level of analysis at which they primarily operate. These authors applied their multilevel typology to the classification of ambidexterity mechanisms (i.e., mechanisms that enable the simultaneous pursuit of exploration and exploitation), which, given their close relatedness to integration mechanisms, justifies the use of their framework in the present context. In their classification, organization-level mechanisms relate to *strategy, structure, operations, and inter-organizational relationships*; group-level mechanisms cover *social context and team interactions*; and individual-level mechanisms emphasize *managerial roles and leadership behaviors*. A few of the integration mechanisms uncovered in the context of this review require two additions to the framework: a *systems and processes* category as an organization-level component (Kang and Snell, 2009) and a *cognition* category as an individual-level component. **Table 2-4** illustrates how groups of integration

mechanisms were associated with a given capability and level of analysis. It is important to note that this classification is a much-simplified account of reality. Indeed, a given integration mechanism may operate at multiple levels of analysis and also support more than one capability. These spillovers and overlaps notwithstanding, each group of integration mechanisms tends to be more closely associated with one level of analysis and capability; it is this primary mapping that is shown in **Table 2-4**.

Table 2-4: Classification of Integration Mechanisms by Level of Analysis and Associated Capability

	UNIFYING CAPABILITY	ENABLING CAPABILITY	CONNECTING CAPABILITY	COMBINATIVE CAPABILITY
Organization Level <i>strategy</i> <i>structure</i> <i>systems & processes</i> <i>inter-firm relationships</i>	Unifying Frame of Reference (e.g., paradoxical vision, shared goals and values, compelling strategic intent)	Organizational Design (e.g., evolutionary and tension-nurturing organizational structures, intermediaries units, etc.)	Boundary Networks (e.g., knowledge hubs, transformation networks, peer networks, etc.)	Systems Capabilities (e.g., task formalization, organization-wide information processes, templates, design rules, etc.)
Group Level <i>social context</i> <i>team interactions</i>	Socially Integrated Senior Teams	Incentive Alignment (e.g., senior team contingency rewards, joint accountability, paradoxical definition of success, etc.)	Boundary Objects (e.g., joint project specifications, stage-gate processes, contracts and trust, etc.)	Coordination Capabilities (e.g., cross-functional interfaces, resource sharing, communication programs, etc.) Socialization Capabilities (e.g., teamwork and collective confidence, shared understandings, communities of practice, etc.)
Individual Level <i>leadership behavior</i> <i>managerial role</i> <i>cognition</i>	Paradoxical Cognition (e.g., complex strategic integration skills, ambidextrous cognitive styles, perspective-taking abilities, etc.)	Controlled Empowerment (e.g., purposeful improvisation, multifunctional shared governance, etc.) Sense of Identity (e.g., public recognition, corporate social identity frames, etc.)	Boundary Roles (e.g., boundary crossers, manager's connectedness, knowledge brokers, etc.)	

Not only does the result of this classification support the multilevel nature of integration mechanisms, but it also suggests that most capabilities can be developed at any level of analysis. This latter point constitutes a second useful theoretical insight about the nature of integration, and leads to the second proposition:

Proposition 2: Integrative capacity can be developed at the organization, group, and individual levels of the firm.

Integration Mechanisms are Flexible and Dynamic. This review also suggests that integration mechanisms are *flexible* (i.e., they are adjustable regarding how tightly they “link” the exploration and exploitation domains) and *dynamic* (i.e., they can be adjusted over time as the particular context and priorities dictate). These valuable features of integration mechanisms are discussed in a variety of studies from the surveyed literature. For example, slight modifications in the enactment of routines – through artifacts and communities – can support alternating orientation toward conflicting goals (D’Adderio, 2014); distributed gate-keeping and simple rules work together to allow for “fast switching” between exploratory and exploitative learning (Lyytinen, Rose and Yoo, 2010); ambidextrous leadership and temporal flexibility enable managers to alternate between exploration-friendly (“opening”) and exploitation-friendly (“closing”) behaviors as the need of the innovation task requires (Rosing, Frese and Bausch, 2011); finally, in the context of knowledge-sharing alliances, “inter-temporal” changes to structural arrangements and control mechanisms between partners can improve the long-term prospect of the relationship (Sun and Lo, 2014). Because integration mechanisms are flexible and dynamic, they can be used to orchestrate the interactions between the exploratory and exploitative knowledge domains to adapt to prevailing circumstances. Consequently, integration mechanisms play an important role in the ability of organizations to sense and seize opportunities, which suggests that, together, these mechanisms may form the basis of a broader dynamic capability as defined by Teece (2007).

In sum, I argue that integrative capacity is a dynamic capability due to its strategic role in (1) enabling flows and transformation of knowledge assets upon which lower-level organizational capabilities depend, and in (2) unlocking synergies between complementary knowledge domains to sustain competitive advantage. This rationale, along with the other findings from this review, leads to the third proposition:

***Proposition 3:** The unifying, enabling, connecting, and combinative capabilities represent four dimensions of integrative capacity, a higher-level dynamic capability.*

Finally, this review has shown that a variety of integration mechanisms can be used to achieve the same given objective (i.e., unifying, enabling, connecting, or combining). This suggests that organizations can develop each of these four capabilities in ways that are idiosyncratic and path-dependent. It follows that integrative capacity – which comprises these four capabilities – will also possess this attribute of equifinality typical of dynamic capabilities (Eisenhardt and Martin, 2000), which leads to the fourth and final proposition:

***Proposition 4:** Integrative capacity is a dynamic capability with significant commonalities across organizations, although its development may be achieved through firm-specific approaches.*

2.5.2 The Effectiveness of Integration Mechanisms

Of the sixty-one articles included in this review, only eleven were quantitative studies that could be used to assess the effectiveness of specific integration mechanisms. Still, a few observations can be made (see **Table 2-5** for a summary of these studies).

First, the high heterogeneity of contexts, levels of analysis, and types of dependent variables prevent any sweeping generalization of the findings. However, the results do highlight the overall positive role played by integration mechanisms on innovation performance (e.g., Kyriakopoulos and Moorman, 2004a; Moreno-Luzon, Gil-Marques and Valls-Pasola, 2013; Sivadas and Dwyer, 2000), business performance (e.g., Lin et al., 2013b; Menguc and Auh,

2008), and ambidexterity of various types (e.g., Jansen, Van Den Bosch and Volberda, 2006; Lin and McDonough, 2014; Mom, van den Bosch and Volberda, 2009; Tiwana, 2008).

Second, the diverse effects of integration mechanisms – direct (5), indirect (3), moderating (1), or mediating (2) – show that their precise role and impact on organizational outcomes have not yet coalesced. This represents a challenge for scholars in their articulation of broad managerial recommendations regarding the links between integration and performance.

Third, with the exception of Sivadas and Dwyer (2000) and Jansen, Van Den Bosch and Volberda (2006), all studies investigate the impact of a single integration mechanism. None of the studies included in this review investigated integration at a higher level of abstraction, such as that of an organizational capability.

In sum, the quantitative studies included in this review do not lend themselves to an aggregative approach, let alone any kind of meta-analysis. While the results suggest a positive effect on organizational outcomes, they do not provide a definitive word on the impact of integration mechanisms on innovation or business performance.

Table 2-5: Summary of Quantitative Studies

Authors	Year	Integration Mechanism <i>(independent variable)</i>	Effect	Key Findings <i>(dependent variable in bold)</i>	Level of Analysis	Related Capability
Tiwana	2008	Bridging Ties Strong Ties	Indirect	In the context of project alliances, strong ties, as well as their interaction with bridging ties, indirectly impact alliance ambidexterity by enhancing knowledge integration (mediating variable).	Inter-Organization	Connecting (Integrative Networks) Connecting (Integrative Networks)
Sivadas, Dwyer	2000	Cooperative Competency (Trust, Communication, Coordination)	Direct	In the context of alliance partnerships, cooperative competency is positively related to new product development success .	Inter-Organization	Combinative (Socialization) Combinative (Coordination) Combinative (Coordination)
Gil-Marques, Moreno-Luzon	2013	Culture of Exploration / Exploitation	Mediating	The implementation of TQM-related human resource indirectly leads to higher levels of both radical and incremental innovation by positively fostering a cultural change toward both exploration and exploitation (mediating variable).	Organization	Combinative (Socialization)
Phene, Tallman, Almeida	2012	Level of Control through Ownership	Direct	In the context of acquisitions, level of ownership control is positively related to exploration but negatively related to exploitation .	Inter-Organization	Enabling (Controlled Empowerment)
Jansen, Tempelaar, van den Bosch, Volberda	2009	Senior Team Social Integration Cross-Functional Interfaces	Mediating	Senior team social integration and cross-functional interfaces mediate the relationship between structural differentiation and ambidexterity .	Organization	Unifying (Socially Integrated STs) Combinative (Coordination)
Menguc Auh	2008	Market Orientation (Customer Orientation, Competitor Orientation, Interfunctional Coordination)	Moderating	In terms of firm performance , market orientation interacts (moderating variable) with ambidexterity positively for prospectors but negatively for defenders.	Organization	Enabling (Incentive Alignment) Enabling (Incentive Alignment) Combinative (Coordination)
Kyriakopoulos, Moorman	2004	Market Orientation	Direct	Market-oriented firms that pursue high levels of both market exploration and market exploitation strategies exhibit higher levels of new product performance .	Organization	Enabling (Incentive Alignment)
Lin, McDonough	2014	Ambidextrous Cognitive Frame (Independent Cognitive Style x Reflection Cognitive Style) Intra-SBU Learning Inter-SBU Learning	Indirect	Ambidextrous cognitive frames indirectly foster innovation ambidexterity by facilitating intra-SBU learning and inter-SBU learning simultaneously (mediating variables).	Organization	Unifying (Paradoxical Cognition) Connecting (Boundary Networks) Connecting (Boundary Networks)
Lin, McDonough, Lin, Lin	2013	Open Organizational Culture Intraorganizational Learning Interorganizational Partnering	Indirect	The combination of the three learning capability dimensions indirectly fosters higher business performance by positively impacting innovation ambidexterity (mediating variable).	Organization	Combinative (Socialization) Connecting (Boundary Networks) Connecting (Boundary Networks)
Jansen, Van den Bosch, Volberda	2005	Combinative Capabilities (Coordination, Systems, Socialization)	Direct	Coordination capabilities positively impact the acquisition stage and, to a lesser extent, the transformation stage of the absorptive capacity construct. Socialization capabilities positively impact the transformation and exploitation stages of the absorptive capacity construct.	Organization	Combinative (Coordination) Combinative (Systems) Combinative (Socialization)
Mom, van den Bosch, Volberda	2009	<u>Manager's</u> Decision-Making Authority Task Formalization Participation in Cross-Functional Interfaces Connectedness to other Organization Members	Direct	Personal types of coordination mechanisms have a greater positive impact on manager's ambidexterity that formal structural types. Formalization of a manager's tasks does <u>not</u> negatively impact manager's ambidexterity . Manager's participation in cross-functional interfaces is positively related to manager's ambidexterity . Manager's connectedness is positively related to manager's ambidexterity .	Individual	Enabling (Controlled Empowerment) Combinative (Systems) Combinative (Coordination) Connecting (Boundary Roles)

2.6 Discussion

The management of the exploration-exploitation duality is more complex than originally thought. From relatively simple differentiation-based approaches (e.g., Tushman and O'Reilly, 1996; Tushman and Romanelli, 1985), scholars have shifted their focus to more integrative strategies (e.g., Gibson and Birkinshaw, 2004; Smith and Tushman, 2005). There is also a growing realization that the effective management of the exploration-exploitation duality might require shifts between strategies over time (Raisch and Tushman, 2016) and the coexistence of different strategies across levels of the organizations (Andriopoulos and Lewis, 2009; Jansen et al., 2009; Turner, Swart and Maylor, 2013). This increasing complexity is reflected in the various redefinitions of what ambidexterity means: from the ability to simultaneously explore and exploit (O'Reilly and Tushman, 2004) to its more elaborate definition as a dynamic capability being built upon “the routines and processes by which organizations mobilize, **coordinate**, and **integrate** dispersed exploratory and exploitative efforts, and allocate, reallocate, **combine**, and **recombine** resources and assets across differentiated units.” (Jansen et al., 2009:797 - emphasis added).

The present review approaches this complexity by referring back to the two cardinal abilities that underlie the effective management of the exploration-exploitation duality: differentiation and integration. This approach is based on the premise that the conceptualization of the ability to differentiate between and integrate across conflicting knowledge domains offers a valuable lens for exploration-exploitation research as well as other related streams of investigation. For reasons stated at the outset, this review focuses exclusively on the ability to integrate and makes three main theoretical contributions.

This review started from the premise that the management of the exploration-exploitation duality is a central strategic concern, particularly as it relates to integration of knowledge across these conflicting domains. Yet the large number and variety of integration mechanisms discussed in the literature only complicate our understanding of strategic integration issues. By making sense of a large range of integration mechanisms operating at multiple levels of the

organization, this review's first contribution is to reveal the nature of integration as a strategic, multilevel organizational capability. This shift from the tactical level of integration mechanisms to the strategic level of organizational capability is a valuable step that helps inform strategy-making. Specifically, the proposed concept of integrative capacity suggests two things: first, that leaders can make strategic decisions to improve their organizations' ability to integrate knowledge from conflicting domains by developing each of the four sub-capabilities discussed in this review; second, that these leaders can initiate the development of these capabilities at any level of the organization. Further building on this strategic view of integration, I proposed a conceptualization of integrative capacity as a dynamic capability that contributes to the firm's ability to maintain competitive advantage through the value-adding integration of two key knowledge assets.

The second contribution is to the field of ambidexterity research. At the beginning of this review I described how all ambidexterity approaches discussed in the literature (i.e., temporal, structural, contextual, paradoxical) rely on the dual ability to differentiate and integrate. One could infer, therefore, that the ability to integrate across knowledge domains is an important contextual factor in explaining the success or failure of ambidexterity strategies. The concept of integrative capacity thus provides ambidexterity researchers with a potential mediating or moderating construct that may help explain why or under what conditions specific ambidexterity approaches lead to higher performance. Importantly, integrative capacity, like ambidexterity, is a multilevel concept, which allows for future investigations of their interrelationship at all levels of the organizations.

Finally, this review contributes to paradox theory. The differentiation and integration of contradictory yet interdependent elements are paradox resolution strategies that have been discussed in the literature (e.g., Andriopoulos and Lewis, 2009; Smith and Tushman, 2005). However, to date, paradox scholars have investigated only a limited number of differentiating and integrating practices (e.g., Andriopoulos and Lewis, 2009; Smith, 2015) and have not yet

provided a higher level conceptualization of the ability to differentiate and integrate between paradoxical elements. This review not only extends the range of integration mechanisms beyond those discussed in extant studies but also provides valuable conceptual insights that may apply to paradoxes other than exploration-versus-exploitation.

2.7 Further Research and Limitations

The management of the exploration-exploitation duality through the lens of integration and differentiation offers many avenues for future research.

Ambidexterity research is the primary field that concerns itself with the management of the exploration-exploitation duality. In their meta-analysis of the ambidexterity-performance relationship, Junni and colleagues (2013) suggest that the mixed results of prior research can, to a large extent, be explained by contextual factors and methodological choices that moderate that relationship between ambidexterity and performance. In particular, these authors point to the measurement of ambidexterity as being one such moderator. As mentioned earlier, the definition of ambidexterity has evolved beyond the simultaneous engagement in exploration and exploitation to include notions of “coordination,” “integration,” and “combination” (Jansen et al., 2009). Yet these notions are not reflected in the traditional conceptualization and operationalization of the ambidexterity concept. This gap invites further research into the exact nature of the relationships between the ability to simultaneously engage in exploration and exploitation (i.e., ambidexterity), the ability to integrate knowledge across these domains (i.e., integrative capacity), and organizational performance. On a related line of inquiry, the question of which type of ambidexterity strategy (structural, temporal, contextual, or paradoxical) would benefit the most from greater integrative capacity is worthy of further investigation.

The ability to differentiate and integrate is essential not only to the management of the exploration-exploitation duality but also to the management of paradoxes in general (Lewis and Smith, 2014). The concept of integrative capacity has been developed based on the review of integration mechanisms pertaining to one specific type of paradox. To be relevant to the meta-theory of paradox,

however, the concept needs to be generalized further. Similar reviews of integration mechanisms associated with other types of paradoxes would enrich our understanding of integration, and take us closer to a general conceptualization of the ability to integrate paradoxical elements.

Finally, while prior research suggests that the integration of exploration and exploitation has a positive effect on organizational outcomes, too much integration across these knowledge domains may be counterproductive (Smith, 2014). Consequently, there may well be decreasing returns to developing ever higher levels of integrative capacity. Further research is needed to understand under what conditions the development of integrative capacity is most/least beneficial.

Finally, this review is not without limitations. The systematic review process implies the use of predetermined search strings. The implication is that the design of these search strings is crucially important to the identification of articles to be included for review. While I have devoted great care in crafting these search strings, I cannot guarantee that they led to the identification of *all* relevant articles. Also, ninety percent of the articles identified through database searches were dismissed based on abstract screening only. Consequently, there is a risk that some insightful articles may have been dismissed because the abstract did not meet the selection criteria while the main body of the article may well have. Finally, for the sake of greater reliability, the inductive process that led to the findings and conceptualization presented in this paper would have benefited from the involvement of multiple coders and interpreters.

2.8 Conclusion

The ability of organizations to integrate across knowledge domains is central to capturing the value created by differentiation. This review was an attempt to leverage studies of tactical integration mechanisms for the purpose of defining a strategic organizational capability. The impetus for this work was based on the premise that a conceptualization of integration as an organizational capability could provide a valuable lens for ambidexterity and paradox researchers while

remaining relevant to practice by grounding the theorizing in concrete managerial practices.

2.9 References

- Adler, P.S., Goldoftas, B. and Levine, D.I. (1999) 'Flexibility versus efficiency? A case study of model changeovers in the Toyota production system.', *Organization Science*, 10(1), pp. 43–68.
- Almeida, P., Song, J. and Grant, R.M. (2002) 'Are firms superior to alliances and markets?', *Organization Science*, 13(2), pp. 147–161.
- Altman, E.J., Nagle, F. and Tushman, M.L. (2013) 'Innovating without information constraints: Organizations, communities, and innovation when information costs approach zero.', in *The Oxford Handbook of Creativity, Innovation and Entrepreneurship*. Oxford: Oxford University Press, pp. 353–375.
- Andriopoulos, C. and Lewis, M.W. (2009) 'Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation.', *Organization Science*, 20(4), pp. 696–717.
- Andriopoulos, C. and Lewis, M.W. (2010) 'Managing innovation paradoxes: Ambidexterity lessons from leading product design companies.', *Long Range Planning*, 43(1), pp. 104–122.
- Baldwin, C. and von Hippel, E. (2011) 'Modeling a paradigm shift: From producer innovation to user and open collaborative innovation.', *Organization Science*, 22(6), pp. 1399–1417.
- Baldwin, C.Y. and Clark, K.B. (2000) *Design Rules: The power of modularity*. Cambridge, MA: MIT Press.
- Barkema, H.G. and Shvyrkov, O. (2007) 'Does top management team diversity promote or hamper foreign expansion?', *Strategic Management Journal*, 28(7), pp. 663–680.
- Benner, M.J. and Tushman, M.L. (2003) 'Exploitation, exploration, and process management: The productivity dilemma revisited.', *Academy of Management Review*, 28(2), pp. 238–256.
- Benner, M.J. and Tushman, M.L. (2015) 'Reflections on the 2013 Decade Award--"Exploitation, exploration, and process management: The productivity dilemma revisited" ten years later.', *Academy of Management Review*, 40(4), pp. 497–514.
- Bettenhausen, K. and Murnighan, J. (1985) 'The emergence of norms in competitive decision-making groups.', *Administrative Science Quarterly*, 36(3), pp. 20–35.
- Birkinshaw, J. and Gupta, K. (2013) 'Clarifying the distinctive contribution of ambidexterity to the field of organization studies.', *Academy of Management Perspectives*, 27(4), pp. 287–298.
- Bledow, R., Frese, M., Anderson, N., Erez, M. and Farr, J. (2009) 'A dialectic

perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity.', *Industrial & Organizational Psychology*, 2(3) Cambridge University Press, pp. 305–337.

Boer, M. de, Van Den Bosch, F.A.J. and Volberda, H.W. (1999) 'Managing organizational knowledge integration in the emerging multimedia complex.', *Journal of Management Studies*, 36(May), pp. 379–398.

Van den Bosch, F.A.J., Volberda, H.W. and de Boer, M. (1999) 'Coevolution of firm absorptive capacity and knowledge environment: Organizational forms and combinative capabilities.', *Organization Science*, 10(5), pp. 551–568.

Boumgarden, P., Nickerson, J. and Zenger, T.R. (2012) 'Sailing into the wind: Exploring the relationships among ambidexterity, vacillation, and organizational performance.', *Strategic Management Journal*, 33(6), pp. 587–610.

Bröring, S., Herzog, P., Broring, S. and Herzog, P. (2008) 'Organising new business development: Open innovation at Degussa.', *European Journal of Innovation Management*, 11(3) Bradford: Emerald Group Publishing, Limited, pp. 330–348.

Brown, S.L. and Eisenhardt, K.M. (1997) 'The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations.', *Administrative Science Quarterly*, 42(1), pp. 1–34.

Burgelman, R.A. and Doz, Y.L. (2001) 'The power of strategic integration.', *MIT Sloan Management Review*, 42(3), pp. 28–38.

Christensen, C.M. (1997) *The innovator's dilemma: When new technologies cause great firms to fail*. Boston: Harvard Business School Press.

Cohen, W.M. and Levinthal, D.A. (1990) 'Absorptive capacity: A new perspective on learning and innovation.', *Administrative Science Quarterly*, 35(1), pp. 128–152.

Cooper, R.G. (1990) 'Stage-gate systems: A new tool for managing new products.', *Business Horizons*, 33(3), pp. 44–54.

Crossan, M.M. and Bedrow, I. (2003) 'Organizational learning and strategic renewal.', *Strategic Management Journal*, 24(11), pp. 1087–1105.

Crossan, M.M., Lane, H.W. and White, R.E. (1999) 'An organizational learning framework: From intuition to institution.', *Academy of Management Review*, 24(3), pp. 522–537.

D'Adderio, L. (2014) 'The replication dilemma unravelled: How organizations enact multiple goals in routine transfer.', *Organization Science*, 25(5), pp. 1325–1350.

Denyer, D. and Tranfield, D. (2009) 'Producing a systematic review.', in *The Sage Handbook of Organizational Research Methods*. London: Sage, pp. 671–689.

Denyer, D., Tranfield, D. and van Aken, J.E. (2008) 'Developing design propositions through research synthesis.', *Organization Studies*, 29(3), pp. 393–413.

Duncan, R.B. (1976) 'The ambidextrous organization: Designing dual structures for innovation.', in *The management of organization design - Strategies and Implementation*. New York: North Holland, pp. 167–189.

Eisenhardt, K.M. and Martin, J.A. (2000) 'Dynamic capabilities: What are they?', *Strategic Management Journal*, 21(10–11) John Wiley and Sons, pp. 1105–1121.

Farjoun, M. (2010) 'Beyond dualism: Stability and change as a duality.', *Academy of Management Review*, 35(2), pp. 202–225.

Galinsky, A.D., Ku, G. and Wang, C.S. (2005) 'Perspective-taking and self-other overlap: Fostering social bonds and facilitating social coordination.', *Group Processes & Intergroup Relations*, 8(2), pp. 109–124.

Gassmann, O., Widenmayer, B. and Zeschky, M. (2012) 'Implementing radical innovation in the business: The role of transition modes in large firms.', *R and D Management*, 42(2), pp. 120–132.

Gersick, C.J.G. (1991) 'Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm.', *Source: The Academy of Management Review Academy of Management Review*, 16(1), pp. 10–36.

Gibson, C.B. and Birkinshaw, J. (2004) 'The antecedents, consequences, and mediating role of organizational ambidexterity.', *Academy of Management Journal*, 47(2) Academy of Management, pp. 209–226.

Gough, D., Oliver, S. and Thomas, J. (2012) *An introduction to systematic reviews*. London: Sage.

Gulati, R. and Puranam, P. (2009) 'Renewal through reorganization.', *Organization Science*, 20(2), pp. 422–440.

Gupta, A.K. and Govindarajan, V. (2000) 'Knowledge flows within multinational corporations.', *Strategic Management Journal*, 21(4), pp. 473–496.

Güttel, W.H., Konlechner, S.W., Müller, B., Trede, J.K. and Lehrer, M. (2012) 'Facilitating ambidexterity in replicator organizations: Artifacts in their role as routine recreators.', *Schmalenbach Business Review (SBR)*, 64(3) Fachverlag der Verlagsgruppe Handelsblatt, pp. 187–203.

Hansen, M.T. (2002) 'Knowledge networks: Explaining effective knowledge sharing in multiunit companies.', *Organization Science*, 13(3), pp. 232–248.

Harryson, S. (2006) *Know-who based entrepreneurship: From knowledge creation to business implementation*. Cheltenham: Edward Elgar Publishing.

Hayes, K.J. and Fitzgerald, J.A. (2009) 'Managing occupational boundaries to improve innovation outcomes in industry-research organisations.', *Journal of*

Management and Organization, 15(4) Lyndfield: Australian and New Zealand Academy of Management (ANZAM), pp. 423–437.

Helfat, C.E. and Peteraf, M. a. (2003) 'The dynamic resource-based view: Capability lifecycles.', *Strategic Management Journal*, 24(10 SPEC ISS.), pp. 997–1010.

Henderson, R. and Cockburn, I. (1994) 'Measuring competence? Exploring firm effects in pharmaceutical research.', *Strategic Management Journal*, 15(S1), pp. 63–84.

Jackson, W.A. (1999) 'Dualism, duality and the complexity of economic institutions.', *International Journal of Social Economics*, 26(4), p. 545.

Jansen, J.J.P., Van Den Bosch, F.A.J. and Volberda, H.W. (2005) 'Managing potential and realized absorptive capacity: How do organizational antecedents matter?', *Academy of Management Journal*, 48(6), pp. 999–1015.

Jansen, J.J.P., Van Den Bosch, F.A.J. and Volberda, H.W. (2006) 'Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators.', *Management Science*, 52(11), pp. 1661–1674.

Jansen, J.J.P., Tempelaar, M.P., van den Bosch, F.A.J. and Volberda, H.W. (2009) 'Structural differentiation and ambidexterity: The mediating role of integration mechanisms.', *Organization Science*, 20(4), pp. 797–811.

Jensen, R. and Szulanski, G. (2004) 'Stickiness and the adaptation of organizational practices in cross-border knowledge transfers.', *Journal of International Business Studies*, 35(6), pp. 508–523.

Junni, P., Sarala, R.M., Taras, V. and Tarba, S.Y. (2013) 'Organizational ambidexterity and performance: A meta-analysis.', *The Academy of Management Perspectives*, 27(4), pp. 299–312.

Kahn, K.B. (1996) 'Interdepartmental integration: A definition with implications for product development performance.', *Journal of Product Innovation Management*, 13(2), pp. 137–151.

Kang, S.-C. and Snell, S. a. (2009) 'Intellectual capital architectures and ambidextrous learning: A framework for human resource management.', *Journal of Management Studies*, 46(1), pp. 65–92.

Kauppila, O.-P. (2010) 'Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships.', *Strategic Organization*, 8(4), pp. 283–312.

Kogut, B. and Zander, U. (1992) 'Knowledge of the firm, combinative capabilities, and the replication of technology.', *Organization Science*, 3(3), pp. 383–397.

Kyriakopoulos, K. and Moorman, C. (2004) 'Tradeoffs in marketing exploitation and exploration strategies: The overlooked role of market orientation.',

International Journal of Research in Marketing, 21(3), pp. 219–240.

Lavie, D. and Rosenkopf, L. (2006) 'Balancing exploration and exploitation in alliance formation.', *Academy of Management Journal*, 49(4), pp. 797–818.

Lavie, D., Stettner, U. and Tushman, M.L. (2010) 'Exploration and exploitation within and across organizations.', *The Academy of Management Annals*, 4(1), pp. 109–155.

Lawrence, P.R. and Lorsch, J.W. (1967) *Organization and environment: Managing differentiation and integration*. Boston: Division of Research, Graduate School of Business Administration, Harvard University.

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

Lewis, M.W. (2000) 'Exploring paradox: Toward a more comprehensive guide.', *The Academy of Management Review*, 25(4), pp. 760–776.

Lewis, M.W. and Smith, W.K. (2014) 'Paradox as a metatheoretical perspective: Sharpening the focus and widening the scope.', *Journal of Applied Behavioral Science*, 50(2), pp. 127–149.

Lin, H.-E. and McDonough, E.F. (2014) 'Cognitive frames, learning mechanisms, and innovation ambidexterity.', *Journal of Product Innovation Management*, 31, pp. 170–188.

Lin, H.-E., McDonough, E.F., Lin, S.-J. and Lin, C.Y.-Y. (2013) 'Managing the exploitation/exploration paradox: The role of a learning capability and innovation ambidexterity.', *Journal of Product Innovation Management*, 30(2) Wiley-Blackwell, pp. 262–278.

Litchfield, R.C. and Gentry, R.J. (2010) 'Perspective-taking as an organizational capability.', *Strategic Organization*, 8(3), pp. 187–205.

Lüscher, L.S. and Lewis, M.W. (2008) 'Organizational change and managerial sensemaking: Working through paradox.', *Academy of Management Journal*, 51(2), pp. 221–240.

Lyytinen, K., Rose, G. and Yoo, Y. (2010) 'Learning routines and disruptive technological change: Hyper-learning in seven software development organizations during internet adoption.', *Information Technology and People*, 23(2) Case Western Reserve University, Cleveland, OH, United States, pp. 165–192.

Maniak, R., Midler, C., Beaume, R. and Pechmann, F. (2014) 'Featuring capability: How carmakers organize to deploy innovative features across products.', *Journal of Product Innovation Management*, 31(1) Wiley-Blackwell, pp. 114–127.

March, J.G. (1991) 'Exploration and exploitation in organizational learning.', *Organization Science*, 2(1), pp. 71–87.

Mayrhofer, W. (1997) 'Warning: Flexibility can damage your organizational health!', *Employee Relations*, 19(6), pp. 519–534.

Menguc, B. and Auh, S. (2008) 'The asymmetric moderating role of market orientation on the ambidexterity–firm performance relationship for prospectors and defenders.', *Industrial Marketing Management*, 37(4), pp. 455–470.

Miner, A.S., Bassoff, P. and Moorman, C. (2001) 'Organizational improvisation and learning: A field study.', *Administrative Science Quarterly*, 46(2), pp. 304–337.

Mom, T.J.M., van den Bosch, F.A.J. and Volberda, H.W. (2009) 'Understanding variation in managers' ambidexterity: Investigating direct and interaction effects of formal structural and personal coordination mechanisms.', *Organization Science*, 20(4) INFORMS: Institute for Operations Research, pp. 812–828.

Montazemi, A.R., Pittaway, J.J., Qahri Saremi, H. and Wei, Y. (2012) 'Factors of stickiness in transfers of know-how between MNC units.', *Journal of Strategic Information Systems*, 21(1) DeGroote School of Business, McMaster University, 1280 Main Street, Hamilton, ON L8S 4M4, Canada, pp. 31–57.

Moreno-Luzon, M.D., Gil-Marques, M. and Valls-Pasola, J. (2013) 'TQM, innovation and the role of cultural change.', *Industrial Management & Data Systems*, 113(8), pp. 1149–1168.

Nazir, S. and Pinsonneault, A. (2012) 'IT and firm agility: An electronic integration perspective.', *Journal of the Association for Information Systems*, 13(3), pp. 150–171.

Nooteboom, B. (2000) 'Institutions and forms of co-ordination in innovation systems.', *Organization Studies*, 21(5), pp. 915–939.

O'Reilly, C. a, Caldwell, D.F. and Barnett, W.P. (1989) 'Work group demography, social integration, and turnover', *Administrative Science Quarterly*, 34(1), pp. 21–37.

O'Reilly, C.A. and Tushman, M.L. (2008) 'Ambidexterity as a dynamic capability: Resolving the innovator's dilemma.', *Research in Organizational Behavior*, 28, pp. 185–206.

O'Reilly, C.A. and Tushman, M.L. (2011) 'Organizational ambidexterity in action: How managers explore and exploit.', *California Management Review*, 53(4), pp. 5–22.

O'Reilly, C.A. and Tushman, M.L. (2004) 'The ambidextrous organization.', *Harvard Business Review*, 82(4), pp. 74–81.

Obstfeld, D. (2005) 'Social networks, the tertius iungens orientation, and involvement in innovation.', *Administrative Science Quarterly*, 50(1) Administrative Science Quarterly, pp. 100–130.

Orton, J.D. and Weick, K.E. (1990) 'Loosely coupled systems: A reconceptualization.', *Academy of Management Review*, 15(2), pp. 203–223.

- Parker, S.K. and Axtell, C.M. (2001) 'Seeing another viewpoint: Antecedents and outcomes of employee perspective taking.', *Academy of Management Journal*, 44(6), pp. 1085–1100.
- Patriotta, G., Castellano, A. and Wright, M. (2013) 'Coordinating knowledge transfer: Global managers as higher-level intermediaries.', *Journal of World Business*, 48(4), pp. 515–526.
- Peeters, T. and Martin, X. (2017) 'Strategies for knowledge use in R&D and their implications for innovative performance.', *R and D Management*, 47(1), pp. 47–60.
- Raisch, S. and Birkinshaw, J. (2008) 'Organizational ambidexterity: Antecedents, outcomes, and moderators.', *Journal of Management*, 34(3), pp. 375–409.
- Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M.L. (2009) 'Organizational ambidexterity: Balancing exploitation and exploration for sustained performance.', *Organization Science*, 20(4), pp. 685–695.
- Raisch, S. and Tushman, M.L. (2016) 'Growing new corporate businesses: From initiation to graduation.', *Organization Science*, 27(5), pp. 1237–1257.
- Regné, P. and Zander, U. (2011) 'Knowledge and strategy creation in multinational companies: Social-identity frames and temporary tension in knowledge combination.', *Management international review*, 51(6) Stockholm School of Economics, pp. 821–850.
- Robert Baum, J. and Wally, S. (2003) 'Strategic decision speed and firm performance.', *Strategic Management Journal*, 24(11), pp. 1107–1129.
- Rosing, K., Frese, M. and Bausch, A. (2011) 'Explaining the heterogeneity of the leadership-innovation relationship: Ambidextrous leadership.', *Leadership Quarterly*, 22(5), pp. 956–974.
- Rothaermel, F.T. and Deeds, D.L. (2004) 'Exploration and exploitation alliances in biotechnology: A system of new product development.', *Strategic Management Journal*, 25(3), pp. 201–221.
- Setia, P., Sambamurthy, V. and Closs, D.J. (2008) 'Realizing business value of agile IT applications: Antecedents in the supply chain networks.', *Information Technology and Management*, 9, pp. 5–19.
- Siggelkow, N. and Levinthal, D.A. (2003) 'Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation.', *Organization Science*, 14(6), pp. 650–669.
- Simsek, Z. (2009) 'Organizational ambidexterity: Towards a multilevel understanding.', *Journal of Management Studies*, 46(4), pp. 597–624.
- Sirmon, D.G., Hitt, M.A. and Ireland, R.D. (2007) 'Managing firm resources in dynamic environments to create value: Looking inside the black box.', *Academy of Management Review*, 32(1), pp. 273–292.

Sivadas, E. and Dwyer, F.R. (2000) 'An examination of organizational factors influencing new product success in internal and alliance-based processes.', *Journal of Marketing*, 64(1) American Marketing Association, pp. 31–49.

Smith, W.K. (2014) 'Dynamic decision making: A model of senior leaders managing strategic paradoxes.', *Academy of Management Journal*, 57(6), pp. 1592–1623.

Smith, W.K. and Lewis, M.W. (2011) 'Toward a theory of paradox: A dynamic equilibrium model of organizing.', *Academy of Management Review*, 36(2), pp. 381–403.

Smith, W.K. and Tushman, M.L. (2005) 'Managing strategic contradictions: A top management model for managing innovation streams.', *Organization Science*, 16(5), pp. 522–536.

Spender, J. and Grant, R. (1996) 'Knowledge and the firm: Overview.', *Strategic Management Journal*, 17(S2), pp. 5–9.

Star, S.L. and Griesemer, J.R. (1989) 'Institutional ecology, "translations" and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-39.', *Social Studies of Science*, 19(3), pp. 387–420.

Steiner, C.J. (2000) 'Teaching scientists to be incompetent: Educating for industry work.', *Bulletin of Science, Technology & Society*, 20(2) Sage Publications, pp. 123–132.

Sun, B. and Lo, Y.-J.Y.-J. (2014) 'Achieving alliance ambidexterity through managing paradoxes of cooperation: A new theoretical framework.', *European Journal of Innovation Management*, 17(2) School of Management, Xi'an Jiaotong University, Xi'an, China: Emerald Group Publishing, Limited, pp. 144–165.

Zulanski, G. and Jensen, R.J. (2004) 'Overcoming stickiness: An empirical investigation of the role of the template in the replication of organizational routines.', *Managerial and Decision Economics*, 25(6–7) Chichester: Wiley Periodicals Inc., pp. 347–363.

Taylor, A. and Helfat, C.E. (2009) 'Organizational linkages for surviving technological change: Complementary assets, middle management, and ambidexterity.', *Organization Science*, 20(4), pp. 718–739.

Teece, D.J. (2007) 'Explicating dynamic capabilities: The nature and microfoundations of (sustainable) enterprise performance.', *Strategic Management Journal*, 28(13), pp. 1319–1350.

Teece, D.J., Pisano, G. and Shuen, A. (1997) 'Dynamic capabilities and strategic management.', *Strategic Management Journal*, 18(7) John Wiley & Sons, pp. 509–533.

Thomas, J. and Harden, A. (2008) 'Methods for the thematic synthesis of qualitative research in systematic reviews.', *BMC medical research*

methodology, 8(1) BioMed Central Ltd, p. 45.

Tiwana, A. (2008) 'Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity.', *Strategic Management Journal*, 29(3) John Wiley & Sons, Inc., pp. 251–272.

Tranfield, D., Denyer, D. and Smart, P. (2003) 'Towards a methodology for developing evidence-informed management knowledge.', *British Journal of Management*, 14(3), pp. 207–222.

Tsai, W. and Ghoshal, S. (1998) 'Social capital and value creation: The role of intrafirm networks.', *Academy of Management Journal*, 41(4), pp. 464–476.

Turner, N., Swart, J. and Maylor, H. (2013) 'Mechanisms for managing ambidexterity: A review and research agenda.', *International Journal of Management Reviews*, 15(3) Wiley-Blackwell, pp. 317–332.

Tushman, M.L. and O'Reilly, C.A. (1996) 'Ambidextrous organizations: Managing evolutionary and revolutionary change.', *California Management Review*, 38(4), pp. 8–30.

Tushman, M.L. and O'Reilly, C.A. (1999) 'Building ambidextrous organizations.', *Health Forum Journal*, 42(2), p. 20.

Tushman, M.L. and Romanelli, E. (1985) 'Organizational evolution: A metamorphosis model of convergence and reorientation.', *Research in organizational behavior*, 7, pp. 171–222.

Wenger, E., McDermott, R. and Snyder, W. (2002) *Cultivating communities of practice: A guide to managing knowledge*. Harvard Business School Press Books.

Winter, S.G. and Szulanski, G. (2001) 'Replication as strategy.', *Organization Science*, 12(6), pp. 730–743.

Winter, S.G., Szulanski, G., Ringov, D. and Jensen, R.J. (2012) 'Reproducing knowledge: Inaccurate replication and failure in franchise organizations.', *Organization Science*, 23(3), pp. 672–685.

Zollo, M. and Singh, H. (2004) 'Deliberate learning in corporate acquisitions: Post-acquisition strategies and integration capability in U.S. bank mergers', *Strategic Management Journal*, 25(13), pp. 1233–1256.

2.10 Appendices

Appendix 2-1: Quality Assessment Tool

CONTEXT: What is the specific exploration-exploitation being addressed, and in which context is it investigated?

1. The specific exploration-exploitation duality is clearly explained.
2. The context in which it is investigated is described in detail.

INTERVENTION: What is the nature of the integration mechanism(s) being investigated?

3. The integration mechanisms are described in detail.
4. The integration mechanisms are well-grounded in existing literature.

MECHANISM: How do the integration mechanisms help address the duality?

5. The specific mechanisms of how the integration methods or devices work are clearly explained.
6. The specific mechanisms of how the integration methods or devices work are well-grounded in existing literature.

OUTCOME: What is the evidence proving the effectiveness of the integration mechanisms?

7. The evidence proving the effectiveness of the integration mechanisms is convincing.
8. The evidence proving the effectiveness of the integration mechanisms suggests generalizability.

Scoring Levels (for each of the eight criteria)

- 2 = "To a large extent"
- 1 = "To some extent"
- 0 = "To a small extent"

Appendix 2-2: Type of Exploration and Exploitation Tension by Study

Authors	Year	Tensions	Authors	Year	Tensions
Mayrhofer	1997	Organizational Slack vs. Tight Fit	Andriopoulos, Lewis	2010	Long-term adaptability vs. Short-term survival
Mayrhofer	1997	Softness and Structuredness	Andriopoulos, Lewis	2010	Possibilities vs. Constraints
Mayrhofer	1997	Diversity vs. Coherence	Andriopoulos, Lewis	2010	Passion vs. Discipline
Van den Bosch, Volberda, de Boer	1999	New vs. Existing Knowledge	Andriopoulos, Lewis	2010	Diversity vs. Cohesiveness
Crossan, Lane, White	1999	Feed-Forward (Exploration) vs. Feed-Back (Exploitation)	Farjoun	2010	Stability vs. Change
Heller	1999	Innovation Project vs. Existing Host Organization	O'Reilly, Tushman	2011	Exploration vs. Exploitation
Adler, Goldoftas, Levine	1999	Flexibility vs. Efficiency	Rosing, Frese, Bausch	2011	Exploration vs. Exploitation
Adler, Goldoftas, Levine	1999	Non-Routine vs. Routine Tasks	Régner, Zander	2011	Core vs. Peripheral Social Identity Frames
Sivadas, Dwyer	2000	Radical vs. Incremental Product Innovation	Gebauer, Worch, and Truffer	2012	Exploration vs. Exploitation
Sheremata	2000	Creative vs. Collective Actions	Güttel, Konlechner, Müller, Trede, Lehrer	2012	Exploration vs. Exploitation
Nooteboom	2000	Coordination between Firms	Montazemi, Pittaway, Saremi, Wei	2012	New vs. Existing Know-How
Burgelman, Doz	2001	Core Business vs. New Business Opportunities	Nazir, Pinsonneault	2012	Knowledge Exploration vs. Exploitation
Winter, Szulanski	2001	Business Model Exploration vs. Exploitation	Gassman, Widenmayer, Zeschky	2012	Radical Innovation vs. Operational Business
Zollo, Winter	2002	Implicit vs. Explicit Knowledge	Phene, Tallman, Almeida	2012	New vs. Existing Technological Capabilities
Crossan, Berdrow	2003	Feed Forward (Exploration) vs. Feedback (Exploitation)	Rubera, Ordanini, Calantone	2012	R&D vs. Marketing Competencies
O'Reilly, Tushman	2004	Breakthrough vs. Existing Products	Eriksson	2013	Exploration vs. Exploitation
Kyriakopoulos, Moorman	2004	Marketing Exploration Strategies vs. Marketing Exploitation Strategies	Patriotta, Castellano, Wright	2013	Existing vs. New Problems
Jansen, Van den Bosch, Volberda	2005	New vs. Existing Knowledge	Gil-Marques, Moreno-Luzon	2013	Radical vs. Incremental Innovation
Smith, Tushman	2005	Exploratory vs. Exploitative Innovations	Lin, McDonough, Lin, Lin	2013	Incremental vs. Radical Innovation
Gilsing, Nooteboom	2006	Exploration vs. Exploitation	Revilla, Saenz, Knoppen	2013	Operational Efficiency vs. Innovation
Harryson	2008	Exploration vs. Exploitation	Turner, Swart, Maylor	2013	Renewal (innovation) vs. Refinement (efficiency)
Menguc, Auh	2008	Exploration vs. Exploitation	Patriotta, Castellano, Wright	2013	Formal vs. Information Coordination Mechanisms
Bröring, Herzog	2008	Exploratory vs. Exploitative Units	Gil-Marques, Moreno-Luzon	2013	Exploration vs. Exploitation Culture
Bröring, Herzog	2008	Open vs. Closed Innovation	Patriotta, Castellano, Wright	2013	Replication vs. Creation Strategies
Tiwana	2008	Strong vs. Bridging Ties	Sherif, Tsado, Zheng, Airhia	2013	New vs. Existing Information Technologies
Wang, Rafiq	2009	Exploratory vs. Exploitative Learning	Dixon, Meyer, Day	2014	Exploration vs. Exploitation
Jansen, Tempelaar, van den Bosch, Volberda	2009	Exploratory vs. Exploitative Innovations	Smith	2014	Exploration vs. Exploitation
Andriopoulos, Lewis	2009	Profit vs. Breakthrough Emphasis	Nonaka, Kodama, Hirose, Kohlbacher	2014	Tacit vs. Explicit Knowledge
Hayes, Fitzgerald	2009	Research vs. Commercialization	Lin, McDonough	2014	Incremental vs. Radical Innovation
Mom, van den Bosch, Volberda	2009	Manager's Exploration vs. Exploitation Activities	Maniak, Midler, Beaume, von Pechmann	2014	Research vs. Development
Andriopoulos, Lewis	2009	Tight vs. Loose Couplings	Maniak, Midler, Beaume, von Pechmann	2014	Advanced vs. Production Engineering
Andriopoulos, Lewis	2009	Discipline vs. Passion	D'Adderio	2014	Alignment vs. Improvement
Taylor, Helfat	2009	New Technology vs. Existing Complementary Assets	Sun, Lo	2014	Co-exploration vs. Co-exploitation
Kauppila	2010	Exploration vs. Exploitation	Knight, Harvey	2015	Exploration vs. Exploitation
Litchfield, Gentry	2010	Exploratory vs. Exploitative Knowledge	Turner, Maylor, Swart	2015	Exploration vs. Exploitation
Lyytinen, Rose, Yoo	2010	Exploratory vs. Exploitative Learning Routines	Chen, Kannan-Narasimha	2015	Existing Businesses vs. New Ventures

3 THE EFFECT OF PARADOX MINDSET DIVERSITY ON TEAM INNOVATIVENESS

3.1 Abstract

Innovation projects include periods of simultaneous engagement in exploratory and exploitative activities. Because of the conflicting nature of these tasks, teams experience greater levels of paradoxical tensions during these periods of overlap. Prior research has shown that having a paradox mindset (i.e., the tendency to accept and value contradictions) is essential to unlocking the potential of tensions. However, paradox mindset is a concept that has been primarily studied at the individual level, and its role at the team level is not understood. In this study, I examine how the distribution of paradox mindsets within project teams impacts their ability to leverage paradoxical tensions for greater innovativeness. Using data from 42 teams working on junior consulting mandates, the results show that heterogeneous teams, consisting of an even mix of high and low paradox mindset members, demonstrate greater innovativeness than homogeneous teams composed of either high or low paradox mindset members.

3.2 Introduction

Teams have become the primary locus of innovation within organizations (Ancona and Caldwell, 1992; Olson et al., 2001; Post, 2012). Innovation is the process of generating novel ideas and implementing them in useful ways in new products or procedures (Amabile, 2000; West and Anderson, 1996). This process requires the engagement in both exploratory and exploitative activities (Rosing, Frese and Bausch, 2011) as teams must not only explore and develop new ideas but also do so in effective and efficient ways (Miron, Erez and Naveh, 2004). Therefore, projects aimed at developing new products or innovative solutions constitute a prime context in which exploratory and exploitative efforts come together (Turner et al., 2016).

Exploration versus exploitation is one of the fundamental dichotomies in organizational research. While both sets of activities are necessary for

innovation and sustained business success, they also conflict with each other and exhibit self-reinforcing tendencies that make their balanced pursuit challenging (March, 1991). At the organization level, scholars have proposed to “resolve” this innovation paradox by separating exploratory and exploitative activities, either temporally (e.g., Burgelman, 2002; Tushman and Romanelli, 1985) or structurally (e.g., O'Reilly and Tushman, 2004; Tushman and O'Reilly, 1996). Whether, and how, to apply these solutions at lower levels of the organization remains a subject of debate, leading scholars to suggest alternative approaches such as, for example, creating a supportive yet challenging environment in which individuals choose for themselves when to engage in exploration or exploitation (e.g., Gibson and Birkinshaw, 2004). In the context of innovation projects, in particular, exploration and exploitation efforts are so closely intertwined that their separation may be detrimental to the overall development process (Gebert, Boerner and Kearney, 2010). Indeed, because of the complexity of the problems they seek to address, innovation projects are characterized by iterative, even unpredictable, patterns of engagement in exploratory and exploitative activities (Anderson, De Dreu and Nijstad, 2004; Sheremata, 2000). As a result, innovation projects create greater proximity between these two sets of conflicting and interdependent activities, thereby raising the level of paradoxical tensions that characterize innovative endeavors (Lewis et al., 2002; Miron, Erez and Naveh, 2004). The responsibility to cope with these paradoxical tensions often lies with the project teams themselves, thus posing the question of the types of teams best equipped to do so.

Paradoxes, and the tensions they create, are born from the juxtaposition of contradictory yet mutually related elements (Lewis, 2000). Innovation projects provide the ideal research context to examine paradoxical tensions and their impact on performance. Indeed, the dual requirement of novelty and usefulness implies the necessity to both explore and exploit in a context of finite resources, thereby creating the conditions needed for paradoxical tensions to arise. Paradoxical tensions can impact innovativeness in both positive and negative ways (Lewis, 2000); on the one hand, they can spur creativity by challenging conventional logic (Rothenberg, 1979) and by triggering a dialectical process

between conflicting ideas (Lovelace, Shapiro and Weingart, 2001); on the other hand, they may increase anxiety and discomfort, resulting in defensive reactions such as denial and avoidance (Andriopoulos and Lewis, 2009; Smith and Berg, 1987). Scholars have suggested that the tendency to accept and value contradictions – i.e., have a paradox mindset – is an important cognitive mechanism through which individuals can tap into the creative potential of tensions (e.g., Ingram et al., 2014; Lusch, Lewis and Ingram, 2006; Miron-Spektor et al., 2018). Prior empirical work on the relationship between paradox mindset and innovativeness has focused on individuals as the primary unit of analysis, thus leaving interesting team-level questions unexplored. One such question has to do with the diversity of paradox mindsets within a team, and the impact of this diversity on innovativeness. Will teams composed exclusively of high paradox mindset members produce more innovative outputs than teams that have a mix of high and low paradox mindset individuals? While existing research suggests that diversity in cognitive styles leads to greater innovativeness, the question of whether diversity of paradox mindsets is equally desirable remains unanswered. To fill this gap, this study sets out to test the moderated mediation model shown in **Figure 3-1**. Importantly, this paper will discuss how the simultaneous engagement in exploratory and exploitative activities impacts innovativeness, as well as the extent to which the diversity of paradox mindsets within a team moderates the relationship between paradoxical tensions and innovativeness.

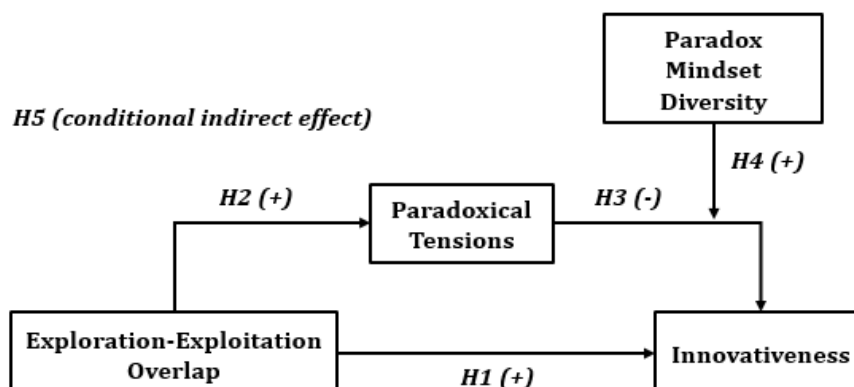


Figure 3-1: Conceptual Model

3.3 Literature Review and Hypothesis Development

Both exploratory and exploitative activities are central to the innovation process (Rosing, Frese and Bausch, 2011). “Exploration includes things captured by terms such as search, variation, risk taking, experimentation, play, flexibility, discovery, innovation. Exploitation includes such things as refinement, choice, production, efficiency, selection, implementation, execution” (March, 1991, p.71). Innovation teams must not only explore and develop new ideas, but they must also meet quality and efficiency demands (Miron, Erez and Naveh, 2004). Scholars generally make a broad-level distinction between the creativity and implementation stages of the innovation process (Farr, Sin and Tesluk, 2003; King, 1990). In the new product development literature, these stages are further broken down into phases such as idea generation, evaluation and selection, prototype building, and product commercialization (Amabile, 1988; Farr, Sin and Tesluk, 2003; West, 2002).

While early research informed by project management practices offers a sequential view of the innovation process with distinct stages neatly unrolling one after the other (e.g., Zaltman, Duncan and Holbek, 1973), there is now widespread agreement that this perspective fails to capture the dynamic and turbulent nature of new product development (McCarthy et al., 2006; Rosing, Frese and Bausch, 2011). Innovation projects rely on complex problem-solving approaches that require iterating between information scanning, processing, integration, evaluation and selection (Sheremata, 2000). Exploratory and exploitative activities thus unfold with limited predictability (Bledow et al., 2009) as the emphasis shifts over time based on current circumstances (Burgelman, 2002; Jansen, Van Den Bosch and Volberda, 2006). The result is overlap between development stages (Constant, 2000; Schroeder et al., 1989; West, 1990) and co-occurrence of exploratory and exploitative activities at the project team level.

Given the conflicting nature of exploration and exploitation, scholars have proposed temporal (e.g., Burgelman, 2002; Tushman and Romanelli, 1985) or structural (e.g., O'Reilly and Tushman, 2004; Tushman and O'Reilly, 1996)

separation of those activities. However, in the context of time-bound innovation projects, the separation of *knowledge generation* and *knowledge integration* activities may be somewhat arbitrary and disruptive (Gebert, Boerner and Kearney, 2010). Instead, the simultaneous engagement in creative and collective action has been found to yield superior new products and solutions (Sheremata, 2000) as it is through the continuous interplay of creativity and implementation that innovative problem solving takes place (Taggar, 2002). Similarly, field studies on process concurrency – i.e., the degree to which different organizational functions simultaneously conduct project work – find that concurrency leads to faster and higher quality outcomes thanks to greater upstream and downstream understanding of both constraints and opportunities, which, in turn, enables more effective joint problem solving (Adler, 1995; Rosenthal, 1992; Wheelwright and Clark, 1992). Gilson et al. (2005) have shown that creativity (an exploratory activity) and standardization (an exploitative activity) not only co-occur within work teams but also interact to yield superior customer satisfaction. Other scholars have argued that keeping the tensions between exploration and exploitation within the same subunit encourages the dialectical process of discussing conflicting ideas that ultimately leads to greater innovation performance (e.g., Lovelace, Shapiro and Weingart, 2001).

In the present study, innovation performance refers to the innovativeness of project outputs. Following Sethi et al. (2001), innovativeness is defined as “meaningful uniqueness” (p. 74), namely, the extent to which the outputs differ from existing alternatives or conventional practice and are viewed as useful by the customer or client. This definition of innovativeness is in line with those used in other fields of research such as in the social psychology of creativity where outcomes are considered innovative when they are both novel and appropriate (Amabile, 1983), or in the marketing literature where the innovativeness of a product refers to its differentiation from competing offerings and its meaningfulness to consumers (Andrews and Smith, 1996).

In sum, projects are the prevalent organizational form where exploratory and exploitative efforts come together (Turner et al., 2016). They offer a micro-level context in which teams must address the unique and novel aspects of a particular assignment, within the constraints of limited resources and strict deadlines (Havermans et al., 2015). Innovation projects, in particular, do not tend to follow a strictly sequential pattern wherein exploitative activities follow exploratory activities without any overlap. Instead, these activities will co-occur, which, as argued, will have a positive impact on the innovativeness of project outputs.

Hypothesis 1: There is a positive relationship between the extent to which a team engages simultaneously in exploratory and exploitative activities, and the innovativeness of its outputs.

Lewis (2000) defines paradoxes as “contradictory yet interrelated elements – elements that seem logical in isolation but absurd and irrational when appearing simultaneously” (p. 760). The coexistence of these cognitively or socially constructed paradoxes gives rise to tensions, which is how actors experience the hidden “simultaneity of conflicting truths” (p. 761).

From the outset, March's (1991) foundational article lays out the paradoxical nature of exploration and exploitation, describing them as equally necessary yet fundamentally incompatible activities competing for scarce resources. Beyond the fact that exploration and exploitation require different routines and mindsets (Gupta, Smith and Shalley, 2006), scholars have also emphasized their mutual dependency (e.g., Bledow et al., 2009; Rosing, Frese and Bausch, 2011). This interrelationship is embedded in the definition of innovation itself as “the successful implementation of creative ideas by an organization.” (Amabile, 2000, p. 332), which implies a strong complementarity between creativity (exploration) and implementation (exploitation). Indeed, without original ideas or new knowledge, organizations risk falling into a “competency trap” whereby the use of existing yet suboptimal experience is rewarded and reinforced (Levitt and March, 1988). The result is exploitation driving out exploration, what Levinthal and March (1993) call the “success trap.” The latter stand in contrast to the

“failure trap” (Levinthal and March, 1993) which relates to the inability to generate sufficient returns from creative ideas or new experiments, thus leading to ever more exploration at the expense of exploitation.

Another aspect of paradoxes is that a stronger emphasis on one pole of the underlying duality intensifies the need to address the other (Lewis, 2000). Again, this feature is present in the context of the exploration-exploitation paradox insofar as the more one tries to access new knowledge and ideas, the more one needs to integrate them into collective action (Sheremata, 2000). In short, innovation is characterized by tensions and paradoxes (Lewis et al., 2002; Miron, Erez and Naveh, 2004), in part because the innovation process requires the combination of exploratory and exploitative activities which are both conflicting and interrelated.

The mere existence of an exploration-exploitation paradox does not necessarily mean that the actors will experience the associated tensions which may remain latent. It is the juxtaposition of the opposing elements of a paradox, combined with certain environmental factors, which triggers both the experience and recognition of paradoxical tensions (Smith and Lewis, 2011). Earlier, I argued that the non-sequential nature of the innovation process leads to the co-occurrence of exploratory and exploitative activities within project teams. This simultaneous engagement in contradictory yet interrelated activities will, in essence, force the juxtaposition of paradoxical elements within the same task environment, thus increasing the salience of paradoxical tensions. Consequently, I argue that team members will experience a level of paradoxical tension that is in proportion to the degree of overlap between exploratory and exploitative activities.

Hypothesis 2: There is a positive relationship between the extent to which a team engages simultaneously in exploratory and exploitative activities, and the level of paradoxical tensions experienced by its members.

Paradoxes, and the tensions they create, can act as catalysts as well as inhibitors of change (Lewis, 2000). They can spur innovation and improve

performance, or be counterproductive as a consequence of the higher levels of anxiety and stress they generate (Lewis, 2000; Smith and Berg, 1987).

On the positive side, Rothenberg (1979) has shown how creative geniuses in the field of music, painting, and science have leveraged the power of tensions and antithetical elements to “transcend ordinary logic” (p. 55) and develop groundbreaking insights. In the same vein, Wright, (1982) praised the virtues of having a “both/and” mindset over the dichotomous logic of “either/or” thinking. In the field of management, leadership teams can spark learning and creativity through the juxtaposition of competing demands (Eisenhardt and Westcott, 1988; Osono et al., 2008). Similarly, scholars have put forward the view that creativity is a process of tension resolution through the combination of opposites (e.g., Martin, 2007; Ward, Finke and Smith, 1995). Actors should, therefore, embrace tensions in their search for novel associations that will fuel innovation (Fong, 2006).

On the negative side, people may react defensively in the face of paradoxical tensions, and strive to maintain the illusion of order by suppressing the relatedness of contradictory elements (Lewis, 2000). While the experience of paradoxical tensions can be threatening to individuals, approaching them as dilemmas or trade-offs can result in dysfunctional responses. In an attempt to avoid anxiety and discomfort, actors may feel compelled to make simplistic binary choices and seek consistency through deep commitments to those decisions (Festinger, 1962). However, focusing on a single element of a paradox to the exclusion of the other can only serve as a short-term defense mechanism, one that obfuscates the relatedness of opposing poles (Sundaramurthy and Lewis, 2003). This type of response may ultimately impact, or indeed impede, sense making, decision making and action within organizations (Smith and Lewis, 2011).

Which of the positive or negative impact of paradoxical tensions will dominate in the context of innovation project teams is an open question. While De Dreu and Weingart (2003) have shown that a negative relationship exists between conflict and performance, other studies have found that conflicts enhance divergent

thinking and exploration of new ideas (e.g., Jehn, 1995; Nemeth et al., 2004). Specifically, Beersma and De Dreu (2005) have identified a positive effect of conflict on divergent tasks and a negative effect on convergent ones. Miron-Spektor, Gino and Argote (2011) provide further support for a positive relationship between conflict and creativity, but only once the subject's paradoxical frame has been activated. Conversely, in their study of family firms, Ingram et al. (2014) have shown that paradoxical tensions have a detrimental effect on innovative behaviors.

While the studies mentioned confirm the double-edged nature of paradoxical tensions, I posit that, in the absence of any mental frame priming (as is the case in this study), paradoxical tensions will have a negative impact on innovativeness.

Hypothesis 3: There is a negative relationship between the level of perceived paradoxical tensions and the innovativeness of a team's outputs.

Early research on paradox management encouraged actors to embrace conflicting emotions and immerse themselves within paradoxical tensions (Smith and Berg, 1987). More recently, scholars have been reinforcing this view by stressing that the ultimate aim is not the eradication but rather the active management of paradoxes through strategies of "acceptance" and "resolution" (e.g., Andriopoulos and Lewis, 2009; Luscher, Lewis and Ingram, 2006; Smith and Lewis, 2011). Acceptance strategies enhance the ability of actors to embrace paradoxes and approach related tensions as opportunities to improve desired outcomes through "both/and" thinking (Smith and Lewis, 2011). Calabretta, Gemser and Wijnberg (2017) provide examples of acceptance strategies in the context of the intuition-rationality paradox, such as creating emotional equanimity with respect to each pole of the duality, or lowering defensiveness in the face of tensions. Acceptance strategies, therefore, promote the engagement with, rather than the elimination of, paradoxical tensions (Smith, 2014). Beyond acceptance, resolution strategies aim to address the needs of paradoxical elements through alternating cycles of differentiation and integration (Andriopoulos and Lewis, 2009; Jay, 2013; Smith,

2014). There, too, the ultimate aim is not the elimination of tensions but the recognition of the distinctive benefits of each pole of a duality (Jay, 2013) as well as the identification of the linkages and synergies that may exist between them (Smith, 2014). Calabretta, Gemser and Wijnberg (2017) provide examples of potential resolution strategies such as the proper structuring of information to facilitate the process of establishing connections, or the mix of affective and cognitive criteria to avoid potential biases in favor of a single pole of the intuition-rationality paradox.

In both acceptance and resolution strategies, actors actively engage in the process of perception and interpretation (Papachroni, Heracleous and Paroutis, 2016), as well as second-order thinking and self-reflection (Lewis, 2000). There is, therefore, a strong link between the management of paradoxes and cognitive styles which relates to the different ways in which people “perceive, think, solve problems, learn and relate to others” (Witkin et al., 1977:p.5). Studies have investigated the impact of cognitive styles on the ability of individuals to generate ideas, be creative and innovative (e.g., Kirton, 1976; Miron, Erez and Naveh, 2004; Scott and Bruce, 1994). In the context of projects, scholars have suggested that psychological characteristics may be effective predictors of team performance (e.g., Harrison et al., 2002; Pelled, Eisenhardt and Xin, 1999), as well as help explain team behavior and effectiveness (e.g., Bell et al., 2011; Miron-Spektor, Erez and Naveh, 2011; Post, 2012). In particular, cognitive styles, such as analytical or intuitive thinking, can influence the innovation behavior of individuals (De Visser et al., 2014). Systematic problem solving, for example, leads to relatively lower levels of innovative behavior (Scott and Bruce, 1994), while intuitive processing of information is positively linked to greater levels of product originality and attractiveness (Puccio, Treffinger and Talbot, 1995).

According to Smith and Tushman (2005), paradoxical cognition requires the use of paradoxical frames – i.e., “mental templates in which [actors] recognize and accept the simultaneous existence of contradictory forces” (p. 526) – which will support the cognitive processes of differentiating and integrating. The ability to

think paradoxically enables actors to tap into the positive potential of paradoxical tensions (Lewis, 2000; Smith and Lewis, 2011). Miron-Spektor et al. (2018) have recently conceptualized this ability in their *paradox mindset* construct, which they define as the “tendency to value, accept and feel comfortable with tensions” (p. 37). These authors have shown that, in a context of high tensions, individuals endowed with a paradox mindset obtained higher appraisals from their supervisors with respect to their in-role job performance and innovation abilities. Similarly, Ingram et al. (2014) have investigated the moderating effect of paradoxical thinking on the relationship between paradoxical tensions and innovative behavior in the context of family firms. While this moderation effect was not statistically significant, the authors have found a direct positive effect of paradoxical thinking on innovative behavior. More research is needed to clarify the exact nature of the relationship between tensions, paradox mindset and innovation-related measures. In particular, little is known about the impact of paradox mindset on innovativeness in the context of teams.

The paradox mindset construct comprises both emotional and cognitive elements that, together, help to address effectively the tensions that arise in complex, diverse, and fast-paced environments (Miron-Spektor et al., 2018). As such, approaching problems with a paradox mindset is reflective of a specific cognitive style insofar as it relates to an individual's preferred cognitive strategy for acquiring, processing and using knowledge with the aim of solving problems (Chan, 1996; Shalley, Zhou and Oldham, 2004). Diversity in cognitive styles leads to greater levels of innovation (Basadur and Head, 2001) and is particularly valuable when the tasks involved are complex and non-routine (Pelled, Eisenhardt and Xin, 1999). Innovation teams composed of a mix of highly creative people, conformists, and members with sharp attention to detail perform better than more homogeneous teams (Miron-Spektor, Erez and Naveh, 2011).

Having a paradox mindset allows individuals to attend to divergent perspectives and strive to establish balance between them (Miron-Spektor et al., 2018), to immerse themselves in tensions and search for more optimal responses (Luscher, Lewis and Ingram, 2006), to use conflict to generate new understandings (Poole and Van de Ven, 1989) and search more broadly for integrative solutions (Miron-Spektor et al., 2018). It is not an automatic consequence, however, that *all* members of a team should be endowed with the ability to think paradoxically. Indeed, it may be beneficial to have individuals who seek to avoid tensions so as to more freely and fully engage in a single pole of a given duality while relying on other team members - or the team as a whole - to achieve the superior synthesis of conflicting activities (Bledow et al., 2009). For example, low paradox mindset individuals tend to have a greater need for cognitive closure or NFCC (Miron-Spektor et al., 2018), which may be beneficial in the context of time-bound innovation projects. High NFCC individuals exhibit quicker decision-making (Webster and Kruglanski, 1998), rely significantly more on existing knowledge (Webster and Kruglanski, 1998), display a lower tolerance for ambiguity (Webster and Kruglanski, 1994), tend to stick to prior decisions (Kruglanski, Webster and Klem, 1993), and show a greater need for structure (Webster and Kruglanski, 1994). I argue that these traits may contribute to the success of innovation projects, in particular when it comes to exploitation-related activities.

Consequently, it may be beneficial to have a mix of high paradox mindset individuals for their openness, acceptance of contradictions, willingness to explore, and integrative thinking capacity (Miron-Spektor et al., 2018), and high NFCC team members for their desire for predictability, preference for structure, and decisiveness (Webster and Kruglanski, 1994). The former will play a leading role in enabling the necessary integration processes and unlocking synergies between exploration and exploitation, while the latter will contribute to the efficient and timely implementation of new ideas by leveraging existing knowledge, making swift decisions and committing to a course of action. This rationale leads to the formulation of the following hypothesis.

***Hypothesis 4:** The relationship between perceived paradoxical tensions and innovativeness is moderated by the diversity of paradox mindsets within the team. For teams that exhibit high paradox mindset diversity, the impact of paradoxical tensions on innovativeness is positive, whereas it is negative for teams that exhibit low paradox mindset diversity.*

Hypothesis 1 postulates a direct positive effect of exploratory and exploitative activity overlap on innovativeness. The conceptual model shown in **Figure 3-1** also suggests that there will be an indirect effect of this overlap on innovativeness through increased levels of paradoxical tensions. The impact of this indirect effect will be conditional on the level of paradox mindset diversity within the team.

***Hypothesis 5:** There is an indirect effect of exploratory-exploitative activity overlap on innovativeness through greater levels of perceived paradoxical tensions. This indirect effect is positive for teams with high paradox mindset diversity, whereas it is negative for teams with low paradox mindset diversity.*

3.4 Methods

3.4.1 Sample

This study followed 42 teams (250 individuals) of undergraduate students from a leading hospitality management school in Switzerland working on junior consulting mandates for external client organizations who pay an average fee of US\$ 10,000 per project. The characteristics of the sample are shown in **Table 3-1**.

Table 3-1: Sample Characteristics

Sample size	42 teams (250 participants)
Team size	40 teams of 6, 2 teams of 5
Male	38.5%
Female	61.5%
Nationalities	54
Average Age	24.3
Average GPA	4.93 (max. = 6.0)

The objective of these nine-week mandates was to develop useful and creative business recommendations based on market research conducted by the teams. In six of the nine weeks, individual team members were asked to complete a questionnaire capturing data about the various constructs and variables of interest. Paradox mindset scores and control variables were collected once at the beginning of the project, whereas data about the simultaneous engagement in exploratory and exploitative activities, along with the level of perceived paradoxical tensions, were collected on five different occasions over the course of the project. Upon completion of the mandate, the faculty coach assigned to that project was asked to assess the innovativeness of the solutions developed by the team. Each faculty coach involved in this process assessed ten to eleven projects, which enhanced the consistency (same evaluator across many projects) and sensitivity (ability to compare across projects) of the evaluation process. It was not deemed appropriate, however, that *all* faculty coaches should assess *all* projects as they each had a limited understanding of the contexts, objectives, industries, and client expectations related to the projects they did not supervise directly.

The projects fell into one of three categories, namely, the creation of new product/service concepts, marketing and sales programs, or business development strategies. The distribution of project types and client industries, as well as examples of consulting assignments for each project category, are shown in **Table 3-2** and **Table 3-3**.

Table 3-2: Project Types and Client Industries

Client Industry	Types of Project			Total
	<i>Business Development Strategy</i>	<i>Marketing & Sales Programs</i>	<i>Concept Development</i>	
Consulting	1	2	2	5
Consumer products	2	2	1	5
Education			2	2
Entertainment	1	1	2	4
Food & Beverage	2	1	11	14
Hospitality	2	1	2	5
Non-Profit	1		2	3
Technology	1	3		4
	10	10	22	42

Table 3-3: Examples of Consulting Assignments

Business Development Strategy

*Develop a market penetration strategy for COMPANY A's products and services for the Swiss and Belgian markets.
Refine the brand strategy and create an international growth plan for COMPANY B's hotel chain.
Identify new revenue stream opportunities and develop five-year financial projections for COMPANY C's business.*

Marketing and Sales Program

*Develop a sales and marketing strategy for COMPANY D's health products targeting U.K. consumers.
Create a commercial plan to support the development of COMPANY E's business in the Swiss market.
Develop a marketing initiative and sales plan for COMPANY F's branded products in Bangkok, Singapore, and Hong Kong.*

Concept Development

*Create a wine tourism concept around COMPANY G's properties in Spain.
Develop a creative customer offering for COMPANY H's personal branding services.
Create an innovative foodwaste management program for COMPANY I's hotels in the U.K.*

3.4.2 Measures

Exploration-exploitation overlap. There is an on-going debate as to whether exploration and exploitation should be measured as separate dimensions – i.e., the “orthogonal” view – or as two ends of a spectrum – i.e., the “continuum” view (Birkinshaw and Gupta, 2013). In this study, I follow Gupta, Smith and Shalley's (2006) rationale that this choice is dependent on the level of analysis and that the lower that level is, the more appropriate the continuum view becomes. Indeed, at the team level, it is sensible to argue that the more time team members devote to certain categories of activities, the less time they can dedicate to others. This view is entirely consistent with March's (1991) who considered exploration and exploitation to be distinct activities competing for time and resources.

Unfortunately, the scales available in the literature to measure, at the team level, the simultaneous engagement in exploration and exploitation either follow the orthogonal view, which allows for simultaneously high levels of both exploration and exploitation (e.g., Jansen et al., 2016; Liu and Leitner, 2012), or do not focus on knowledge-related activities (e.g., Haas, 2010; Swart et al., 2016). The present study, therefore, required that a new measure be developed to quantify the simultaneous engagement in exploratory and exploitative activities in a way that is consistent with the continuum view.

Innovation teams – such as those involved in research or product development – primarily engage in knowledge-intensive activities (Alvesson, 2004). The absorptive capacity literature provided insights that helped define what such activities may consist of, as well as whether they should be considered exploratory or exploitative. Specifically, this study follows Zahra and George's (2002) conceptualization of absorptive capacity as a sequence of knowledge processing stages which include acquisition, assimilation, transformation, and exploitation. Defining and categorizing activities in this manner is justified as innovation teams must first acquire and assimilate new knowledge before they can transform and exploit it to develop useful and novel solutions (Cohen and Levinthal, 1990; Tiwana and Mclean, 2005; Zahra and George, 2002). While there is no absolute boundary that can be drawn between purely exploratory and exploitative stages, Zahra and George's (2002) concepts of potential absorptive capacity (PACAP) and realized absorptive capacity (RACAP) help make this distinction: PACAP refers to the first two stages of knowledge *acquisition* and *assimilation*, and, therefore, relates primarily to knowledge exploration; RACAP refers the last two stages of knowledge *transformation* and *exploitation*, and, therefore, relates primarily to knowledge exploitation. This association of PACAP with exploration and RACAP with exploitation can also be found in the works of other absorptive capacity researchers (e.g., Ojo et al., 2014; Volberda, Foss and Lyles, 2010).

Consistent with the continuum view, I asked team members to estimate the percentage of time that they had personally spent on exploratory activities (i.e., those related to the acquisition and assimilation of knowledge) and exploitative activities (i.e., those related to the transformation and exploitation of knowledge). The actual question that was presented to the respondents is shown in **Appendix 3-1** and includes adaptations of items taken from individual-level (Lowik, Kraaijenbrink and Groen, 2016) and team-level (Backmann, Hoegl and Cordery, 2015) absorptive capacity scales validated in prior literature. The inclusion of both individual and team level activities is warranted given that certain stages of absorptive capacity – for example, knowledge acquisition – depends mostly on the actions of individual team members, while others – for

example, knowledge transformation – are more effectively conducted collectively (Ojo et al., 2014). For each of the four sets of activities, an average of all individual responses was taken to obtain the percentage of time that the team as a whole spent on those activities. I then calculated the average amount of time that the team spent on exploration-related activities by adding together the percentages devoted to knowledge acquisition and assimilation. Similarly, I calculated the average amount of time that the team spent on exploitation-related activities by adding together the percentages devoted to knowledge transformation and exploitation. To capture the extent to which teams engaged *simultaneously* in exploration and exploitation, I multiplied the percentage of time that the team spent on exploration-related activities by the percentage of time spent on exploitation-related activities. This operationalization, based on taking the product rather than the sum or the difference of exploration and exploitation measures, is consistent with the majority of quantitative studies found in the closely related field of ambidexterity research (see Birkinshaw and Gupta (2013) for a review). Finally, I computed a grand average of the five exploration-exploitation overlap measures collected over the course of the project to obtain an overall score for a given project and team.

Paradoxical tensions. I measured the level of paradoxical tensions experienced by team members using a scale recently developed and validated by Miron-Spektor et al. (2018). This data was collected, along with the activity measures, at five different times over the course of the project. Each team member was asked to indicate the level of paradoxical tensions they had personally experienced over the course of the preceding week. The level of paradoxical tensions experienced was assessed using a 7-item scale ranging from 1, “strongly disagree,” to 7, “strongly agree,” and included items such as “I often had to meet contradictory requirements” or “My work was filled with tensions and contradictions.” Individual levels of paradoxical tensions were then averaged to obtain the overall level of paradoxical tensions experienced by the team. Finally, a grand average of the five weekly measures of perceived paradoxical tensions was taken to obtain an overall measure of that construct for a given project and team.

Paradox mindset diversity. In the first week of the projects, I measured the extent to which individual team members exhibited a paradox mindset by using the scale developed and validated by Miron-Spektor et al. (2018). The degree to which an individual had a paradox mindset was assessed using a 10-item scale ranging from 1, “strongly disagree,” to 7, “strongly agree,” and included items such as “I am comfortable dealing with conflicting demands at the same time” or “Tensions between ideas energize me.” To measure diversity, I followed prior team creativity and innovation research which defines and measures cognitive diversity as the cognitive distance between members of the group (e.g., Shin et al., 2012; Van der Vegt and Janssen, 2003). Because this definition equates maximum diversity as maximum separation, I used the standard deviation (Harrison and Klein, 2007) of team members’ paradox mindset scores as a measure of paradox mindset diversity within the team.

Innovativeness. As discussed previously, the innovativeness of a solution consists of the combination of two independent dimensions: utility and novelty (Stock, Oliveira and Von Hippel, 2015). I adapted the scale from Im and Workman (2004) to measure both dimensions, and subsequently followed the suggestion to create a single indicator of innovativeness (Calantone, Chan and Cui, 2006; Sethi et al., 2001) by multiplying them together which captures the fact that balance between utility and novelty is preferable to equivalently high but one-sided scores. This operationalization thus stays very close to the definition of innovativeness as outcomes that are considered *both* novel and appropriate (Amabile, 1983).

Control variables. The setting for this study allowed to ignore a few covariates that were naturally controlled for. For example, due to the nature of the sample, team members were highly homogeneous in terms of age and past work experience. Also, almost all teams were of equal size (forty teams of six, two teams of five). Finally, all projects lasted nine weeks with identical start and end dates. The variables that were controlled for included the following. *Gender mix:* To calculate gender diversity within teams, I used Teachman's (1980) index: $H = -\sum_{i=1}^2 P_i(\ln P_i)$ where P_1 and P_2 represent the proportion of females,

respectively males, within the team. *Team combined Grade Point Average (GPA)*: To control for the level of academic abilities, I computed the team's average of individual GPAs (GPAs can range from 1 to 6). *Prior related knowledge*: I also controlled for the fact that team members may have had pre-existing knowledge or experience closely associated with the mission of the project. To do so, I asked respondents to indicate their level of agreement (1="Strongly disagree", 5="Strongly Agree") with the statement "I have previous work experience in an area that is closely related to the mission of our project". I computed the average of team members' responses to compute the team's overall level of prior related knowledge. *Team familiarity*: I also controlled for previous teamwork experiences between the members. To do so, I asked individual team members the following question: "In the context of your studies, how many of your team members have you already worked with in a team before this project?" I then took an average of the responses as a proxy for team familiarity. *Degree of creativity required*: While all projects required teams to produce useful solutions, the requirement regarding creativity varied somewhat. Consequently, I also controlled for the level of creativity required for the project. This requirement was assessed by the faculty coach assigned to the team who was asked to indicate his/her level of agreement (1="Strongly disagree", 7="Strongly Agree") relative to the statement "To be a success, this particular project requires that the team bring a significant level of creativity."

3.5 Results

3.5.1 Descriptive Statistics

Table 3-4 summarizes the means, standard deviations, and correlations coefficients for the various research variables. The Cronbach's alphas for the two multi-item scales used in this study were 0.79 for paradox mindset and 0.87 for paradoxical tensions, which are both above the acceptable threshold of 0.7 (Nunnally, 1978).

Table 3-4: Means, Standard Deviations, and Correlations

Variable	Mean	s.d.	1	2	3	4	5	6	7
<i>Controls</i>									
1. Gender diversity	0.54	0.22							
2. Team familiarity	3.03	0.96	.22						
3. Prior related knowledge	2.94	0.60	-.02	-.08					
4. Team GPA	4.84	0.18	-.10	.08	-.12				
5. Creativity requirement	4.59	1.99	.16	-.13	-.22	.01			
<i>Contextual predictors</i>									
6. Exploration-Exploitation Overlap	2244	171	.12	.18	.01	.01	-.07		
7. Paradox mindset diversity	0.68	0.24	-.03	.06	.05	.18	.12	.25	
<i>Mediator</i>									
8. Paradoxical tensions	3.97	0.45	.01	-.02	.08	.06	-.01	.42**	.04

n = 42

**p* < .05

***p* < .01

3.5.2 Hypothesis Testing

Figure 3-2 shows the statistical model that corresponds to the conceptual model in **Figure 3-1**.

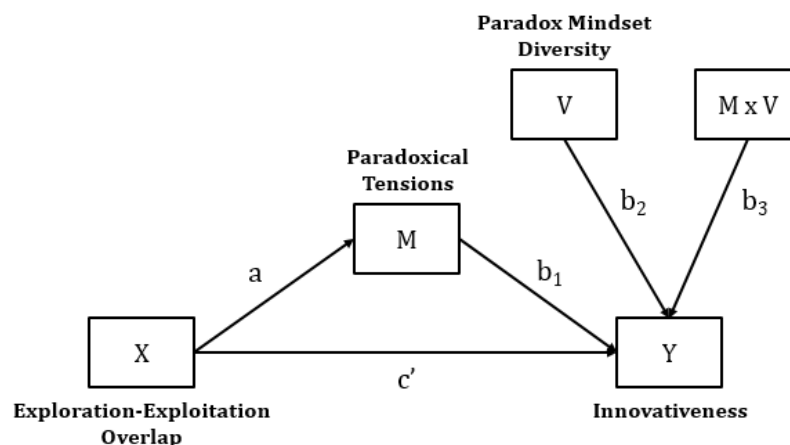


Figure 3-2: Statistical Model

To test the various relationships in the model, I used the PROCESS macro for SPSS (Hayes, 2013), and generated 95% confidence intervals based on 10,000 bias-corrected bootstrap samples. The results are summarized in **Table 3-5**.

First, we can see that, holding all control variables constant, the relationship between exploration-exploitation overlap and paradoxical tensions is positive and significant, $a=0.0012$, 95% CI=0.0003 to 0.0020, $p=0.01$, and accounts for 18.4% of the variance in perceived paradoxical tensions. This provides support for Hypothesis 2, namely, the more a team engaged in exploratory and exploitative activities simultaneously, the greater the level of paradoxical tensions its members experienced. If we look at the relationship to the output variable (i.e., innovativeness), we note that while there is a positive direct effect between exploration-exploitation overlap and innovativeness this effect is not significant, $c'=0.012$, 95% CI=-0.011 to 0.035, $p=0.28$. Therefore, Hypothesis 1 is not supported. Hypothesis 3 posits that higher levels of paradoxical tensions will negatively impact innovativeness. This hypothesis is confirmed as there is a negative and statistically significant direct effect between those two constructs, $b1=-29.633$, 95% CI=-54.468 to -4.799, $p=0.02$.

Let us now turn to paradox mindset diversity as a potential moderator of the relationship between paradoxical tensions and innovativeness. The interaction effect is both positive and significant, $b_3=38.661$, 95% CI=4.304 to 73.019, $p=0.029$, and accounts for 9.7% of the variance in innovativeness. Hypothesis 4 is, therefore, supported. The visualization of this moderation effect shown in **Figure 3-3** confirms the theoretical argument that paradoxical tensions can be either beneficial or detrimental to innovativeness depending on how diverse a team is in terms of paradox mindsets; the changing sign of the line slopes reflects this dual aspect of paradoxical tensions.

Table 3-5: Regression Results

		Paradoxical Tensions (M)					Innovativeness (Y)						
		Coeff.	s.e	p	95% CI	ΔR^2			Coeff.	s.e.	p	95% CI	ΔR^2
Constant		0.428	2.136	0.84	-3.908, 4.764				65.757	63.370	0.31	-63.325, 194.839	
Control variables													
	Gender diversity	-0.036	0.341	0.92	-0.728, 0.657				10.017	8.104	0.23	-6.490, 26.523	
	Team familiarity	-0.044	0.079	0.58	-0.205, 0.117				1.536	1.843	0.41	-2.219, 5.291	
	Prior related knowledge	0.060	0.119	0.62	-0.182, 0.301				5.333 †	2.976	0.08	-0.728, 11.395	
	Team GPA	0.173	0.381	0.65	-0.600, 0.947				1.093	9.013	0.90	-17.268, 19.453	
	Creativity requirement	0.007	0.038	0.85	-0.069, 0.083				2.523 **	0.913	0.01	0.664, 4.382	
Contextual predictor													
	Exploration-Exploitation Overlap (X)	$a \rightarrow$	0.001 **	0.000	0.01	0.000, 0.002	0.184	$c' \rightarrow$	0.012	0.011	0.28	-0.011, 0.035	
	Paradox mindset diversity (W)							$b_2 \rightarrow$	-141.491 *	69.233	0.05	-282.517, -0.465	
Mediator													
	Paradoxical tensions (M)							$b_1 \rightarrow$	-29.633 *	12.192	0.02	-54.468, -4.799	
Interaction effect													
	M x W							$b_3 \rightarrow$	38.661 *	16.867	0.03	4.304, 73.019	0.097
						$R^2 = 0.196$ F(6, 35) = 1.424, p = .233							$R^2 = 0.412$ F(9, 32) = 2.495, p < .05

N = 42

Values are unstandardized beta coefficients.

† $p < .10$, * $p < .05$, ** $p < .01$

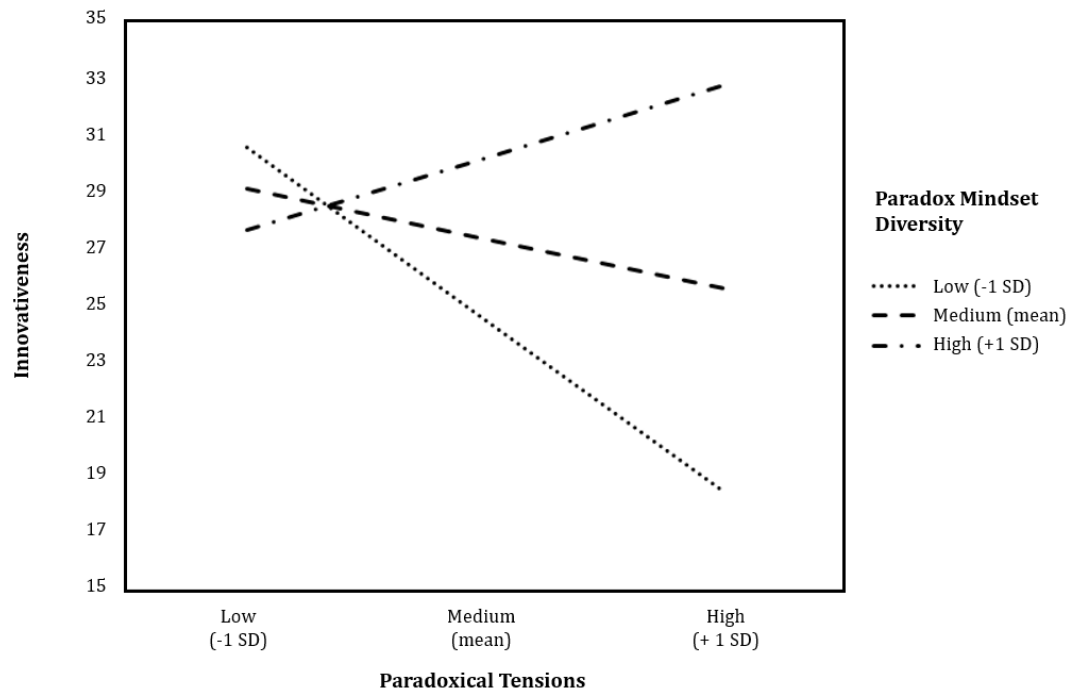


Figure 3-3: Moderation Effect of Paradox Mindset Diversity

I must qualify this result, however. When probing the interaction using the Johnson-Neyman technique (Johnson and Neyman, 1936), I found that the region of significance does not extend to the entire range of values of the moderator. At the 5% confidence level, the moderation effect is only significant for low values of paradox mindset diversity; specifically, the region of significance covers the bottom 29% of values in the dataset. In practical terms, this means that, for teams with low paradox mindset diversity, there is a statistically significant difference in how innovative their outputs were depending on whether they had experienced low or high levels of paradoxical tensions. Specifically, low paradox mindset diversity teams fared significantly worse, in terms of innovativeness of their outputs, when they operated under a climate of high paradoxical tensions. As the level of perceived paradoxical tensions decreases, however, there is less and less difference in how low, medium, and high paradox mindset diversity teams perform. While **Figure 3-3** also suggests that medium and high paradox mindset diversity teams will perform differently under various levels of perceived paradoxical tensions, these performance differences are not statistically significant at the 5% confidence level. At the

10% confidence level, however, the moderation effect also becomes statistically significant for teams with very high paradox mindset diversity. Namely, these teams produced more innovative outputs when they experienced high levels of perceived paradoxical tensions. This result suggests that only the teams that are very diverse in terms of their paradox mindsets can truly unlock the innovative potential of paradoxical tensions. The regions of significance of the moderation effect for both the 5% and 10% confidence levels are shown in **Figure 3-4** and **Figure 3-5**, respectively.

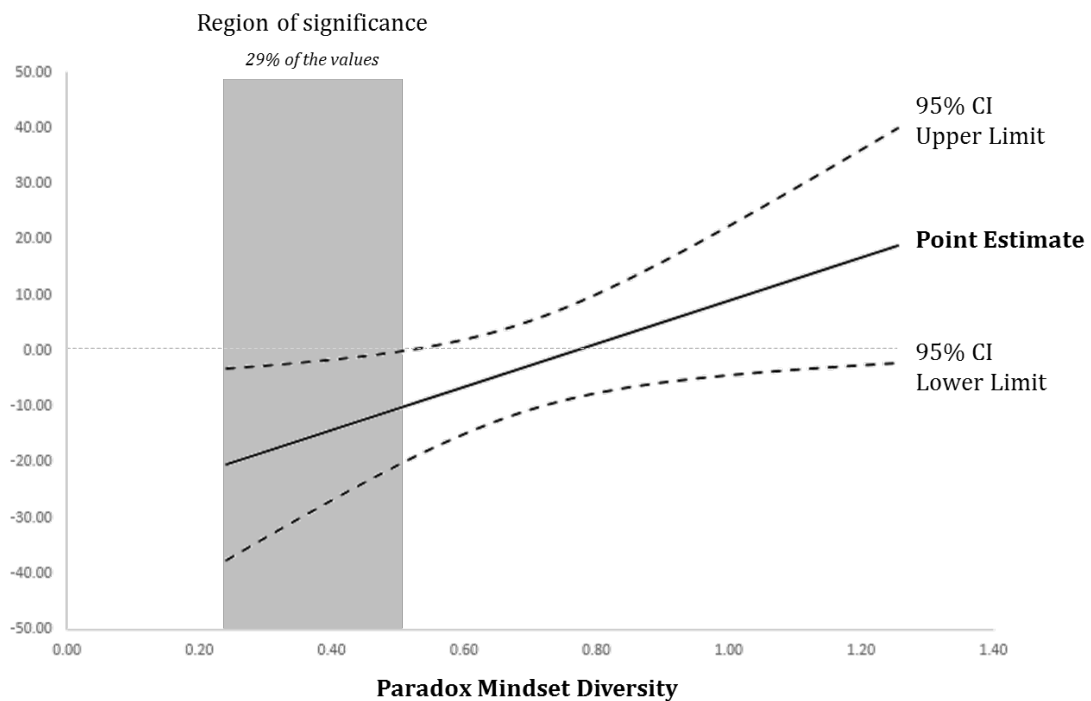


Figure 3-4: Conditional Effect of Perceived Paradoxical Tensions on Innovativeness with Regions of Significance at the 5% Confidence Level

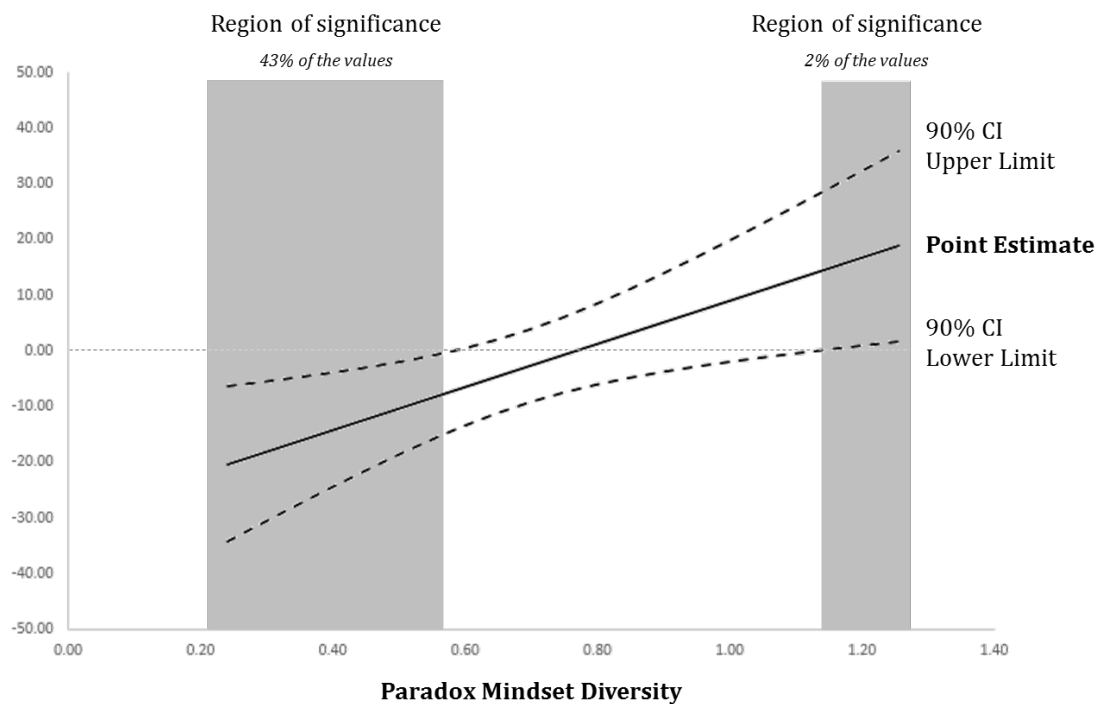


Figure 3-5: Conditional Effect of Perceived Paradoxical Tensions on Innovativeness with Regions of Significance at the 10% Confidence Level

Finally, evidence of interaction between perceived paradoxical tensions and paradox mindset diversity does not necessarily establish whether the indirect effect of exploration-exploitation overlap on innovativeness is itself moderated (Hypothesis 5). To do so, we must look at the product of the effect of exploration-exploitation overlap on paradoxical tensions, namely the a coefficient, and the conditional effect of paradoxical tensions on innovativeness, namely $b_1 + b_3W$. The indirect effect can, therefore, be expressed as a linear function to the moderator – i.e., paradox mindset diversity (W) – and takes the mathematical form of $(ab_1 + ab_3W)$. The slope of this line (i.e., ab_3) is referred to as the index of moderated mediation. This index provides a measure of how much, and in which direction, the moderating variable influences the strength of the indirect effect. The output from the PROCESS macro shows that this index is both positive and statistically significant, $\text{index}=0.0457$, $95\% \text{ CI}=0.0031$ to 0.1154 . The relationship between the moderating variable and the indirect effect is illustrated in **Figure 3-6**. Because the index (i.e., the slope of the line) is positive, we can say that the indirect effect of exploration-exploitation overlap on

innovativeness through paradoxical tensions is an increasing function of paradox mindset diversity. Indeed, we see that, for roughly the lower half of the recorded paradox mindset diversity scores, the indirect effect was negative, while for the upper half it was positive. Hypothesis 5 is, therefore, supported. Simply put, this means that greater overlap between exploratory and exploitative activities has a positive indirect effect on innovativeness for teams that exhibit high paradox mindset diversity, while it has a negative indirect effect for teams that exhibit low paradox mindset diversity.

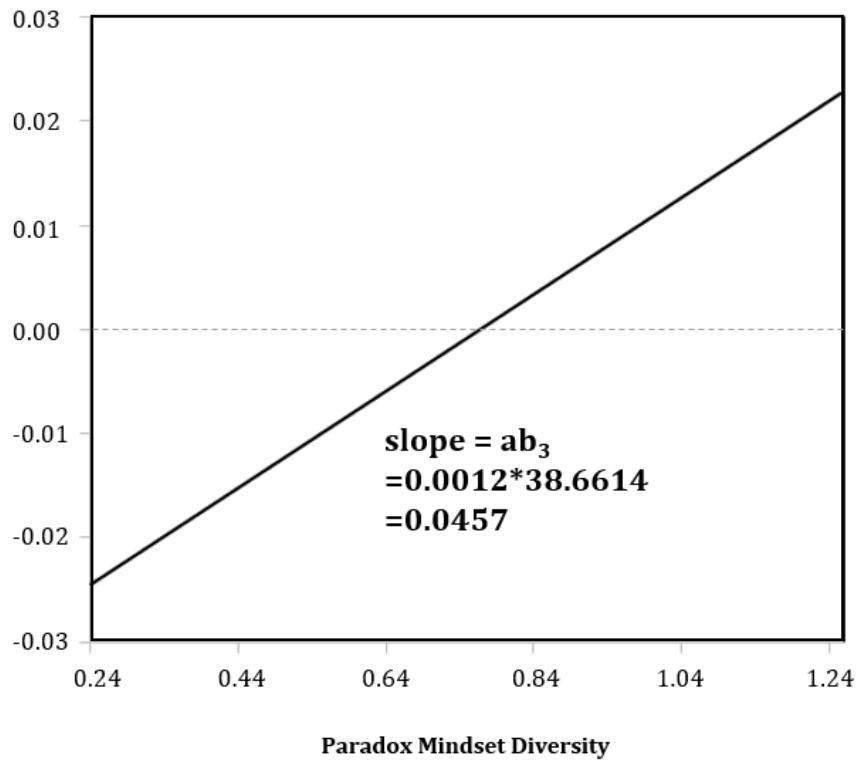


Figure 3-6: Indirect Effect (through Perceived Paradoxical Tensions) of Exploration-Exploitation Activity Overlap on Innovativeness

Table 3-6 summarizes the support received by each of the hypotheses put forth in this study.

Table 3-6: Hypothesis Support Summary

	Hypothesis	Supported?
H1	There is a positive relationship between the extent to which team engages simultaneously in exploratory and exploitative activities (i.e., exploration-exploitation overlap), and the innovativeness of its outputs.	NO
H2	There is a positive relationship between the extent to which team engages simultaneously in exploratory and exploitative activities (i.e., exploration-exploitation overlap), and the level of paradoxical tensions experienced by its members.	YES
H3	There is a negative relationship between the level of perceived paradoxical tensions and the innovativeness of a team's outputs.	YES
H4	The relationship between perceived paradoxical tensions and innovativeness is moderated by the diversity of paradox mindsets within the team. For teams that exhibit high paradox mindset diversity, the impact of paradoxical tensions on innovativeness is positive, whereas it is negative for teams that exhibit low paradox mindset diversity.	YES
H5	There is an indirect effect of exploration-exploitation overlap on innovativeness through greater levels of perceived paradoxical tensions. This indirect effect is positive for teams with high paradox mindset diversity, whereas it is negative for teams with low paradox mindset diversity.	YES

The above analyses have highlighted the impact of paradox mindset diversity on innovativeness. But what can we say about teams that do *not* exhibit such diversity? Although answering this question was not the focus of this particular study, I provide some initial insights through a statistical comparison of mean innovativeness scores between three different categories of teams. The first category includes the teams that are relatively homogeneous in terms of paradox mindsets, but whose members tend to have *below average* paradox mindset scores. The second category includes the teams that have high paradox mindset diversity, namely, the teams that include a mix of high and low paradox mindset members. Finally, the third category includes the teams that are relatively homogeneous in terms of paradox mindsets, and whose members tend to have *above average* paradox mindset scores. This categorization implies that, as we move from the first to the third category, the proportion of high paradox mindset individuals within the teams tends to increase. Given our earlier findings of the role of paradox mindset diversity on innovativeness, one would expect a curvilinear relationship between the proportion of high paradox mindset individuals within a team and the level of innovativeness of their outputs. Using our classification one would also expect category 1 and category 3 teams to score lower on innovativeness than category 2 teams. An open question is whether a significant performance difference exists between category 1 and category 3 teams. In other words, is it preferable to have a homogeneously low or a homogeneously high paradox mindset team?

I will now explain the method used for classifying the teams into the three categories. First, I distinguished between high and low diversity teams. Given the relatively small sample size, one of the objectives was to create three categories of roughly equal sizes. To achieve this, I set the threshold target for diversity at the 33% percentile. Using a cut-off diversity score of 0.83, I was able to classify 13 teams (31%) in the high diversity category. I then computed the median paradox mindset score for the low diversity teams that remained. I used the median because the aim was to split the remaining teams evenly across categories 1 and 3. The paradox mindset threshold was thus set at 5.09 (the

median) and resulted in the classification of 15 teams (36%) in category 1, and 14 teams in category 3 (33%). The descriptives for each category are shown in **Table 3-7**.

I proceeded to conduct a series of two-tailed independent t-tests to check for statistically significant differences in mean innovativeness scores between the various categories. This resulted in three different t-tests which are summarized in **Table 3-8**.

Two main findings emerged from these tests. First, and as expected, both categories of homogeneous teams (1 and 3) scored lower on innovativeness when compared to the category of heterogeneous teams (2). The differences were statistically significant at the 5% level for the category 1 vs. 2 test, and at the 1% level for the category 2 vs. 3 test. This finding confirms, albeit through a rather simplistic statistical approach, the benefits of having teams that include a mix of both high and low paradox mindset individuals. The second finding is that, while the means of category 1 and category 3 teams differ (25.95 vs. 19.69, respectively), this difference was not statistically significant at the 5% level. Consequently, this result does not support the claim that a specific configuration of homogeneous teams – i.e., homogeneously low or homogeneously high – is preferable when it comes to innovativeness.

Table 3-7: Descriptives for Homogeneously Low, Heterogeneous, and Homogeneously High Teams

#	Category	Teams in category	% of all teams	Paradox Mindset		Innovativeness	
				<i>mean</i> ^a	<i>diversity</i> ^b	<i>mean</i>	<i>s.e.</i>
1	Homogenous with Low Paradox Mindset	15	36%	4.75	0.52	25.95	2.81
2	Heterogenous	13	31%	4.99	0.94	34.55	2.39
3	Homogenous with High Paradox Mindset	14	33%	5.34	0.59	19.69	3.21

^a Refers to the average paradox mindset score of teams in the category.

^b Refers to the average paradox mindset diversity score of teams in the category.

Table 3-8: Independent t-tests of Innovativeness Means

Independent t-test	t	df	Sig. (2-tailed)
Category 1 vs. Category 2	-2.290	26	0.030
Category 2 vs. Category 3	3.664	25	0.001
Category 1 vs. Category 3	1.470	27	0.153

Finally, while this analysis does not rigorously prove the existence of a curvilinear relationship between the proportion of high paradox mindset members and innovativeness, the graph shown in **Figure 3-7** does suggest that such a relationship exists and invites further investigation.

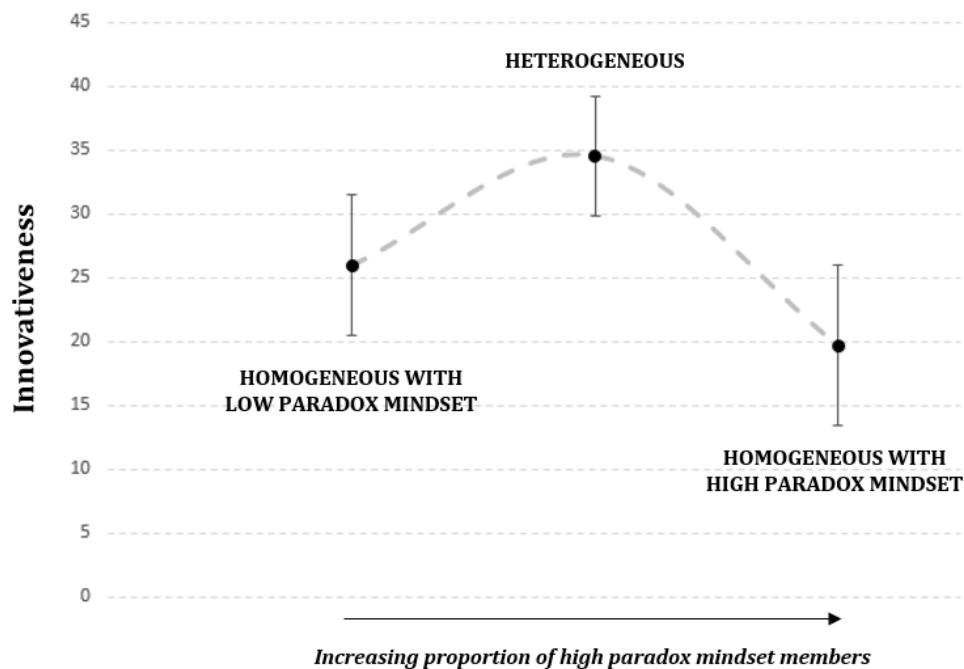


Figure 3-7: Innovativeness Means and Confidence Intervals Across Team Categories

3.6 Discussion

The previous analyses provide a number of insights into the nature, and relative importance, of the relationships between the simultaneous engagement in exploratory and exploitative activities, paradoxical tensions, paradox mindset, and innovativeness. The findings show that while greater exploration-exploitation overlap does not necessarily improve innovativeness, it does create higher levels of perceived paradoxical tensions. In keeping with prior theory (e.g., Lewis, 2000; Smith and Berg, 1987), the results confirm the double-edged nature of those tensions and highlight the conditions under which (i.e., teams exhibiting high paradox mindset diversity) these tensions can be leveraged for

greater innovativeness. Arguably, this study's most intriguing finding is that having a diversity of paradox mindsets within a team is preferable to having homogeneously high levels across its members. Importantly for paradox theory, this finding suggests that, in the context of teams, there may be decreasing returns associated with the concept of paradox mindset, which constitutes a novel and valuable insight into this relatively recent construct.

Contrary to expectations, simultaneously engaging in exploratory and exploitative activities did not contribute to higher levels of innovativeness. When it comes to the exploration-exploitation duality, there are three potential measures of engagement that may impact innovativeness: simultaneity, balance, and timing. In this study, I set out to test the simultaneity hypothesis and have argued based on prior literature (e.g., He and Wong, 2004; Sheremata, 2000; Taggar, 2002) that the concurrent enactment of opening and closing strategies is beneficial to project outcomes. However, rather than simultaneity, an alternate explanatory factor of greater innovativeness may be the achievement of an optimal balance between exploration and exploitation (Birkinshaw and Gibson, 2004; March, 1991). Conceptually, one could argue that this balance is achieved when teams successfully avoid Levinthal and March's (1993) *failure* trap (by not overemphasizing new knowledge creation at the expense of knowledge utilization) and *success* trap (by resisting undue reliance on existing knowledge to the detriment of the novelty of the outputs). Similarly, in the absorptive capacity literature, Jansen, Van Den Bosch and Volberda (2005) have also raised the question of an optimal balance, or equivalently a desired efficiency factor (Zahra and George, 2002), between potential and realized absorptive capacity. Finally, beyond simultaneity and balance, greater innovativeness may be a consequence of proper timing and intensity of exploratory and exploitative activities. As the relative importance of those activities may shift over time (Burgelman, 2002; Jansen, Van Den Bosch and Volberda, 2006), high performance may depend on a team's ability to enact the proper relative emphasis between exploration and exploitation throughout the life of a project. While the development of innovative solutions may not follow a perfect sequence of distinct stages, its success may rely on an early

emphasis on exploration followed by a focus on exploitation in the later stages as suggested by prior research (e.g., Seidel, 2007; De Visser et al., 2014).

The simultaneous engagement in exploratory and exploitative activities did raise the level of perceived paradoxical tensions and accounted for a sizeable amount (18.4%) of the explained variance. This finding was expected and agrees with prior theory on the conflicting nature of exploration and exploitation. One should note, however, that the simultaneous engagement in exploratory and exploitative activities only accounted for less than a fifth of the explained variance in perceived paradoxical tensions. This raises the question of other candidate constructs that may also play a significant role in the level of paradoxical tensions experienced by project teams. Because the scale used to measure tensions applies to a broad variety of paradoxes and does not focus exclusively on paradoxes of learning such as exploration-versus-exploitation, it is reasonable to expect that there may be other types of paradoxes at play. In particular, Smith and Lewis (2011) have identified three other families of paradoxes, each likely to be relevant to the context of innovation projects, such as paradoxes of belonging (e.g., individual vs. collective), paradoxes of performing (e.g., competing goals of multiple stakeholders), or paradoxes of organizing (e.g., control vs. empowerment). Nevertheless, this study's contribution was to show that the simultaneous engagement in exploratory and exploitative activities is a significant contributing factor in raising the level of perceived paradoxical tensions.

While paradoxical tensions may spur greater creativity and innovativeness (Eisenhardt and Westcott, 1988; Rothenberg, 1979), this study provides further evidence that some contextual element (in this case, paradox mindset diversity) is required to unlock that potential. The results show that, absent that contextual element, paradoxical tensions are detrimental to innovativeness, which is in line with other empirical studies using the construct (e.g., Ingram et al., 2014; Miron-Spektor et al., 2018). This negative impact of paradoxical tensions has been argued by early paradox theorists such as Smith and Berg (1987) and Vince and Broussine (1996), who point out that the initial responses to paradoxes

usually involves a variety of defensive reactions that, while they offer a temporary reprieve, tend to exacerbate those tensions in the long run.

While paradoxical tensions had a negative impact on innovativeness, this effect was moderated by the degree to which teams were diverse in terms of the paradox mindsets. Specifically, using maximum separation as a measure of diversity, the results suggest that the ideal innovation project team has an equal mix of very high and very low paradox mindset members. While individual-level studies had already hypothesized the moderating role of paradox mindset on innovative behavior (e.g., Ingram et al., 2014), in-role job performance and innovation (e.g., Miron-Spektor et al., 2018), the present study is the first, to my knowledge, to investigate paradox mindset at the team level, thus allowing for an investigation into the role played by diversity. The findings suggest that paradox mindset diversity acts as an “insurance” against climates of high paradoxical tensions. Indeed, the negative impact of paradoxical tensions on innovativeness is particularly pronounced for low paradox mindset diversity teams. As diversity increases, this negative effects can be partially, or even fully, mitigated. Although I did not find a statistically significant difference in innovativeness for high diversity teams under a climate of low and high paradoxical tensions, the results suggest that very high paradox mindset diversity teams may benefit from high levels of tensions.

The results, however, also show that the double-edged nature of paradoxical tensions is heavily skewed toward a proportionally greater negative effect. In other words, low paradox mindset diversity teams were hurt more by high levels of paradoxical tensions than high paradox mindset diversity teams benefited from them. An interesting question has to do with the extent to which time may play a factor in this asymmetry of impact. Indeed, the negative effect of paradoxical tensions may manifest itself more readily as teams react defensively to tensions, at least initially, while the beneficial effects of tensions may require more time to materialize. Miron-Spektor, Gino and Argote (2011) have found that priming individuals with paradoxical frames is a precondition to being able to leverage tensions for greater creativity. Similarly, Calabretta,

Gemser and Wijnberg (2017) propose a three-step process to fully exploit the potential of the tension between intuitive and rational thinking. The first step of this process consists of the careful preparation of individuals before any practice-based enactment of paradoxical thinking. These studies suggest that, without such priming or preparation, actors may be ill-prepared to take advantage of paradoxical tensions however salient they may be at a given moment. The finding that more homogeneous teams, whether similarly high or similarly low on paradox mindset, achieve lower innovativeness scores than heterogeneous teams supports the hypothesis that there is something to homogeneity itself (regardless of whether members share an ability for paradoxical thinking) that prevents teams from leveraging paradoxical tensions. One could hypothesize that the beneficial impact of paradox mindset diversity may be the result of the juxtaposition of conflicting individual perspectives and cognitive approaches which, through a dialectical process of discussions and interactions, may help spur greater recognition and awareness of tensions. A question for further research, therefore, is the potential role that paradox mindset diversity may play in providing a form of “organic priming” that nudges members of a team toward greater acceptance of tensions. More generally, the benefits of paradox mindset diversity for innovativeness is consistent with prior research on the positive relationship between cognitive diversity and innovation (e.g., Basadur and Head, 2001).

Together, the findings of this study contribute to the paradox and team innovation literature. Most quantitative studies on paradoxical tensions and paradox mindset have focused on the individual level of analysis (e.g., Ingram et al., 2014; Miron-Spektor et al., 2018; Miron-Spektor, Gino and Argote, 2011). To my knowledge, the present study represents the first attempt to investigate paradox mindset in the context of teams. Through its focus on diversity, this research also extends existing lines of inquiry into the heterogeneity of cognitive styles and its impact on innovation (e.g., Basadur and Head, 2001; Miron-Spektor, Erez and Naveh, 2011). Finally, this study links the meta-theory of paradox to the absorptive capacity literature by showing that Zahra and George's (2002) influential conceptualization includes mutually dependent yet

contradictory knowledge-processing stages which, if pursued in parallel, can create paradoxical tensions. This finding is an invitation to absorptive capacity researchers to consider whether, and how, the lens of paradox theory could enrich future investigations in the field.

3.7 Future Research and Limitations

This section highlights how future research may build upon the findings from this study, as well as provides suggestions for methodological improvements. First, I found no direct effect between the simultaneous engagement in exploratory and exploitative activities and innovativeness. Any definition of simultaneity is dependent on the choice of the time period over which it is measured. I used a time period of one week and measured simultaneity at five different times during a project and computed a grand average used in the testing of our various hypotheses. Consequently, this study defined and measured simultaneity as the *sustained* engagement in both exploratory and exploitative activities throughout the project. Future empirical studies could instead investigate the potential benefits of simultaneity over briefer and more specific periods of time. Alternatively, future research should seek to identify whether the balance and timing of exploration and exploitation activities over the life of a project have a greater impact on innovativeness than simultaneity. For example, when looking at the cooperation between departments in the context of NPD, Olson et al. (2001) have shown that the benefits from the functional integration of exploration- and exploitation-oriented functions – such as R&D and operations – depends on the appropriate timing of that integration.

Second, on the question of the double-edged nature of paradoxical tensions, this study found these tensions to have an asymmetric impact on innovativeness. Namely, paradoxical tensions had a proportionally greater negative impact on innovativeness for homogeneous teams than the corresponding positive effect they had for heterogeneous teams. More research should be conducted to determine whether this asymmetry holds for moderating variables other than paradox mindset diversity. Such empirical work would help

determine whether it is ever beneficial to promote greater levels of paradoxical tensions, and under which condition it may be desirable to do so.

Third, while this study has shown evidence of the positive moderating effect of paradox mindset diversity on innovativeness, I could only hypothesize about the generative mechanisms that may explain this effect. Observational research of innovation teams could contribute to the development of a more detailed rationale for why teams with a mix of low and high paradox mindset members seem to be able to mitigate the negative effect of paradoxical tensions. Similarly, such research could also help uncover the reasons why homogeneously high and homogeneously low paradox mindset teams appear unable to leverage paradoxical tensions. While the present study has shown that these two types of homogeneous teams performed lower on innovativeness than heterogeneous teams, it did not address the question of whether the causes for this underperformance are shared or different across these two groups.

Finally, I propose three methodological improvements for future studies. First, while there seem to be benefits to diversity defined as maximum separation (i.e., a 50/50 split between low and high paradox mindset members), studies involving larger innovation teams could shed some light on whether maximum paradox mindset diversity is always desirable, or whether it has decreasing returns beyond a certain threshold. While studies have generally produced evidence of the positive effects of cognitive diversity in teams on innovativeness (e.g., Miron-Spektor, Erez and Naveh, 2011) and creativity (e.g., Basadur and Head, 2001), others studies have found that cognitive diversity may also negatively impact team cohesion (e.g., Mello and Delise, 2015), team consensus (e.g., Aggarwal and Woolley, 2013), and team satisfaction (e.g., Kurtzberg, 2005). Second, while I have controlled for the degree of novelty required by a project, the variety of project types and client industries made a more rigorous classification of incremental vs. radical innovation projects difficult. Future research involving more comparable projects could make a clearer distinction regarding the desired level of innovation, and test the extent

to which this study's findings hold across incremental and radical innovation projects. Finally, the sample in our study consists of senior undergraduate students working on consulting assignments for paying external organizations. While there were many benefits to this empirical context in terms of providing a well-controlled environment that closely mimics professional business consulting situations, I acknowledge the necessity to replicate this study with professional innovation or NPD teams comprised of individuals with a greater diversity of experience and functional expertise.

3.8 Practical Implications

As more of the innovation-related work conducted in organizations is performed by teams, the question of the optimal composition of such teams remains of high practical relevance. This study suggests that, when forming innovation teams, attention should be paid to the tendencies of individuals to recognize, accept and value contradictions. In particular, organizations should strive to maximize diversity within teams, ideally through equal representation of low and high paradoxical mindset members. At the very least, some minimum diversity should be ensured since homogeneous teams operating in environments characterized by high levels of paradoxical tensions have been shown to be significantly less innovative. In the absence of diversity, perhaps because the team is already in place or because the pool of potential members is inherently homogeneous in terms of paradox mindsets, the findings suggest that paradoxical tensions should be minimized. To achieve this objective, one option is to reduce the amount of overlap between exploratory and exploitative activities a team engages in at any point in time. Careful project planning that avoids overlap between exploratory and exploitative activities could assist in that effort. Finally, while this study suggests that very high diversity teams could potentially benefit from increased levels of perceived tensions, it is premature to recommend that any concerted effort be made to artificially inflate the level of paradoxical tensions for those teams, given that this positive effect was quantitatively marginal and ultimately benefited very few teams.

3.9 References

- Adler, P.S. (1995) 'Interdepartmental interdependence and coordination: The case of the design/manufacturing interface.', *Organization Science*, 6(2), pp. 147–167.
- Aggarwal, I. and Woolley, A.W. (2013) 'Do you see what I see? The effect of members' cognitive styles on team processes and errors in task execution.', *Organizational Behavior and Human Decision Processes*, 122(1), pp. 92–99.
- Alvesson, M. (2004) *Knowledge work and knowledge-intensive firms*. Oxford: Oxford University Press.
- Amabile, T.M. (2000) 'Stimulate creativity by fueling passion.', in *Handbook of principles of organizational behavior*. E. Locke. Malden, MA: Blackwell, pp. 331–341.
- Amabile, T.M. (1988) 'A model of creativity and innovation in organizations.', *Research in Organizational Behavior*, 10(1), pp. 123–167.
- Amabile, T.M. (1983) *The social psychology of creativity*. New York: Springer-Verlag.
- Ancona, D.G. and Caldwell, D.F. (1992) 'Bridging the boundary: External activity and performance in organizational teams.', *Administrative Science Quarterly*, 37(4) Administrative Science Quarterly, pp. 634–665.
- Anderson, N., De Dreu, C.K.W. and Nijstad, B.A. (2004) The routinization of innovation research: A constructively critical review of the state-of-the-science. *Journal of Organizational Behavior*.
- Andrews, J. and Smith, C. (1996) 'In search of marketing imagination: Factors affecting the creativity of marketing programs.', *Journal of marketing research*, 33(2), pp. 174–187.
- Andriopoulos, C. and Lewis, M.W. (2009) 'Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation.', *Organization Science*, 20(4), pp. 696–717.

- Backmann, J., Hoegl, M. and Cordery, J.L. (2015) 'Soaking it up: Absorptive capacity in interorganizational new product development teams.', *Journal of Product Innovation Management*, 32(6) Blackwell Publishing Ltd, pp. 861–877.
- Basadur, M. and Head, M. (2001) 'Team performance and satisfaction: A link to cognitive style within a process framework.', *The Journal of Creative Behavior*, 35(4), pp. 227–248.
- Beersma, B. and De Dreu, C.K.W. (2005) 'Conflict's consequences: Effects of social motives on postnegotiation creative and convergent group functioning and performance.', *Journal of Personality and Social Psychology*, 89(3), pp. 358–374.
- Bell, S.T., Villado, a. J., Lukasik, M. a., Belau, L. and Briggs, a. L. (2011) 'Getting specific about demographic diversity variable and team performance relationships: A meta-analysis.', *Journal of Management*, 37(3), pp. 709–743.
- Birkinshaw, J. and Gibson, C. (2004) 'Building ambidexterity into an organization.', *MIT Sloan Management Review*, 45(4) Sloan Management Review, pp. 47–55.
- Birkinshaw, J. and Gupta, K. (2013) 'Clarifying the distinctive contribution of ambidexterity to the field of organization studies.', *Academy of Management Perspectives*, 27(4), pp. 287–298.
- Bledow, R., Frese, M., Anderson, N., Erez, M. and Farr, J. (2009) 'A dialectic perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity.', *Industrial & Organizational Psychology*, 2(3) Cambridge University Press, pp. 305–337.
- Burgelman, R.A. (2002) 'Strategy as vector and the inertia of coevolutionary lock-in.', *Administrative Science Quarterly*, 47(2), pp. 325–357.
- Calabretta, G., Gemser, G. and Wijnberg, N.M. (2017) 'The interplay between intuition and rationality in strategic decision making: A paradox perspective.', *Organization Studies*, 38(3–4), pp. 365–401.

Calantone, R.J., Chan, K. and Cui, A.S. (2006) 'Decomposing product innovativeness and its effects on new product success.', *Journal of Product Innovation Management*, 23(5), pp. 408–421.

Chan, D. (1996) 'Cognitive misfit of problem-solving style at work: A facet of person–organization fit.', *Organizational Behavior and Human Decision Processes*, 68(3), pp. 194–207.

Cohen, W.M. and Levinthal, D.A. (1990) 'Absorptive capacity: A new perspective on learning and innovation.', *Administrative Science Quarterly*, 35(1), pp. 128–152.

Constant, E. (2000) 'Recursive practice and the evolution of technological knowledge.', in Ziman, J. (ed.) *Technological innovation as an evolutionary process*. Cambridge, UK: Cambridge University Press, pp. 219–233.

De Dreu, C.K.W. and Weingart, L.R. (2003) 'Task versus relationship conflict, team performance, and team member satisfaction: a meta-analysis.', *The Journal of Applied Psychology*, 88(4), pp. 741–749.

Eisenhardt, K.M. and Westcott, B. (1988) 'Paradoxical demands and the creation of excellence: The case of just-in-time manufacturing.', in Quinn, R. E. and Cameron, K. S. (eds.) *Paradox and transformation: Toward a theory of change in organization and management organization and management*. Cambridge, MA: Ballinger, pp. 169–194.

Farr, J.L., Sin, H.-P. and Tesluk, P.E. (2003) 'Knowledge management processes and work group innovation.', in Shavinina, L. V. (ed.) *The international handbook on innovation*. Oxford, UK: Elsevier Science, pp. 574–586.

Festinger, L. (1962) *A theory of cognitive dissonance*. New York: Peterson & Co.

Fong, C.T. (2006) 'The effects of emotional ambivalence on creativity.', *Academy of Management Journal*, 49(5), pp. 1016–1030.

Gebert, D., Boerner, S. and Kearney, E. (2010) 'Fostering team innovation: Why is it important to combine opposing action strategies?', *Organization Science*, 21(3), pp. 593–608.

Gibson, C.B. and Birkinshaw, J. (2004) 'The antecedents, consequences, and mediating role of organizational ambidexterity.', *Academy of Management Journal*, 47(2) Academy of Management, pp. 209–226.

Gilson, L.L., Mathieu, J.E., Shalley, C.E. and Ruddy, T.M. (2005) 'Creativity and standardization: Complementary or conflicting drivers of team effectiveness?', *Academy of Management Journal*, 48(3), pp. 521–531.

Gupta, A.K., Smith, K.G. and Shalley, C.E. (2006) 'The interplay between exploration and exploitation.', *Academy of Management Journal*, 49(4), pp. 693–706.

Haas, M. (2010) 'The double-edged swords of autonomy and external knowledge: Analyzing team effectiveness in a multinational organization', *Academy of Management Journal*, 53(5), pp. 989–1008.

Harrison, D.A. and Klein, K.J. (2007) 'What's the difference? Diversity constructs as separation, variety, or disparity in organizations.', *Academy of Management Review*, 32(4), pp. 1199–1228.

Harrison, D.A., Price, K.H., Gavin, J.H. and Florey, A.T. (2002) 'Time, teams, and task performance: Changing effects of surface- and deep-level diversity on group functioning.', *Academy of Management Journal*, 45(5), pp. 1029–1045.

Havermans, L.A., Den Hartog, D.N., Keegan, A. and Uhl-Bien, M. (2015) 'Exploring the role of leadership in enabling contextual ambidexterity.', *Human Resource Management*, 54, pp. s179–s200.

Hayes, A.F. (2013) *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York: The Guilford Press.

He, Z.-L. and Wong, P.-K. (2004) 'Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis.', *Organization Science*, 15(4), pp. 481–494.

Im, S. and Workman, J.P. (2004) 'Market orientation, creativity, and new product performance in high-technology firms.', *Journal of Marketing*, 68(2), pp. 114–132.

Ingram, A.E., Lewis, M.W., Barton, S. and Gartner, W.B. (2014) 'Paradoxes and innovation in family firms: The role of paradoxical thinking.', *Entrepreneurship: Theory and Practice*, 40(1), pp. 161–176.

Jansen, J.J.P., Van Den Bosch, F.A.J. and Volberda, H.W. (2006) 'Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators.', *Management Science*, 52(11), pp. 1661–1674.

Jansen, J.J.P., Van Den Bosch, F.A.J. and Volberda, H.W. (2005) 'Managing potential and realized absorptive capacity: How do organizational antecedents matter?', *Academy of Management Journal*, 48(6), pp. 999–1015.

Jansen, J.J.P., Kostopoulos, K.C., Mihalache, O.R. and Papalexandris, A. (2016) 'A socio-psychological perspective on team ambidexterity: The contingency role of supportive leadership behaviours.', *Journal of Management Studies*, 53(6), pp. 939–965.

Jay, J. (2013) 'Navigating paradox as a mechanism of change and innovation in hybrid organizations.', *Academy of Management Journal*, 56(1), pp. 137–159.

Jehn, K. (1995) 'A multimethod examination of the benefits and detriments of intragroup conflict.', *Administrative Science Quarterly*, 40(2), pp. 256–282.

Johnson, P.O. and Neyman, J. (1936) 'Tests of certain linear hypotheses and their application to some educational problems.', *Statistical Research Memoirs*, 1, pp. 57–93.

King, N. (1990) 'Innovation at work: The research literature.', in West, M. A. and Farr, J. L. (eds.) *Innovation and creativity at work: Psychological and organizational strategies*. Oxford, UK: John Wiley & Sons, pp. 15–59.

- Kirton, M.J. (1976) 'Adaptors and innovators: A description and a measure.', *Journal of Applied Psychology*, (61), pp. 622–629.
- Kruglanski, A.W., Webster, D.M. and Klem, A. (1993) 'Motivated resistance and openness to persuasion in the presence or absence of prior information.', *Journal of personality and social psychology*, 65(5), pp. 861–876.
- Kurtzberg, T.R. (2005) 'Feeling creative, being creative: An empirical study of diversity and creativity in teams.', *Creativity Research Journal*, 17(1), pp. 51–65.
- Levinthal, D.A. and March, J.G. (1993) 'The myopia of learning.', *Strategic Management Journal*, 14, pp. 95–112.
- Levitt, B. and March, J.G. (1988) 'Organizational learning.', *Annual Review of Sociology*, 14(1988), pp. 319–340.
- Lewis, M.W. (2000) 'Exploring paradox : Toward a more comprehensive guide.', *The Academy of Management Review*, 25(4), pp. 760–776.
- Lewis, M.W., Ann Welsh, M., Dehler, G.E. and Green, S.G. (2002) 'Product development tensions: Exploring contrasting styles of project management.', *Academy of Management Journal*, 45(3), pp. 546–564.
- Liu, L. and Leitner, D. (2012) 'Simultaneous pursuit of innovation and efficiency in complex engineering projects-A study of the antecedents and impacts of ambidexterity in project teams.', *Project Management Journal*, 43(6) John Wiley & Sons, Inc., pp. 97–110.
- Lovelace, K., Shapiro, D.L. and Weingart, L.R. (2001) 'Maximizing cross-functional new product teams' innovativeness and constraint adherence: A conflict communications perspective.', *Academy of Management Journal*, 44(4), pp. 779–793.
- Lowik, S., Kraaijenbrink, J. and Groen, A. (2016) 'The team absorptive capacity triad: A configurational study of individual, enabling, and motivating factors.', *Journal of Knowledge Management*, 20(5), pp. 1083–1103.

- Luscher, L.S., Lewis, M. and Ingram, A. (2006) 'The social construction of organizational change paradoxes.', *Journal of Organizational Change Management*, 19(4), pp. 491–502.
- March, J.G. (1991) 'Exploration and exploitation in organizational learning.', *Organization Science*, 2(1), pp. 71–87.
- Martin, R. (2007) *The opposable mind: How successful leaders win through integrative thinking*. Boston, MA: Harvard Business School Publishing.
- McCarthy, I.P., Tsinopoulos, C., Allen, P. and Rose-Anderssen, C. (2006) 'New product development as a complex adaptive system of decisions.', *Journal of Product Innovation Management*, 23(5), pp. 437–456.
- Mello, A.L. and Delise, L.A. (2015) 'Cognitive diversity to team outcomes: The roles of cohesion and conflict management.', *Small Group Research*, 46(2), pp. 204–226.
- Miron-Spektor, E., Erez, M. and Naveh, E. (2011) 'The effect of conformist and attentive-to-detail members on team innovation: Reconciling the innovation paradox.', *Academy of Management Journal*, 54(4), pp. 740–760.
- Miron-Spektor, E., Gino, F. and Argote, L. (2011) 'Paradoxical frames and creative sparks: Enhancing individual creativity through conflict and integration.', *Organizational Behavior and Human Decision Processes*, 116(2), pp. 229–240.
- Miron-Spektor, E., Ingram, A., Keller, J., Smith, W.K. and Lewis, M.W. (2018) 'Microfoundations of organizational paradox: The problem is how we think about the problem.', *Academy of Management Journal*, 61(1), pp. 26–45.
- Miron, E., Erez, M. and Naveh, E. (2004) Do personal characteristics and cultural values that promote innovation, quality, and efficiency compete or complement each other? *Journal of Organizational Behavior*.
- Nemeth, C.J., Personnaz, B., Personnaz, M. and Goncalo, J.A. (2004) 'The liberating role of conflict in group creativity: A study in two countries.', *European Journal of Social Psychology*, 34(4), pp. 365–374.

- Nunnally, J.C. (1978) *Psychometric theory*. 2nd edn. New York: McGraw-Hill.
- O'Reilly, C.A. and Tushman, M.L. (2004) 'The ambidextrous organization.', *Harvard Business Review*, 82(4), pp. 74–81.
- Ojo, A.O., Raman, M., Chong, S.C. and Chong, C.W. (2014) 'Individual antecedents of ACAP and implications of social context in joint engineering project teams: A conceptual model.', *Journal of Knowledge Management*, 18(1), pp. 177–193.
- Olson, E.M., Walker, O.C., Ruekert, R.W. and Bonner, J.M. (2001) 'Patterns of cooperation during new product development among marketing, operations and R&D: Implications for project performance.', *Journal of Product Innovation Management*, 18(4), pp. 258–271.
- Osono, E., Shimizu, N., Takeuchi, H. and Dorton, J. (2008) *Extreme Toyota: Radical contradictions that drive success at the world's best manufacturer*. Hoboken, NJ: Wiley.
- Papachroni, A., Heracleous, L. and Paroutis, S. (2016) 'In pursuit of ambidexterity: Managerial reactions to innovation–efficiency tensions.', *Human Relations*, 69(9), pp. 1791–1822.
- Pelled, L.H., Eisenhardt, K.M. and Xin, K.R. (1999) 'Exploring the black box: An analysis of work group diversity, conflict, and performance.', *Administrative Science Quarterly*, 44(1), pp. 1–28.
- Poole, M.S. and Van de Ven, A.H. (1989) 'Using paradox to build management and organization theories.', *Academy of Management Review*, 14(4), pp. 562–578.
- Post, C. (2012) 'Deep-level team composition and innovation: The mediating roles of psychological safety and cooperative learning.', *Group & Organization Management*, 37(5), pp. 555–588.

Puccio, G.J., Treffinger, D.J. and Talbot, R.J. (1995) 'Exploratory examination of relationships between creativity styles and creative products.', *Creativity Research Journal*, 8(2), p. 157.

Rosenthal, S.R. (1992) *Effective product design and development*. Homewood, IL: Irwin.

Rosing, K., Frese, M. and Bausch, A. (2011) 'Explaining the heterogeneity of the leadership-innovation relationship: Ambidextrous leadership.', *Leadership Quarterly*, 22(5), pp. 956–974.

Rothenberg, A. (1979) *The emerging goddess*. Chicago: University of Chicago Press.

Schroeder, R.G., Van de Ven, A.H., Scudder, G.D. and Polley, D. (1989) 'The development of innovation ideas.', in Van de Ven, A. H., Angle, H. L. and Poole, M. (eds.) *Research on the management of innovation: The Minnesota studies*. New York: Harper & Row, pp. 107–133.

Scott, S.G. and Bruce, R.A. (1994) 'Determinants of innovation behavior: A path model of individual innovation in the workplace.', *Academy of Management Journal*, 37(3), pp. 580–607.

Seidel, V.P. (2007) 'Concept shifting and the radical product development process.', *Journal of Product Innovation Management*, 24(6), pp. 522–533.

Sethi, R., Smith, D.C., Park, C.W. and Park, W. (2001) 'Cross-functional product development teams, creativity, and the innovativeness of new consumer products.', *Journal of Marketing Research*, 38(1), pp. 73–85.

Shalley, C.E., Zhou, J. and Oldham, G.R. (2004) The effects of personal and contextual characteristics on creativity: Where should we go from here? *Journal of Management*.

Sheremata, W.A. (2000) 'Centrifugal and centripetal forces in radical new product development under time pressure.', *Academy of Management Review*, 25(2) Academy of Management, pp. 389–408.

- Shin, S.J., Kim, T.Y., Lee, J.Y. and Bian, L. (2012) 'Cognitive team diversity and individual team member creativity: A cross-level interaction.', *Academy of Management Journal*, 55(1), pp. 197–212.
- Smith, K.K. and Berg, D.N. (1987) *Paradoxes of group life: understanding conflict, paralysis, and movement in group dynamics*. San Francisco: Jossey-Bass.
- Smith, W.K. (2014) 'Dynamic decision making: A model of senior leaders managing strategic paradoxes.', *Academy of Management Journal*, 57(6), pp. 1592–1623.
- Smith, W.K. and Lewis, M.W. (2011) 'Toward a theory of paradox: A dynamic equilibrium model of organizing.', *Academy of Management Review*, 36(2), pp. 381–403.
- Smith, W.K. and Tushman, M.L. (2005) 'Managing strategic contradictions: A top management model for managing innovation streams.', *Organization Science*, 16(5), pp. 522–536.
- Stock, R.M., Oliveira, P. and Von Hippel, E. (2015) 'Impacts of hedonic and utilitarian user motives on the innovativeness of user-developed solutions.', *Journal of Product Innovation Management*, 32(3), pp. 389–403.
- Sundaramurthy, C. and Lewis, M. (2003) 'Control and collaboration: Paradoxes of governance.', *Academy of Management Review*, 28(3), pp. 397–415.
- Swart, J., Turner, N., van Rossenberg, Y. and Kinnie, N. (2016) 'Who does what in enabling ambidexterity? Individual actions and HRM practices.', *The International Journal of Human Resource Management*, Advance on(0), pp. 1–28.
- Taggar, S. (2002) 'Individual creativity and group ability to utilize individual creative resources: A multilevel model.', *Academy of Management Journal*, 45(2), pp. 315–330.

Teachman, J.D. (1980) 'Analysis of population diversity: Measures of qualitative variation.', *Sociological Methods & Research*, 8(3), pp. 341–362.

Tiwana, A. and Mclean, E.R. (2005) 'Expertise integration and creativity in information systems development.', *Journal of Management Information Systems*, 22(1), pp. 13–43.

Turner, N., Swart, J., Maylor, H. and Antonacopoulou, E. (2016) 'Making it happen: How managerial actions enable project-based ambidexterity.', *Management Learning*, 47(2), p. 1350507615610028-.

Tushman, M.L. and O'Reilly, C.A. (1996) 'Ambidextrous organizations: Managing evolutionary and revolutionary change.', *California Management Review*, 38(4), pp. 8–30.

Tushman, M.L. and Romanelli, E. (1985) 'Organizational evolution: A metamorphosis model of convergence and reorientation.', *Research in organizational behavior*, 7, pp. 171–222.

Van der Vegt, G.S. and Janssen, O. (2003) 'Joint impact of interdependence and group diversity on innovation.', *Journal of Management*, 29(5), pp. 729–751.

Vince, R. and Broussine, M. (1996) 'Paradox, defense and attachment: Accessing and working with emotions and relations underlying organizational change.', *Organization Studies*, 17(1), pp. 1–21.

De Visser, M., Faems, D., Visscher, K. and De Weerd-Nederhof, P. (2014) 'The impact of team cognitive styles on performance of radical and incremental NPD projects.', *Journal of Product Innovation Management*, 31(6), pp. 1167–1180.

Volberda, H.W., Foss, N.J. and Lyles, M. a. (2010) 'Absorbing the concept of absorptive capacity: How to realize its potential in the organization field.', *Organization Science*, 21(4), pp. 931–951.

Ward, T., Finke, R. and Smith, S. (1995) *Creativity and the mind: Discovering the genius within*. New York: Plenum Press.

- Webster, D.M. and Kruglanski, A.W. (1998) 'Cognitive and social consequences of the need for cognitive closure.', in Stroebe, W. and Hewstone, M. (eds.) *European Review of Social Psychology*. New York: Wiley, pp. 133–173.
- Webster, D.M. and Kruglanski, A.W. (1994) 'Individual differences in need for cognitive closure.', *Journal of Personality and Social Psychology*, 67(6), pp. 1049–1062.
- West, M.A. (2002) 'Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups.', *Applied Psychology*, 51(3), pp. 355–387.
- West, M.A. (1990) 'The social psychology of innovation in groups.', in West, M. A. and Farr, J. L. (eds.) *Innovation and creativity at work: Psychological and organizational strategies*. Chichester, UK: John Wiley & Sons, pp. 309–333.
- West, M.A. and Anderson, N.R. (1996) 'Innovation in top management teams.', *Journal of Applied Psychology*, 81(6), pp. 680–693.
- Wheelwright, S.C. and Clark, K.B. (1992) *Revolutionizing product development*. New York: Free Press.
- Witkin, H. a., Moore, C. a., Goodenough, D. and Cox, P.W. (1977) 'Field-dependent and field-independent cognitive styles and their educational implications.', *Review of Educational Research*, 47(1), pp. 1–64.
- Wright, D. (1982) 'The significance of paradoxical language in Hua-yen Buddhism.', *Philosophy East and West*, 32(3), pp. 325–338.
- Zahra, S.A. and George, G. (2002) 'Absorptive capacity: A review, reconceptualization, and extension.', *Academy of Management Review*, 27(2), pp. 185–203.
- Zaltman, G., Duncan, R. and Holbek, J. (1973) *Innovations and organizations*. New York: John Wiley & Sons, Inc.

3.10 Appendices

Appendix 3-1: Measure of Exploration-Exploitation Activities

	<i>During the past 7 days, what percentage of your time have you personally spent on the following groups of activities ?</i>
_____ % ⁽¹⁾	Search for new knowledge across many different areas. Identify what new knowledge is most valuable to my team. Acquire new knowledge that might help me in my work.
_____ % ⁽²⁾	Analyze the newly acquired knowledge. Share my new knowledge within the team. Explain the new knowledge to my teammates.
_____ % ⁽³⁾	Develop new ideas together with my teammates. Extract insights from the new knowledge we have acquired. Transform existing knowledge into new ideas.
_____ % ⁽⁴⁾	Apply the newly acquired knowledge to my work. Exploit the new knowledge to develop recommendations. Use the new knowledge to improve my work.

Note: ⁽¹⁾ and ⁽²⁾ correspond to the *acquisition* and *assimilation* stages of absorptive capacity, respectively.

⁽¹⁾ and ⁽²⁾ were added together to give a measure of the proportion of time spent on *exploration*-related activities.

⁽³⁾ and ⁽⁴⁾ correspond to the *transformation* and *exploitation* stages of absorptive capacity, respectively.

⁽³⁾ and ⁽⁴⁾ were added together to give a measure of the proportion of time spent on *exploitation*-related activities.

4 THE ROLE OF PARADOX RESOLUTION STRATEGIES IN EMBEDDING TENSIONS: AN EXPLORATORY STUDY IN THE CONTEXT OF NEW PRODUCT DEVELOPMENT

4.1 Abstract

Paradoxical tensions are contradictory yet interrelated elements (dualities) embedded in organizing processes. While paradox theory advocates for the alternating use of “accommodation” and “choice” strategies in response to tensions, little is known regarding how these resolution strategies, in turn, act as organizing processes to influence how deeply tensions become embedded in a given organizational context. This question has significant managerial relevance, however, as paradoxical tensions can either foster creativity and synergy or, conversely, trigger anxiety and inertia. Using 16 semi-structured interviews with senior innovation leaders, I explore this question by comparing and contrasting different resolution strategies used in the context of new product development projects. The findings suggest that resolution strategies differ primarily in the way that they attend to each pole of a duality over the project’s life. I conceptualize these differences through the lens of paradox theory and develop a model to explain how specific features of resolution strategies lead to more or less deeply embedded tensions.

4.2 Introduction

Paradoxes are a fact of organizational life (Cameron and Quinn, 1988; Clegg, Vieira Da Cunha and Pina E Cunha, 2002; Seo, Putnam and Bartunek, 2004). While they may trigger defensive reactions and decision paralysis leading to organizational inertia, they can also provide opportunities for organizations to transcend contradictions (Lewis, 2000). At the heart of paradox management is the idea that the simultaneous pursuit of conflicting objectives generates tensions that can be leveraged for both short-term excellence and long-term success (Smith and Lewis, 2011). To manage paradoxes effectively, scholars point to the importance of three elements: paradoxical thinking, namely the ability to recognize and embrace contradictions (Lewis, 2000; Smith and

Tushman, 2005); the implementation of “choice” and “accommodation” strategies (sometimes also referred to as “differentiating” and “integrating” strategies, respectively) to capture both individual and synergistic contributions of opposing poles (Andriopoulos and Lewis, 2009; Smith, 2014); finally, the pattern of decisions to ensure a balanced treatment of opposites over time (Smith, 2014; Smith and Lewis, 2011).

In their dynamic equilibrium model, Smith and Lewis (2011) link these elements in a circular manner wherein resolution strategies are implemented in response to paradoxical tensions while also playing a role in embedding these tensions within the organization. However, the authors provide limited theorization of how resolution strategies cause tensions to become embedded in a given organizational context. The present study, therefore, aims to refine our understanding of this “closing link” of the dynamic equilibrium model by investigating the specific organizational context of new product development projects. The study thus addresses the following research question:

*“How do paradox resolution strategies embed tensions
in the context of new product development projects?”*

Paradox research provides a meta-theoretical lens with which to investigate the management of organizational tensions (Lewis and Smith, 2014). As a meta-theory, its value lies in defining general principles that inform studies across a wide range of phenomena (Pierce and Aguinis, 2013), as well as in providing a tool for theorizing across multiple research streams (Ritzer, 2001). These research streams may, in turn, contribute to the development of the overarching paradigm through the addition, for example, of new variables and relationships (Qiu, Donaldson and Luo, 2012). Accordingly, while this study aims to contribute to the meta-theory of paradox, it also draws specific insights from the ambidexterity literature, a research stream closely related to the meta-theory of paradox (Birkinshaw and Gupta, 2013) and highly relevant to innovation projects (Turner et al., 2016).

The overall methodological approach for this study is illustrated in **Appendix 4-1** and is reflected in the structure of the paper which consists of the following

parts. First, I set the theoretical background by reviewing Smith and Lewis's (2011) dynamic equilibrium model for managing paradoxes and by summarizing the main resolution strategies discussed in the ambidexterity literature. Second, I present the findings from my exploratory research and describe the resolution strategies used to deal with key new product development (NPD) dualities. Third, I use the lens of paradox theory and ambidexterity theory to define a set of generic constructs that characterize these resolution strategies. Lastly, I propose a preliminary conceptual model that uses these new constructs to explain how certain features of resolution strategies lead to more or less deeply embedded tensions.

4.3 Literature Review

Smith and Lewis (2011) define paradox as “contradictory yet interrelated elements that exist simultaneously and persist over time.” (p.382). Paradoxes are inherent in the act of organizing (Clegg, Vieira Da Cunha and Pina E Cunha, 2002; Seo, Putnam and Bartunek, 2004), and their underlying tensions can be leveraged for greater learning and creativity (Eisenhardt and Westcott, 1988; Rothenberg, 1979), flexibility and resilience (Farjoun, 2002; Weick, Sutcliffe and Obstfeld, 1999; Weick and Quinn, 1999), and higher performance at the team (Losada and Heaphy, 2004) and organizational (Cameron and Lavine, 2006) levels. Consequently, the manner in which leaders respond to tensions is an important contributing factor to their organization’s chances of survival (Quinn, 1988). To explain the mechanisms by which organizations can tap into the power of paradoxes, Smith and Lewis (2011) propose a dynamic equilibrium model in which long-term success rests on the ability to recognize, embrace, and manage contradictions over time. Their model constitutes the key theoretical framework to which this study aims to contribute. The full model, as well as the specific area of focus for this study, are illustrated in **Appendix 4-2**.

While Smith and Lewis’s model is cyclical, a sensible starting point is the presence of latent tensions that are embedded in the process of organizing. These tensions, the authors explain, become salient to actors through environmental factors such as the plurality of stakeholders, changes in the

environment, and the scarcity of resources, as well as individual factors such as the cognitive ability to recognize and juxtapose contradictory demands. Once actors experience tensions, they can either resist or embrace them. Individuals with cognitive complexity, behavioral complexity, and emotional equanimity will be more inclined to accept tensions. Once the critical first step of acceptance is achieved, tensions can be managed through the implementation of resolution strategies that seek to engage with tensions (rather than eliminate them) and to explore their dynamic relationship. Resolution strategies fall into two main categories: “choice” strategies which favor a specific pole of the duality, and “accommodation” strategies which address both poles of a duality simultaneously to identify linkages and unlock potential synergies. Smith and Lewis suggest that dynamic equilibrium is achieved through purposeful iterations between these strategies to ensure that opposing poles receive adequate attention over time. They argue that decision patterns will appear “consistently inconsistent” as leaders dynamically shift between these strategies. Finally, the authors briefly note that these strategies will also influence the extent to which paradoxical tensions will be embedded within the strategy, structure, rules, processes, and identities present in the organization; however, little is offered regarding the causal mechanisms at play. It is this “closing link” of the dynamic equilibrium model that the present study seeks to explicate through its investigation of NPD-related tensions and their management.

To aid in this effort, it is helpful to turn to ambidexterity theory, a well-researched stream that is both closely related to paradox theory (Papachroni, Heracleous and Paroutis, 2015) and highly relevant to the innovation context of NPD (Atuahene-Gima and Murray, 2007). The ambidexterity field provides a rich literature that describes specific resolution strategies that can be used to address not only paradoxes of *learning* but also paradoxes of *organizing* (e.g., Graetz and Smith, 2005), *belonging* (e.g., Wang, Huang and Tan, 2013), and *performing* (e.g., Minoja, 2012). Thus, second to the meta-theory of paradox itself, ambidexterity is one of the more general theories that inform the management of conflicting objectives. Importantly, the ambidexterity

approaches discussed in the literature provide insightful illustrations of the meta-theoretical “choice” and “accommodation” strategies of paradox theory. I will now summarize the three prevailing resolution strategies discussed in ambidexterity research.

While definitional issues remain (O'Reilly and Tushman, 2013), ambidexterity, at the broadest level, relates to the organization's ability to address internal tensions and meet conflicting demands that arise in their task environment (Raisch and Birkinshaw, 2008). March's (1991) seminal paper on organizational learning played a critical role in associating ambidexterity more specifically with the simultaneous pursuit of exploration and exploitation. March highlights both the contradictory nature of exploration and exploitation, as well as their interdependence, thus shifting the focus of organizational research from a trade-off mindset to one of paradoxical thinking (Eisenhardt, 2000; Gavetti and Levinthal, 2000; Lewis, 2000). A number of resolution strategies have been suggested to reconcile the conflicting needs of exploration and exploitation. Following are brief descriptions of the approaches that have received the most attention in the literature.

Ambidexterity through temporal differentiation. Early studies of organizational adaptation focused on how firms can adjust to changing environments by realigning their internal structure (e.g., Chandler, 1977). This view was formalized in the theory of punctuated equilibrium which suggests that organizations respond to environmental shifts through a sequence of successive changes to internal structure and processes (Tushman and Romanelli, 1985). This sequential process has been observed in subsequent research on the history of firms' evolution (e.g., Kauppila, 2010; Lovas and Ghoshal, 2000; Rosenbloom, 2000; Tripsas, 1997). More recently, other approaches based on alternating periods of exploration and exploitation have been suggested, for example, through the use of “semisttructures” and “rhythmic switching” (Brown and Eisenhardt, 1997) or through the process of “organizational vacillation” (Boumgarden, Nickerson and Zenger, 2012). In

paradox theory terms, temporal differentiation equates to an alternation of “choice” strategies, with a relatively limited emphasis on “accommodation.”

Ambidexterity through structural differentiation. Starting with Duncan's (1976)'s work – the first to use the term “ambidexterity” – the majority of extant research focuses on the spatial separation of exploratory and exploitative activities through the creation of distinct units. This type of separation fosters the development of the specific competencies needed to address the conflicting demands of exploration and exploitation (Gilbert, 2005), allowing for the creation of tailored organizational structures in terms of size, autonomy, processes, incentives, and cultures (Benner and Tushman, 2003; O'Reilly and Tushman, 2008; Tushman and O'Reilly, 1996). Scholars differ on the extent to which coupling should exist between units, ranging from little or no coupling, especially when the aim is disruptive innovation (Christensen, 1998), to a mix of loose and tight coupling within and between subunits (Bradach, 1997; O'Reilly and Tushman, 2004). Whatever the degree of separation, the responsibility for integrating exploration and exploitation falls primarily on senior leaders who understand the dual needs of differentiated units. In paradox theory terms, structural differentiation combines long-term “choice” strategies (supported by organizational design decisions) and targeted “accommodation” strategies (enacted by the senior leadership).

Ambidexterity through behavioral integration. While the first two approaches described above rely on a separation of exploration and exploitation through time or space, Birkinshaw and Gibson (2004) suggest that ambidexterity can also be achieved by *simultaneously* addressing conflicting goals within the *same* business unit. These authors refer to this approach as “contextual ambidexterity” as it emphasizes the importance of designing the proper organizational context, namely the systems, processes, and beliefs that shape the behavior of individuals (Ghoshal and Bartlett, 1994). Specifically, Gibson and Birkinshaw argue that contexts that provide an adequate mix of support, trust, discipline, and stretch, will enable and encourage individuals to decide for themselves how to best divide their time between exploration and exploitation.

In contrast to temporal and structural differentiation approaches, contextual ambidexterity relies on the ability of individuals, rather than organizational units, to enact the desired balance between exploration and exploitation. In paradox theory terms, behavioral integration is primarily an “accommodation” strategy as it emphasizes the reconciliation (rather than the separation) of conflicting objectives within a given context.

As alluded to earlier, Smith and Lewis’s (2011) dynamic equilibrium model implies the existence of a feedback mechanism by which paradox resolution strategies are implemented in response to tensions while also playing a role in embedding these tensions in a given organizational context. Our current inability to adequately describe paradox resolution strategies as a set of interdependent and measurable constructs prevents the development of conceptual models to explain this feedback mechanism. This study, therefore, seeks to address this gap by identifying and characterizing the different resolution strategies used in the process of developing new products in order to better understand the role played by these strategies in embedding tensions in the task environment of time-bound projects.

4.4 Methods

This study aims to clarify a specific link in Smith and Lewis’s (2011) dynamic equilibrium model through an in-depth examination of paradox resolution strategies in the specific context of new product development projects. As such, this study is deeply anchored not only in paradox theory but also in ambidexterity theory which, as discussed previously, provides well-researched illustrations of how “choice” and “accommodation” strategies are used in the management of the exploration-exploitation duality, a key duality in new product development (Rothaermel and Deeds, 2004). Given these strong theoretical underpinnings, the empirical work was designed to provide targeted information about a relatively narrow topic of interest, and, therefore, gives primary importance to depth over scope.

The research is based on 16 interviews with senior-level innovation leaders with extensive experience in the area of new product development. The main

objectives of these interviews, and their subsequent analysis, was (1) to identify the types of paradoxical tensions that emerge during NPD projects, (2) to detail the strategies used to manage these tensions, and (3) to understand how these strategies play a role in embedding tensions in the task environment of an NPD project.

4.4.1 Research Context and Participants Selection

This study investigates the management of paradoxical tensions at the project level, with a specific focus on initiatives¹ related to the development of new products since it has been shown to be a context fraught with tensions (Dougherty, 1996). The NPD context also provides two additional benefits for the investigation of tension management. First, NPD processes tend to be highly structured, often using some form of Stage-Gate[®] process (Cooper, 1990), thus allowing informants to point with some accuracy to the stages at which tensions arise and when associated management practices are used. Second, because NPD projects are finite in time, resolution strategies must “do their work” in the project’s lifetime, which facilitates their identification and full description. The informant sample is comprised of innovation leaders and project managers from the R&D and marketing departments primarily. These two functional areas were chosen because they are central to the successful development of new products (Gupta, Raj and Wilemon, 1985; Maidique and Hayes, 1984) and often pursue conflicting objectives (Griffin and Hauser, 1996; Gupta, Raj and Wilemon, 1985, 1986). Consequently, discussing NPD initiatives from these two functional perspectives was likely to provide valuable insights into the management of paradoxical tensions. For greater transferability of the findings, I engaged with informants who are active in a variety of industries such as high-technology, fast-moving consumer goods (FMCG), pharma, hospitality services, and education. Finally, I interviewed mostly senior innovation leaders as they could draw from a richer set of project experiences

¹ In the context of this paper, the terms « initiative » and « project » are used interchangeably, which also reflects the informants’ use of these terms.

as contributors, managers, and leaders of NPD initiatives. Due to their hierarchical position and broader responsibilities within the organization, I could also expect these informants to discuss the management of NPD-related tensions from both an execution and strategy perspective

Beyond my own personal network in engineering and brand management, I turned to colleagues with ties to other industries (e.g., hospitality, information technology, consulting, food and beverage) to identify prospective informants that matched the desired profile. This process allowed for the identification of twenty qualified informants currently active in six different sectors of activities. I proceeded to contact each prospect via email to request an interview and included in my message a copy of with my curriculum vitae and a short flyer (see **Appendix 4-3**) describing the research project and the nature of my engagement with them. Out of the twenty informants contacted in this way, sixteen accepted my request for an interview and four declined. Of the latter group, three out of the four prospects worked in industries already covered by other informants, thus limiting the impact on the heterogeneity of the sectors represented. The final sample of informants is detailed in **Table 4-1**.

4.4.2 Data Collection

I conducted 16 interviews (nine face-to-face interviews and seven phone interviews) with lasted between 40 and 90 minutes. I started each interview by collecting some personal information about the informant regarding their current responsibilities within the organization as well as their professional experience, especially, as it related to new product development. I then sought to understand more about the general organizational context surrounding NPD initiatives, such as industry dynamics, the structure, and culture of the organization, as well as the types of products being developed. I asked informants to describe in detail the product development process used in their organization in order to understand the sequence of stages and the terminology used to describe them. I proceeded to ask informants about the “contradictory demands” and “conflicting objectives” that arise in the process of developing new products. As expected, all informants could recount having experienced

such tensions in a number of projects. To increase the trustworthiness of the data (Eisenhardt and Graebner, 2007), I probed further by asking them to provide concrete illustrations of situations in which they experienced a specific tension. I also asked informants to specify the precise stage in the NPD process during which a particular tension was felt most acutely. Finally, I inquired about the concrete strategies used to deal with the tensions they had mentioned, and inquired further about the effectiveness (or lack thereof) of these strategies. All interviews were recorded with the permission of the informants to facilitate the accurate transcription of statements and recollections. The interview guide used for this research is shown **Appendix 4-3** and was reviewed for clarity and flow by two professionals who were not part of the sample but were familiar with new product development activities, as well as by four faculty members conducting research in fields other than paradox theory to avoid bias from pre-existing knowledge.

Table 4-1: Sample of Informants

	Position	Companies¹	Years of Experience	NPD Project Experience²
1	Program Manager	Education (1)	11	10-20
2	Brand Manager	FMCG (1)	9	20-30
3	Retail Innovation Manager	FMCG (2)	15	30-40
4	Global Business Stream Leader	FMCG (3)	25	>50
5	Director Reduced Risk Product Planning and Governance	FMCG (4)	26	30-40
6	European Strategy Portfolio Leader	FMCG (5)	15	30-40
7	Innovation Brand Manager	FMCG (6)	10	10-20
8	Vice-President Guest Technology & Innovation	Hospitality (1)	16	20-30
9	Managing Director of Hospitality Technology Network	Hospitality (2)	40	>50
10	Managing Director of Innovation	Hospitality (3)	18	20-30
11	Chief Commercial Officer	Hospitality (4)	18	10-20
12	Senior Vice-President Global R&D	Pharma (1)	32	>50
13	Lead Software Developer	Technology (1)	17	30-40
14	Innovation Unit Managing Director	Technology (2)	29	>50
15	Senior Business Development Manager	Technology (3)	13	20-30
16	IT Director	Transportation (1)	18	30-40

¹All informants worked in different companies, except informants 4 and 6 who worked in different business units of the same company. FMCG is the abbreviation for the “Fast-Moving Consumer Goods” industry.

²Indicates the approximate number of NPD projects the informant had been directly involved in (either as a contributor, manager, or supervisor) over his/her career at the time of the interview.

4.4.3 Data Analysis

I used the NVivo software which enabled me to code, search, theorize, and recode as new themes and patterns emerged. My analysis used the process of abductive reasoning (Mantere and Ketokivi, 2013) whereby the empirical data leads to initial hunches and insights which, through the coding and categorization process, gradually progresses to more abstract interpretations (Gioia, Corley and Hamilton, 2013; Locke, Golden-Biddle and Feldman, 2008). This analytic and reflective process relied on the continuous interplay between the empirical data and the theories of ambidexterity and paradox to arrive at new theoretical insights. I then discussed these insights in follow-up phone discussions with my research informants to gauge how well they matched with actual experience. I will now describe this multi-stage analysis process in the paragraphs that follow.

Stage 1: Coding and identification of key NPD dualities. I conducted a first coding round during which I labeled all references related to the experience of paradoxical tensions. For these passages, I used different codes to identify the specific type of duality being referred to. For example, I tagged the following comments with the “novelty-vs-feasibility” and “local relevance-vs-global scalability” codes, respectively:

“I feel that the [creativity part] is the most interesting one. That’s when we can really generate interest and enrich something. Often, it doesn’t go any further because we realize that it doesn’t make sense or it’s not feasible.”

“It was an initiative that could appeal to several countries. The problem is that when your communication is too broad because you want to appeal to everybody, you realize that that communication is not sharp enough for your local consumers.”

Not all comments reflected the existence of a duality and captured both ends of it in such neat fashion, however. More often than not, while discussing the main tensions that arise in the process of developing new products, informants made comments that pertained to only a single pole of a duality. In these cases, I labeled the statements with codes that identified the specific pole of the duality

being addressed. For example, in a broader discussion of issues related to “centralization-vs.-coordination,” an informant made the following comment which was tagged with the “coordination” code:

“We have a geographical spread amongst our people [...]. That requires strong project coordination and project directors who are very skilled at this multi-site, multi-language, multicultural relationships.”

I then grouped these “single-pole” codes (e.g., “coordination”) under the higher level code associated with the duality they related to (e.g., “decentralization-vs.-coordination”).

Finally, given the relatively small sample of informants, it was important that this study focus on dualities that were considered relevant by most informants. The identification of key dualities was based on two factors: the number of informants that referred to that specific duality (as a proxy for general relevance) and the number of statements across all informants that referred to that duality (as a proxy for overall importance). I used the code occurrence counts provided by the NVivo software to identify those key dualities.

Stage 2: Identification of micro-practices, practices, and clustered practices. Having identified the NPD dualities that were foremost in the minds of informants, I conducted a second round of coding to identify the practices used to address these dualities. Following Gioia, Corley and Hamilton (2013), the result of this identification process was a three-level structure in which descriptive codes are aggregated into broader interpretive codes.

At the lowest level were the micro-practices mentioned by informants during the interviews. A micro-practice was deemed relevant if it helped address one or both poles of a key NPD duality identified in stage 1. When this was the case, I labeled that micro-practice using a descriptive code and associated it with the specific pole(s) of the duality it helped address. For example, I coded the following comment as a micro-practice called “external boundary scanning” and associated it with the “exploration” pole of the “exploration-vs.-exploitation” duality:

"We surround ourselves with inspiring people. An example is those three guys from Belgium [...] who run a network of digital disruptors. I run bootcamps with these guys so I can hear the latest from Silicon Valley."

At the intermediate level, I used interpretive codes to group micro-practices that were similar to each other in higher-level practices. For example, the micro-practices of *"Developing initiative master plans"* or *"Creating project pipelines"* were associated with the broader practice of *"Sequencing the development of NPD opportunities."*

Finally, at the highest level, I used interpretive codes to group intermediate-level practices that, together, helped address one or both poles of a duality. I refer to this final grouping as "clustered practices." For example, the intermediate-level practices of *"Separating innovation units from mainstream business"* and *"Allocating dedicated teams and resources to innovation"* were grouped as a cluster of practices called *"Enabling the exploration of NPD opportunities independently of existing activities."* The association of a cluster of practices to one or both poles of a duality facilitated the identification of resolution strategies as I will now explain.

Stage 3: Identification and characterization of resolution strategies. In this stage, I first used the lens of ambidexterity theory to interpret the output of stage 2 and identify the types of resolution strategies that the clusters of practices helped enact. More specifically, I sought to understand to what extent the clusters of practices associated with a given duality contributed to structural differentiation, temporal differentiation, or behavioral integration. As will be discussed in more detail later, I was able to identify three distinct resolution strategies and discuss their relationship to traditional ambidexterity approaches. Finally, following the methodological approach illustrated in **Appendix 4-1**, I was able to characterize these resolution strategies by conceptualizing their differences using constructs related to paradox theory.

Stage 4: Development of a preliminary conceptual model. Answering this study's research question necessitated the development of a conceptual model to explain the relationship between paradox resolution strategies and their

propensity to embed tensions in the task environment of NPD projects. The analysis conducted in stage 3 suggested three things: first, the resolution strategies identified throughout the interview process could be described in terms of four basic elements; second, these elements could be represented by measurable constructs; third, causal relationships between these constructs could be inferred by leveraging extant research on paradox management and other relevant fields. The output of this stage was the creation of a preliminary conceptual model that describes how the four constructs characterizing paradox resolution strategies could be linked together through a set of propositions to explain their propensity to embed tensions in the task environment of NPD projects.

4.5 Findings

This section presents the findings related to the types of tensions that arise in the course of developing new products, as well as the different strategies used to manage them.

4.5.1 Main Types of NPD Tensions

The analysis of the interview transcripts revealed that, while informants related a variety of tensions that arise in the course of developing new products, three categories of tensions stood out as being consistently foremost on their minds as indicated by the high relative occurrence rates shown in **Table 4-2**. (This table includes all tensions mentioned by at least two informants.) Because the objective of this study is not the exhaustive identification of NPD-related tensions but an in-depth investigation of resolution strategies, the analysis will focus solely on the top three categories of tensions and their management. Before presenting the findings that relate to resolution strategies, the following paragraphs start by describing these key tensions and illustrate how informants verbalized their experience of them.

Table 4-2: Number of References to Specific Tensions

Tension	Number of informants who mentioned the tension (out of 16)	Total number of comments related to the tension
Exploration-vs.-Exploitation	14	91
Plurality-vs.-Alignment	11	60
Novelty-vs.-Feasibility	10	131
Autonomy-vs.-Control	6	32
Local Relevance-vs.-Global Scalability	4	11
Decentralization-vs.-Coordination	4	7
Grow-vs.-Protect the Brand	2	4

Exploration-Exploitation tensions. In the process of sustaining competitive advantage through new product development, informants experienced a number of tensions related to the dual requirement of having to manage the existing while also create the new. Often, tensions arose when the pressure of attending to the current demands of daily work made it difficult for actors to carve out the necessary time to explore new opportunities. FMCG 1's brand manager, for example, noted how dedicating time to innovation can sometimes be perceived as a risky decision as it may take away from addressing the immediate needs of the existing business:

"We have an obligation to push ahead and feed the machine. You need to have the courage to say: 'I will give a higher priority to innovation versus the usual tasks.'"

Informants also considered innovation work to be fundamentally distinct from implementation work, in particular, when it came to the different mental processes involved. Having to switch back and forth between opposite modes of thinking generated tensions at the individual level and interfered with the ability to perform day-to-day tasks optimally as explained by Technology 1's lead developer:

"It's disruptive for people who are implementing stuff to have to think of new things. 'Oh, I have to implement this AND I have to think about this new thing that will save the company?!'"

While organizations needed to leverage their core competencies to run established businesses, they also had to pursue innovation opportunities which, if successful, could make those very competencies obsolete. Product innovations that implied significant redefinitions of traditional business approaches were particularly prone to raising the overall level of tension across the organization, leaving employees confused or destabilized. Hospitality 4's chief commercial officer, for example, described the reaction of his more operational units in response to a promising shift in the company's business model, which a new vision for its core product enabled:

"We have an organization that is busy with the current business processes of delivering a fantastic hotel experience, so a lot of people said: 'Hold on, our main focus now is no longer about [selling] a night's sleep?!' [...] [This innovation] will be difficult because it will change people's jobs, and it is not part of their jobs to change their jobs."

Similarly, product innovations that required fundamental shifts in entrenched mental models tended to generate greater levels of perceived tensions. FMCG 4's director of planning and governance illustrated this point when he described the challenges of moving sales and marketing staff from selling a traditional tobacco product to an alternative technology-intensive smoking device:

"People have been used to one marketing logic [...] and, over there, there's a new understanding of the marketing logic, so, of course, there's a lot of built-in friction."

Plurality-Alignment tensions. New product development efforts invariably required the involvement of a diverse set of stakeholders. An organizational culture of empowerment and inclusiveness tended to foster a plurality of stakeholders' perspectives which could make the smooth implementation of innovative projects more difficult and could challenge senior executives to weigh the merits of distributed power against the imperatives of moving the innovation process forward. Hospitality 4's chief commercial officer, for example, expressed the delicate balance between respecting the organization's empowerment culture while advancing the corporate innovation agenda:

One thing that's important to understand about how we operate is that we have an inverted pyramid in our organizational chart [...] It's always easy in a top-down organization with a CEO who says 'Guys, we discussed this, this is what we're going to execute, and if you don't do it you don't get a bonus.' In our organization, I need to go back to our hotel managers. You can even get feedback like 'Well, who asked for that? We didn't ask for that, so why are you doing this?' So, it's basically a top-down decision in an organization that is inverted, which makes it extra complex because I cannot say 'Guys, shut up! This is our concept, and we're going to do this.'"

Beyond stakeholders, the involvement of project contributors from multiple different business functions also increased the variety of viewpoints throughout the NPD process. While diverse skillsets and expertise were necessary for the success of NPD initiatives, this diversity also required that roles and processes be put in place to allow for proper coordination and alignment. Most NPD leaders acknowledged the tension arising from the need to orchestrate activities efficiently while maintaining sufficient flexibility to allow for collective integration. While alignment through formalized processes was generally viewed as desirable, project leaders were also aware of the downsides when taken to an extreme as FMCG 6's innovation brand manager noted:

"To get things to move takes so much energy and so much time. [The process] is working in the sense that it is so structured, it is so rigid, everybody has a responsibility, everybody needs to do their thing, everybody needs to commit and deliver to a certain date for the next team to

carry the baton and continue to work. But if one thing breaks in the system, most likely everything else will."

Overall, informants viewed the process of maintaining alignment across multiple functions as one of the main challenges of the NPD process. The extent to which tensions arose, as a result, seemed to depend not only on the prevailing culture and the effectiveness of the roles and processes supposed to foster alignment but also on the existence and clarity of shared goals as implied by FMCG 3's global business stream leader:

"The biggest challenge in a project is to maintain alignment; to make sure that the team is focused on the objective; and that we are clear on what we want to achieve between the sales & marketing people and the research & development people."

Novelty-Feasibility tensions. The pursuit of novelty inherent in new product development was constantly juxtaposed against the equally desirable yet conflicting objective of ensuring feasibility. Maintaining a sufficient level of innovativeness in the face of technical, operational and market constraints was repeatedly identified as a source of tensions. FMCG 1's brand manager, for example, shared the experience of seeing her innovative projects constrained by the various limits imposed by the operations department:

"They're 100% operations, they're deep in execution, and they see us, this innovation machine, generating ideas: 'We could do this and that!' So, we often have to limit ourselves: 'We can't do this, we can't do that, because the plant can't do it, or [a big retailer] would never take it, so we can't do it.' Thinking out of the box is difficult to do when you're in a context of industrial constraints."

Ultimately, the concern shared by the people driving the development of forward-looking initiatives was that feasibility issues would dilute, potentially even erase, the innovative attributes of the products being developed as explained by FMCG 5's portfolio strategy leader:

"The most critical part is really the development phase where we estimate that there is about a 30% fail rate or something like that. So, it's either for

technical reasons - you can't develop the product - or we have to make so many compromises that, in the end, the project is super weak."

Another type of tension surfaced when the business necessity of meeting target launch dates – either to maintain competitive advantage or to capitalize on an existing opportunity – conflicted with the necessary time required to develop products with a sufficient degree of novelty:

"The world moves fast; we're not alone. Our competitors may be working on the same ideas, so it's a race. We wanted to be the first, but sometimes you must accept that things take time." (FMCG 3's business stream leader)

While shortcuts were sometimes taken to ensure the timely launch of new products, these decisions only reinforced the need for greater innovative efforts in the future. FMCG 2's retail innovation manager explained how a hasty new product introduction aimed at growing an underdeveloped market resulted in launching a suboptimal solution:

"The consequence is that we deliver, but not to the level expected because, rather than deal with the root of the problem, it was decided, in relative comfort, to take [an existing] solution and adapt it to the problem. Instead, we should have tried to develop an in-depth understanding of the U.S. consumer need [...] and start thinking about the appropriate solution to address that market problem. Not just choosing the easiest and quickest solution."

Finally, informants also faced the on-going challenge of ensuring that the products developed maintained sufficient novelty while also meeting internal profitability requirements. The resulting tension was particularly acute when those profitability targets had to be met sooner rather than later as FMCG 5's strategy portfolio leader noted:

"The second tension is very often a financial one: when you innovate, you want to go with something innovative, disruptive, and create a strong interest in your target consumers. The problem is that businesses today are forcing you to be productive and profitable by year one, two, three, at the most by year three. And that creates an enormous tension because, very often, to deliver profitability and to be accretive to the business takes more time."

To summarize, informants reported experiencing three main types of paradoxical tensions in the course of developing new products. First, tensions arose whenever exploratory activities related to the early development of new projects overlapped with the exploitative activities of later stages. Second, while informants acknowledged that NPD projects necessitate satisfying the demands of multiple stakeholders and engaging with a variety of knowledge domains, they also recognized the challenges of reconciling potentially conflicting expectations and integrating diverse contributions and perspectives. Finally, informants made repeated references to the on-going tension between addressing feasibility concerns of all types (e.g., technical, operational, and financial) and guaranteeing the development of sufficiently novel products. The following sections will now describe the different strategies employed to manage each of these tensions. To help with the narrative that follows, **Table 4-3** presents the output of stages 2 and 3 of the data analysis process. Importantly, the table illustrates how the empirical data was mapped to specific clustered practices which, in turn, allowed for the identification and conceptualization of distinct approaches to the management of dualities.

Table 4-3: Representative Data of Clustered Practices that Support Distinct Approaches to Tensions

Approach to Tension	Clustered Practices	Representative data coded to clustered practice
Focus on one pole of the duality exclusively, then focus on the other pole exclusively	Enabling the <i>exploration</i> of NPD opportunities independently of existing activities	"I think most people would prefer not to cross over that [innovation-execution] chasm. Just because, in some sense, there are two different thought processes." (Technology 1) "I have working for me Project Directors and Innovation Directors – so people running our established in-house projects [and people whose] job is to search, evaluate, and partner with third parties that can bring in innovation." (Pharma 1) "[We have two sources for innovation]; they are part of our business plan, they're part of the R&D pipeline, they're fully funded." (Pharma 1) "Our group is called Guest Technology & Innovation, and it is comprised of 15 people [...] with the goal to reflect and work on tomorrow's technologies." (Hospitality 1) "[The project] was mostly in the incubation phase, separate from the departments." (Hospitality 4) "We have a full team called 'front-end innovation' and they are based in the U.S., not here in Geneva. And these people look into the future, look into the trends." (FMCG 6) "But this [innovation center] is the only one that is not at a [company] location; the others are coupled with production centers. Bad! You have to be separated!" (Technology 2)
	Selecting and prioritizing NPD opportunities	"They rank, they decide on the priority ... of the requests that came [and decide]: 'These are really important so we should do these first.'" (Technology 1) "That dilemma is solved by looking at gaps in the R&D portfolio ... and trying to fill those gaps either with in-house projects or external projects." (Pharma 1) "On the basis of this BCG study, we presented the results to the executive committee which validated the proposal to test [the concept]." (FMCG 2) "I am also part of the discussions and definition of the strategy, project selection, etc." (FMCG 3) "We do our business case review process: everyone submits their projects for the next year, then there's so much budget for the next year, so then they have to draw a line on what project are approved for that following year." (Hospitality 3) "We mostly try to balance our pipeline, meaning our project over the next 5 years so we can sequence the projects." (FMCG 5)
	Guiding and supporting the <i>exploitation</i> of NPD opportunities	"[Our strategy] is very clearly communicated, and, as long as it meets the efforts of our funding vehicle and of the business plan, then R&D has full autonomy to develop those projects. (Pharma 1) "What I am saying is that it is normal to question the strategy, but at some point we must agree on the strategy and put it in action. Because if we question it every 6 months, we will never be able to achieve the goal we set for ourselves at the time." (FMCG 2) "When the strategy is not sufficiently clear, it allows for too much space to work on concepts and ideas that don't make any sense. Personally, I feel that the strategy should be clear and without any ambiguities, in all aspects." (FMCG 3) "I was lucky that the Chief Commercial Officer at the time was a true sponsor of the project. Without him, we would have never opened the first [location]." (FMCG 2) "Management vision and commitment throughout the project has been pretty instrumental in making this happen. It could not have happened unless there was a very, very senior anchoring of the overall business idea and ambition." (FMCG 4)

Table 4-3 (continued): Representative Data of Clustered Practices that Support Distinct Approaches to Tensions

Approach to Tension	Clustered Practices	Representative data coded to clustered practice
Emphasize one pole of the duality first, then gradually shift the emphasis to the other pole.	Engaging with a <i>plurality</i> of stakeholders and knowledge domains	"My team is comprised of about 30 people with different backgrounds: technologists, engineers. And today we operate under a model where we collaborate with internal and external partners, we're not doing everything ourselves." (FMCG 3) "On each project, you should have the people with the right set of domain skills. If you don't have these people, then you must identify some internal or external resources and include them in the project." (FMCG 3) "We almost always rely on a number of people to make a pilot happen ... because [there might be] operational considerations, there might be technical considerations, we might have security considerations, we might have legal considerations,... So, we have a big checklist upfront to identify those different areas of impact to make sure that you're engaging all the right people on the team at the start." (Hospitality 3) "You need to solve that by having lots of governance reviews in the different specialty areas within the company whether it's manufacturing, whether it's research, whether it's development, whether it's marketing, whether it's sales, and you often have to include the regions in doing that." (Pharma 1) "You are bringing a lot of stakeholders to the table. So, already internally, we are a company where, very honestly, everyone has something to say and says it." (FMCG 2) "[For] something that interacts with every single silo within our organization from finance ...; operations ...; our old partners..., all that needs to change...; so every single department has to chip in." (Hospitality 4) "In FMCG, there is always a lot of stakeholders who are involved in the discussions [...] ; there must be someone from R&D, someone from consumer insights, one marketer, one technical person, and one finance person." (FMCG 5)
	Promoting greater <i>alignment</i> over time between stakeholders and knowledge domains	"At the very beginning, it's kind of like 'What information we all agree will flow from end to end?', and, as the pieces solidify, that's when the individual people who get that task will get together and be 'OK, so what contract should there be?' So, it's very iterative process, there's not one 'Let's all design this thing from scratch fully, and then switch mode to the implementation phase.'" (Technology 1) "So, that is often a must-do need by the company of bringing those assets, and the people who are developing those assets, together on a regular basis so that you have the right hand-over or the right exchange of information within the company." (Pharma 1) "The challenge is to ask the right questions and, maybe, to redirect the brief in order to clarify it. The objective of the concept phase is not to deliver the solution. The objective is to answer all the necessary questions so we can start the Development phase." (FMCG 3) "The concept phase can be like orienteering: you try to get to the various checkpoints, but it's never a straight line. And once you're done with the Concept phase then you switch shoes and you run a 100-meter sprint; that's a straight line." (FMCG 3) "Each of these teams is working on their sub-objectives as part of this plan, then I guess what we are trying to do is manage this corporate calendar, the process for alignment of all these different sub-plans so that it all fits together in a coherent plan." (FMCG 4) "Our objective was more about speed to market and deploying fast, whereas their objective might have been more about control, quality, and support over time." (Hospitality 3) "We try to align as early as we can on time and cost so at least we get it out of the system. We try to be proactive by getting early alignment three years in advance, so we can avoid last-minute issues." (FMCG 6)

Table 4-3 (continued): Representative Data of Clustered Practices that Support Distinct Approaches to Tensions

Approach to Tension	Clustered Practices	Representative data coded to clustered practice
Emphasize both poles of the duality simultaneously.	Continuously making trade-offs between <i>novelty</i> and <i>feasibility</i>	"The product guys are all happy and the marketing people are all happy because they can say to the world 'Our product now does – new and improved!' – but usually engineering is the one who fights that." (Technology 1) "The concept phase is also where the sparring happens. We must negotiate with the marketing and salespeople. They'll say 'We need this, but cheaper' and R&D will respond 'It's completely crazy and unrealistic.'" (FMCG 3) "One the big challenges that we are constantly faced with is to make a lot of compromises as we move forward. That's when there's a bit of dissonance between what we can do and what we want to do." (FMCG 5) "There were always trade-offs on the formula, the size format, to find the right equation, 'optimize the equation' I think that's the best way to put it." (FMCG 5) "By discussing it with R&D, we transformed the product into the language that we know, that means using the characteristics we work with. And, already, you've already altered the idea too much." (FMCG 1) "It's a lot of negotiation and convincing that the franchisor needs to embark on with franchisees. We end up being super salespeople." (Hospitality 1) "We have optimization options: meaning how can I keep the cost of this formula a little bit similar to what we have today without jeopardizing cleaning and getting the malodor benefit also. So, it was this whole optimization element that took us about 3-4 months." (FMCG 6)

4.5.2 Approach to the Exploration-vs.-Exploitation Tension

Enabling the exploration of NPD opportunities independently of existing activities. Widely shared among informants was the view that innovation work, at least initially, is best conducted outside the traditional organizational structure. Informants referred to dedicated innovation units and teams – such as “innovation centers,” “front-end innovation teams,” or “technology innovation units” – that were shielded from the daily demands of established business lines to perform the exploratory work necessary to sustain the continuous renewal of the organization. In their view, the early stages of the innovation process required different thought processes and mindsets and needed to be free from operational constraints and short-term financial objectives. Technology 2’s managing director of innovation explained the benefits of complete structural separation:

"We have four innovation centers [...] but this one, in Lausanne, is the only one that is not [housed in a company building]; the others are coupled with production centers. BAD! You have to be separated. I have been in London and Bangalore [and, when] you go through the reception, you meet this colleague and that colleague [and] your brain is quickly drowned in operational garbage. [When I] walk through the [Lausanne] campus: young students, young people everywhere! Nobody babbles next to me about operational stuff."

Beyond “drowning people in operational garbage,” lack of separation could also affect the development of innovative solutions by focusing on imagined synergies between existing and new businesses to the detriment of truly novel approaches. FMCG 2’s retail innovation manager, for example, explained the failure of his first coffee shop pilot as a direct consequence of having been embedded too deeply within a team responsible for a related yet fundamentally different coffee boutique business:

"The biggest challenge we have [...] is to create a food and beverage environment, an out-of-home experience, and I am put on a team that does not have the slightest idea about these things. Even worse, that team has a bias toward something that is not what we are trying to do. [As a result], the

first pilot we opened in Vienna looks like a boutique, which is the first criticism that everyone makes."

While physically separating innovation units played an important role in minimizing tensions related to the exploration of NPD opportunities, these tensions were further minimized when structural separation was accompanied with sufficient dedicated resources and integration into strategic plans, as illustrated by Pharma 1's SVP of global R&D's comment:

"We have 10 R&D centers around the world, but only two of them are related to pipeline filling; the others are more about operational execution. [...] So, these are our two sources of innovation. We're very comfortable with that; there are no kinds of conflicts or conflicting objectives there. They are part of our business plan; they're part of the R&D pipeline; they're fully funded."

To ensure that innovation efforts did not get short-changed, some companies created separate funds, each with different objectives and time horizons to prevent incremental, short-term projects from starving more innovative, longer-term ones. This separation of resources helped prevent conflicts between the current priorities of established business units and the pursuit of new opportunities:

"Each business unit has their own pot for research, and, to be successful, they tend to make incremental improvements. It's difficult for them to take big, risky steps because they might just waste money and get nothing out of it. Whereas, with the [innovation fund], we're looking at technologies that are related to our company, that might be interesting in 2, 3, 4, 5, 6 years from now. And this is really crucial; you need these different pots with their different targets." (Technology 2's managing director of innovation)

Selecting and prioritizing NPD opportunities. The decisions to move NPD opportunities from the exploratory to the exploitative phase tended to be both strategic and binary. NPD opportunities typically went through a formal assessment process which, if successful, led to the selection and prioritization of these opportunities. While the assessment criteria varied by types of businesses and industries, they typically focused on strategic dimensions as captured by FMCG 3's global business stream leader's comment:

“Everything hangs from the strategy. If we say that we want to be the world leader in coffee beverage, then if we have an idea around green tea we need to stop and reevaluate. But if we have the idea to have a coffee variant with green tea aromas then OK, it fits within the strategic scope. For me, the strategic fit should always take precedence.”

Among the strategic dimensions considered were, for example, the place an NPD opportunity would occupy in a broader initiative program, as described by Pharma 1’s SVP of global R&D: “That dilemma [of selecting NPD opportunities] is solved by looking at gaps in the R&D portfolio.” Alternatively, the alignment between a new product initiative and the equity of the associated brand was another factor often considered in the assessment phase as illustrated by FMCG 6’s innovation brand manager: “For me, it’s about how does it fit with everything that we are working on on the brand, is it consistent or not?” Last but not least, the assessment process typically included a preliminary evaluation of the financial potential of the NPD opportunity, which ultimately decided its fate in terms of whether its development would be pursued further. Technology 2’s Managing Director of Innovation explained how preliminary financial feasibility analysis was often the key to raising interest from his colleagues in more established business units, thus increasing the chances of future development and commercialization of the NPD opportunity: “If you can show, with numbers, that this could really be a money generator, they will jump. It doesn’t have to be a detailed business case, just the basics.”

In sum, NPD opportunities were typically assessed through a combination of strategic criteria pertaining to product portfolio, business fit, and financial potential. These assessments resulted in binary go/no-go decisions which, in effect, moved NPD opportunities from the exploration to the exploitation stage. These decisions were instrumental in achieving the targeted mix between exploration and exploitation and subsequently allowed for the sequencing of initiatives and the creation of project pipelines that could be communicated to lower organizational levels. Further supporting the strategic nature of these decisions, governance bodies and high-level executives were often deeply involved in this process of reviewing and prioritizing initiatives. These high-level

decisions helped provide the rest of the organization with a relatively stable view of future development efforts through, for example, the development of three- to five-year master plans.

Guiding and supporting the exploitation of NPD opportunities. Once selected, innovation opportunities became official NPD projects to be developed for commercial ends, which could be characterized as the exploitation phase of the innovation journey. Despite structural separation, tensions could still arise in this exploitation phase and, therefore, needed to be managed accordingly. Once again, the management of tensions relied on strategic rather than operational devices. Specifically, tensions were more likely to be minimized in contexts providing a clear strategy, adequate resources, and sustained leadership support.

Informants repeatedly emphasized the importance of having a well formulated and well-communicated strategy to guide the development of initiatives as it allowed employees to develop a better understanding of how specific projects fitted into the organization's overall ambition. A clear strategy also helped focus the effort along a consistent long-term path, and avoid distractions related to side opportunities that would invariably arise during the NPD process. Pharma 1's SVP of global R&D made this point as he recalled the dangers of forgetting the "big picture" when surrounded by other promising pursuits:

"The execution of [the strategy] requires effective leadership to make sure that the ship is running in the right direction; that we're not distracted by other opportunities; that we are obsessive and have a long endurance about reaching those goals. Leadership skills are often needed in those cases where we have so many opportunities that, sometimes, the big picture is forgotten."

Conversely, the consequences of an ill-defined strategy was often a lack of discipline and focus that allowed for the pursuit of all sorts of fruitless endeavors in the still early stages of the NPD process as noted by FMCG 3's global business stream leader:

"When the strategy is not sufficiently clear, it allows for too much space to work on concepts and ideas that don't make any sense. [...] the strategy should be clear and without any ambiguities, in all aspects. Otherwise, you do everything and nothing. A strategy that's clear doesn't hinder creativity. On the contrary, it allows us to focus on the things that create value for the business."

Beyond the strategy itself, informants stressed the importance of communicating it effectively. Innovation leaders saw the communication of the strategy as one of their main responsibilities. FMCG 4's director of planning and governance made this point most vividly when, in the early days of a significant business model shift, he expressed more concern about his organization's ability to communicate the new strategy effectively rather than about the ability of the employees to embrace it:

"I think, before we put a question mark on the people, we should put a question mark on our ability to communicate, and establish the rules of engagement, and equipping people for engaging within the boundaries of the brand and the proposition. And I think that's a huge, a huge communication [responsibility] on our side."

Setting and communicating a clear strategic course were deemed essential yet not sufficient. Providing sustained support for the chosen strategy over time was the necessary complement to avoid the emergence of tensions later in the implementation stages. This support came mainly in the form of dedicated resources and leadership commitment to the project. Dedicated resources encompassed both financial and human resources which, if considered inadequate, caused both frustration and confusion, regardless of the perceived worthiness of the strategy itself. For example, FMCG 2's retail innovation manager related his experience of misalignment between means and ends in a communication to his CEO:

"I have a very limited budget, and I'm told 'Reinvent the world of coffee shops.' So, at times, I look at my CEO with my eyes wide open and tell him: 'The ambition is fantastic, but we need to give ourselves the means to do this. [...] I am confused by the overall strategy, but it is clear I cannot run a one-man show. [...] So, if the ambition is to reinvent the world of the coffee

shops, I cannot do it on my own. Even if I was a genius, I could not do it on my own."

Adequate levels of dedicated resources increased the chances of execution success for innovative projects as it did not require the teams involved to "cut corners" or take detrimental shortcuts. FMCG 1's brand manager, for example, explained how lack of resources tended to lead to unwise cost-cutting measures in the development of innovative projects:

"The innovation itself could really be something good, but, then, they don't give you the means. I would need to do a market study [...], validate with the consumer. Otherwise, you launch it, you invest in communication, but it's crap, and no one buys it; it's a failure. But [market research] costs a lot of money. And when you don't have the means, you cut that out."

Leadership commitment, especially when made publicly, went a long way toward making the strategic vision, and the intention to pursue it, credible to both internal and external stakeholders. Clarity of purpose combined with visible commitment from leaders tended to percolate down to all organizational levels and served to preemptively reduce potential tensions between, and within, business functions. FMCG 4's director of planning and governance, for example, explained how top management's buy-in for a major disruptive innovation helped reduce tension during the product development phase:

"We have invested something like two billion dollars behind this program. [...] Of course, such a commitment comes with a very senior, strategic alignment, and also with the Board of Directors' buy-in. Therefore, there has not really been a lot of friction on product development, nor in terms of setting up the manufacturing infrastructure, nor in terms of formulating the science, because this has happened under the mandate of the board."

4.5.3 Approach to the Plurality-vs.-Alignment Tension

Engaging early with a plurality of knowledge domains and stakeholders.

Informants repeatedly stressed the importance of engaging with all relevant stakeholders early in the NPD process. When successful, early stakeholder engagement enabled the definition of clear objectives and the establishment of common expectations. This process, while time-consuming, was viewed as an essential prerequisite to the long-term success of NPD initiatives as explained by Hospitality 2's managing director:

"[Engaging with stakeholders] is very time consuming although, if [companies] do it well – and there are some companies that do this well – it really reduces the risks that the technology will fail because it ensures that all the stakeholders are kind of aligned on what they're doing and why they're doing it and what they expect to get out of it and how their business is going to have to change in order to take advantage of that."

This primary focus on early engagement with relevant stakeholders foreshadowed the need for greater alignment in the future. This was particularly true when the goals of the different parties were equally worthy yet mutually conflicting. The challenge only grew larger with the number of stakeholders and their propensity to voice concerns as explained by FMCG 2's retail innovation manager:

"It's not easy [...] we are a company where, very honestly, everyone has something to say and says it. [...] On top of that, you add an external partner who is a co-investor, so he also has the legitimacy to voice his comments. Hence it adds a lot of stakeholders around the table, not necessarily with the same objectives."

NPD projects also required a variety of contributors from different knowledge domains to collaborate. Here, too, early involvement of employees with complementary expertise was seen as instrumental in understanding the broader implications of specific initiatives. Hospitality 2's managing director of innovation emphasized this point when describing the importance of having a methodical approach to identifying and securing the right set of competencies at the start of the project:

"We almost always rely on a number of people to make a pilot happen because of operational considerations; there might be technical considerations; we might have security considerations; we might have legal considerations. So, we have a big checklist upfront to identify those different areas of impact to make sure that you're engaging all the right people on the team at the start."

With regards to project contributors as well, the early emphasis was on engaging with a variety of knowledge domains in order to gather the needed expertise, and later address integration concerns through an on-going process of alignment as implied by FMCG 3's global business stream leader:

"The two fundamental questions are back on the table: Do you have the best expert, internally or externally? Can you maintain constant alignment and communication? Regardless of whether we work internally or externally, this must be done one way or another."

Fostering greater alignment over time between knowledge domains and stakeholders. Because the NPD process required tapping into different knowledge domains and managing multiple stakeholders' demands, organizations relied on integrative roles and processes to facilitate the assimilation and exploitation of specialized knowledge. In some cases, informants referred to the existence of specific units whose main responsibility was to manage, over time, the coordination and alignment process between multiple knowledge domains:

"To deliver on this program, we have a number of divisions. We have the product development department, the science department, the marketing department, the commercialization department, and then we have a manufacturing or operations department. Each of these teams is working on its sub-objectives as part of this plan, then we [the corporate affairs department] manage the process for alignment of all these different sub-plans so that it all fits together in a coherent plan."
(FMCG 4's director of planning and governance)

In the absence of dedicated structures, alignment was generally the responsibility of the project manager, sometimes referred to as the "orchestra conductor," or the "airplane pilot." Correspondingly, a distinction tended to be

drawn between experts whose role was to contribute expertise from distinct knowledge domains and project managers whose responsibility was to help orchestrate these contributions and ensure alignment between the parties involved. FMCG 3's global business stream leader stressed the distinct nature of these roles and the risks associated with trying to combine them within the same individual:

"Then, of course, there is a difference between experts and project managers. What I ask of a project manager is that he absolutely must be able to keep constant alignment between the various stakeholders. We shouldn't necessarily look for someone with the dual set of competencies; you may have a top-notch expert in one area, but if he does not have the competencies of a project manager, then don't make him a project manager."

Almost all companies investigated relied on some form of Stage-Gate[®] process to coordinate the development of new products and achieve increasing alignment over time. While early phases were typically more exploratory, as the NPD initiative progressed ideas turned into concept definitions which, in turn, were translated into product specifications. As requirements became more specific and larger investments were made, the emphasis on flexibility to redirect the course of development was gradually replaced by a greater focus on alignment. FMCG 3's global business stream leader explained this gradual transition from flexibility to alignment in the course of developing new products:

"The Concept phase can be like orienteering: you try to get to the various checkpoints, but it's never a straight line. And once you're done with the Concept phase then you switch shoes, and you run a 100m sprint; that's a straight line. When we get to the end of the Development phase, it must be possible to implement the specifications that are defined. In the Industrialization phase, it is useful to do some fine-tuning, but there is no negotiation at this stage, what's important is to make it work."

While innovation managers generally understood the necessity of following processes that fostered greater alignment, they also stressed that a premature focus on alignment could be detrimental to innovative projects. In their view,

alignment should be gradually emphasized over time as explained by FMCG 2's retail innovation manager:

"If you want to launch a significant innovative initiative in a large corporation, and from the very first day [...] you want to respect all the processes [...] I think that nine out of ten innovations will stop.[...] What I am saying is that a new or innovative business must have some leeway with respect to the way it organizes itself. Once there's proof that it is profitable, that it is a good project, a good innovation, that we must do it, then, of course, we must put in place and respect all the processes."

The various NPD processes used by the organizations in this study were typically punctuated by various formal touchpoints – sometimes referred to as “gates,” “progress reviews,” “governance reviews” – which brought together stakeholders and contributors from various business functions. The main purpose of these meetings was to evaluate the progress of specific initiatives from a variety of perspectives, which contributed to developing a greater shared understanding of opportunities and challenges among participants. Due to the variety of knowledge domains involved, achieving alignment relied on a process of repeated interactions over time as explained by Pharma 1's SVP of global R&D:

"It's often the dilemma that you see in [assessing progress]. And you need to solve that by having lots of governance reviews in the different specialty areas within the company whether it's manufacturing, whether it's research, whether it's development, whether it's marketing, whether it's sales, and you often have to include the regions in doing that."

4.5.4 Approach to the Novelty-vs.-Feasibility Tension

Continuously making trade-offs between novelty and feasibility. The development of new products was often described as a permanent struggle between the pursuit of innovative ideas and the accommodation of technical and commercial constraints. Typically, this struggle was managed through rounds of negotiations between the various parties involved, as well as cycles of concept and product testing. The use of these strategies started in the very early stages of product development, sometimes in the initial discussions about whether to take on a particular innovation project. Due diligence efforts, for example, aimed not only at assessing the attractiveness of new opportunities but also at providing an initial feasibility evaluation by involving experts and other stakeholders. Pharma 1's SVP of global R&D described how his organization conducts the initial review of potential acquisition target compounds:

"So, it's a bit like an interview with a new candidate employee, we call it due diligence. It has to be very thorough and actually involves the people who, if the project is taken on board, are going to be the ones responsible for executing it. So, you involve the more operational people at an early stage, during the evaluation, and tell them 'If you are to take this on, you are going to be responsible for this.' So, pre-on-boarding stakeholder management is very important."

Back-and-forth cross-functional negotiations were often at the heart of the new product development process insofar as they allowed for some consensus between novelty and feasibility to be reached, thus enabling the projects to move forward. In the earlier stages of NPD, these negotiations often took place between the business-oriented functions (such as Marketing) and the science-based functions (such as R&D). While the former were responsible for formulating and protecting the aspiration behind a new initiative, the latter were more concerned with evaluating and testing its realism. These functions, therefore, engaged in a dialectical process that ultimately led to a series of negotiated commitments between them as illustrated by FMCG 3's global business stream leader's comment:

"The concept phase is also where the sparring happens. We must negotiate with the marketing and salespeople. They'll say, 'We need this but cheaper,' and R&D will respond 'It's completely crazy and unrealistic.' So, there, we need to fine-tune among ourselves, and it's a process that involves both sides."

While guaranteeing sufficient novelty and technical feasibility was a primary focus, this negotiation process was also used to address the tension between novelty and profitability. FMCG 6's innovation brand manager, for example, described this balancing exercise between product attractiveness and profitability:

"Once you get new technology into your formula, you have to understand it comes with a massive upcharge. So, the question is: how can I keep the cost of this formula [...] similar to what we have today without jeopardizing [the product's] benefits. This whole optimization element took us about 3-4 months [because the R&D labs] need to conduct lots of measurements to understand the trade-offs."

Another type of tension surfaced when the necessity of meeting fixed deadlines conflicted with the ability to deliver the degree of novelty required. Reconciliation of these opposite objectives was, again, typically achieved through rounds of negotiations between the parties involved as explained by FMCG 3's global business stream leader: "Negotiating [implementation] times is a recurring thing, for sure." FMCG 5's portfolio strategy leader summarized the essence of this balancing act to meet the needs and objectives of multiple business functions:

"I think of one of the big challenges that we are constantly faced with is to make a lot of compromises as we move forward. [...] That's when there's a bit of dissonance between what we can do and what we want to do. [...] Optimize the equation. I think that's the best way to put it. Optimize the equation between finance, product, and marketing mix."

Finally, in addition to negotiating commitments between business functions, another strategy used to reconcile novelty and feasibility demands was the systematic assessment of project outputs in increasingly more realistic environments. Informants referred to validation methods such as evaluation of

ideas by internal teams, concept testing with consumers, prototype assessments, and controlled deployment in pilot markets. Validation methods were implemented in most phases of the product development process, thus providing a way to systematically and continuously assess both the technical and commercial feasibility of novel solutions. While cross-functional negotiations helped develop a mutual understanding of internal needs, systematic assessments of new ideas, concepts, and products provided the complementary knowledge that pertained to the attractiveness and realism of the innovations under development.

4.6 Characterization of Resolution Strategies

Up to this point, I have identified three categories of paradoxical tensions that emerged in the process of developing new products, and I have described the various resolution strategies used to manage them. Using the lens of paradox and ambidexterity theory, this section will now present a more formal characterization of these strategies, with a particular focus on how the strategies differ in terms of their treatment of opposing poles over time. For the sake of greater clarity, I define “pole emphasis” as the attention (in terms of effort, time, and resources) given to the pursuit of objectives associated with a *single pole* of a duality, and “pole juxtaposition” as the extent to which opposing poles are emphasized *simultaneously* within a given task environment (in this case, the project). To help with the discussion that follows, **Figure 4-1** illustrates how the three resolution strategies described in the previous section are supported by the practices identified in this study.

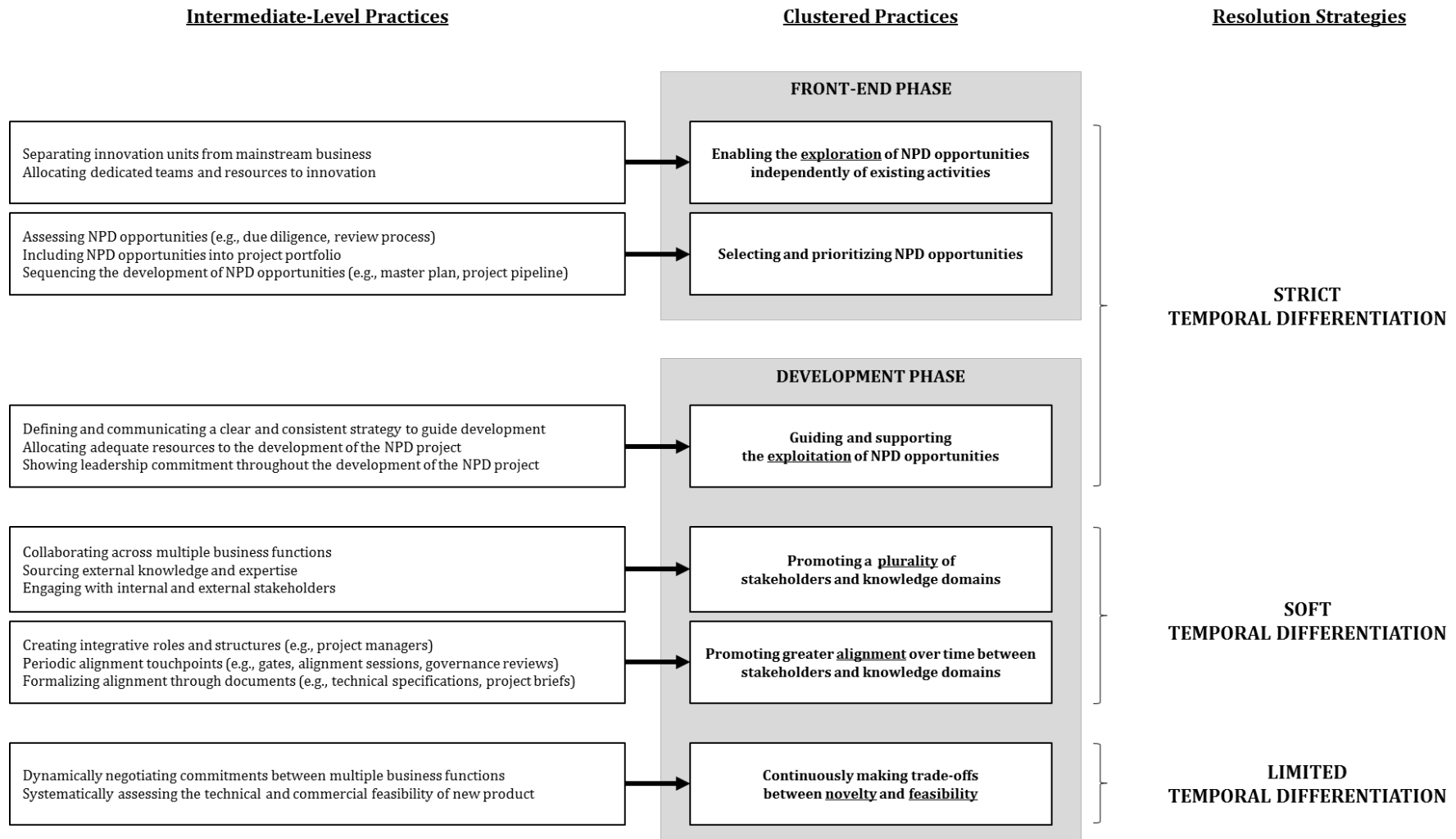


Figure 4-1: Practice-Enabled Resolution Strategies

Strict temporal differentiation. The majority of organizations included in this study followed an innovation process comprised of two distinct parts that can be defined as the exploration and exploitation of NPD opportunities. In the exploration stage, ideas about new products or services were experimented with, for example, through the development of preliminary concepts and prototypes, while often being substantiated by market research and preliminary financial analyses. Once deemed sufficiently mature, these “enhanced” ideas would typically go through a go/no-go decision process before entering the exploitation stage, namely the sequence of activities required for the development of the actual product or service.

These findings are consistent with the literature on new product development (e.g., Cooper, 1993; Khurana and Rosenthal, 1998; Smith and Reinertsen, 1992) which describes the innovation process as two successive stages: the “fuzzy front-end” (FFE) stage and the development stage. (The FFE stage refers to exploratory activities that take place between the time an idea is first considered until it is deemed ready for development (Kim and Wilemon, 2002)). In line with this distinction, I define the “*exploration of NPD opportunities*” as the activities typically conducted during the fuzzy front-end of the innovation process; and the “*exploitation of NPD opportunities*” as those taking place during the development stage.

The findings suggest that, in most cases, the sets of activities associated with the exploration and exploitation of NPD opportunities rarely intersected at the project level. Instead, each pole of this exploration-exploitation duality was addressed through the use of resolution strategies that promoted internal consistency through structural differentiation, dedicated resources, and leadership support. Integrative decisions – namely those that seek to identify opportunities, linkages, and synergies through the juxtaposition of opposites (Smith and Tushman, 2005) – were largely absent at the project level. Instead, NPD opportunities moved from the exploration to the exploitation stage through binary “either/or” decisions made by leaders during the process of assessing, selecting and prioritizing NPD opportunities. This approach, therefore, focused

less on unlocking synergies at the project level and more on achieving the desired balance between exploration and exploitation efforts at the organizational level through the design of product portfolios and creation of initiative master plans.

This finding is in line with Smith's (2015) argument that the management of the exploration-exploitation paradox is a leadership level responsibility which rests on a pattern of shifting “either/or” support decisions between the exploration and exploitation domains. Product portfolios, for example, are the results of a series of “either/or” decisions regarding the inclusion or exclusion of NPD opportunities. While these decisions may themselves appear consistently inconsistent over time (for example, at times favoring radical projects coming from the exploration units, and at other times favoring incremental projects from mainstream business units) once the decisions have been made, they can be systematically supported at the project level through clear strategic goals, leadership commitment, and structural separation.

Importantly, the structural separation of exploration and exploitation activities implied, *de facto*, a strict temporal differentiation at the project level. Namely, exploration activities preceded exploitation activities with little or no overlap; instead, an abrupt transition took place between the two types of activities when the project was handed over from one organizational unit to the next.

In summary, at the project level, a paradox resolution strategy based on strict temporal differentiation is characterized by: (1) an independent emphasis on each pole of the duality, (2) an abrupt change of emphasis over time, (3) no juxtaposition of opposites, and (4) infrequent integrative decisions delegated to a higher organizational level (i.e., leadership level). In paradox theory terms, strict temporal differentiation is a sequence of “choice” resolution strategies at the project level.

Soft temporal differentiation. In contrast, the management of the plurality-vs.-alignment duality was achieved through what can be described as *soft* temporal differentiation. I use the term “soft” to mean that there was a gradual, rather than abrupt, transition of focus from an early emphasis on plurality toward an ever greater emphasis on alignment.

In all the organizations analyzed, the NPD process required the involvement of a plurality of stakeholders and contributors. While the resulting multiplicity of demands and knowledge domains remained throughout the development of new products, this diversity was “reined in” and brought into greater alignment over time. Smith and Lewis (2011) argue that a plurality of stakeholders with competing strategies and goals can be a source of paradoxical tensions at the organizational level. The findings from the present study suggest that this paradox of plurality also operates at the project level and plays a critical role in the success of NPD initiatives.

In the context of NPD, the plurality paradox extends beyond stakeholders to include a plurality of project contributors. Indeed, to secure the information and knowledge necessary to the success of NPD initiatives, the process requires crossing internal organizational boundaries between separate yet interdependent business functions (Burns and Stalker, 1961; Dearborn and Simon, 1958; Dougherty, 1992), as well as crossing the boundaries of the organization itself (Ancona and Caldwell, 1992; Dougherty, 1992). Sheremata (2000) likens this outward quest for ideas, information and knowledge to the centrifugal force in physics as it extends the search space away from the conceptual center of gravity (i.e., the organization or, in the context of this study, the NPD project). This centrifugal force needs to be counterbalanced by an equally powerful centripetal force through structural elements and processes that gather and integrate dispersed knowledge (Sheremata, 2000). In Sheremata’s analogy, centrifugal and centripetal forces perfectly balance each other to keep the organization “in orbit.” However, the present study found that the forces of plurality and alignment did not operate with equal influence in the course of developing new products. Indeed, the centrifugal forces of plurality –

both of stakeholders and of contributors – were predominant in the initial stages of projects, and gradually gave way to the centripetal forces of alignment enacted by roles and processes whose primary aim was collective coordination and integration. As Sheremata (2000) summarized: “Centrifugal force gathers; centripetal force integrates.” (p.390). While these forces may be in equilibrium at the organizational level, this study’s findings suggest that, in the context of time-bound projects, the need to gather precedes the need to integrate.

A similar parallel can also be drawn with prior research on emergent vs. planned project management styles. An emergent style fosters creativity, flexibility, and improvisation, while a planned style emphasizes discipline and direction (Lewis et al., 2002). An emergent style, focused on gathering and cultivating new ideas, manifests itself more predominantly in the early stages of projects (Van De Ven and Polley, 1992), while information gathering and improvisation activities decline over the course of development (Katz, 1982; Lewis et al., 2002).

Consequently, unlike the abrupt transition from exploration to exploitation through the use of binary decisions, the shift of emphasis from plurality to alignment unfolded in a relatively smooth manner through repeated interactions – such as milestone meetings, gate review discussions – which gradually cemented choices and adjusted expectations. As NPD projects progressed, the multiplicity of perspectives and choice flexibility gave way to greater mutual understanding and harder-to-reverse decisions, in line with Van De Ven and Polley’s (1992) argument that as projects move forward, their goals and potential for success become clearer to the team members involved.

In summary, a paradox resolution strategy based on soft temporal differentiation is characterized by: (1) a sequential emphasis on each pole of the duality, (2) a gradual shift in relative emphasis over time, (3) a temporary juxtaposition of opposites, and (4) a reinforcing sequence of integrative decisions at the project level. In paradox theory terms, soft temporal differentiation is a succession of “choice” strategies with an intervening period of “accommodation” when poles are temporarily juxtaposed.

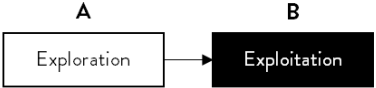
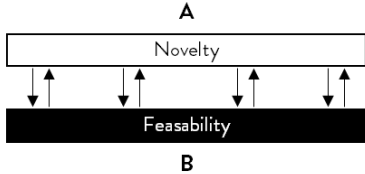
Limited temporal differentiation. Developing new products that were sufficiently novel yet addressed all feasibility constraints was one of the central struggles of the NPD process. The novelty-vs-feasibility duality was manifest throughout all stages of the product development journey. Also, contributors from distinct functional areas tended to protect and promote a specific end of the duality spectrum. The observed dynamics is akin to the freedom-vs.-constraints paradox described in Andriopoulos and Lewis (2009) where design consultancy teams faced the challenge of simultaneously adhering and pushing against the boundaries set by client firms. These authors identified that, even in less innovative projects, development teams always strived to probe the limits of what was feasible. Our study confirms a similar dynamic in the context of feasibility-driven constraints set by internal functions. Furthermore, due to the non-deterministic nature of the NPD process, feasibility issues were not always predictable in advance. Prior scholarly work has often described the NPD process as a continuous problem-solving exercise (e.g., Brown and Eisenhardt, 1995; Clark and Fujimoto, 1990) during which new ideas are needed to address constantly emerging new problems (Sheremata, 2000). In line with this view, this study has shown that the management of tensions related to the novelty-vs-feasibility duality tended to be both proactive and reactive, and was best conducted through a dialectical process between various knowledge domains. Because novelty and feasibility were given constant and equal emphasis, the management of these tensions necessitated that compromises frequently be made throughout the development phase to satisfy both poles of the duality. This dynamic is akin to the notion of “purposeful improvisation” which denotes the ability to leverage existing knowledge and follow established routines while simultaneously challenging boundaries through creativity (Andriopoulos and Lewis, 2009). Lewis et al. (2002) also described how project leaders could enable this dialectical process by iterating between emergent and planned management styles which favor improvisation and discipline, respectively. This ability to iterate between styles to address competing demands has been linked to higher levels of performance (Laufer, 1997). The present study confirms Andriopoulos and Lewis’s (2009) observation of high rates of iterations between

freedom (in this case, novelty) and constraints (in this case, feasibility). From a project-level perspective, this behavioral integration strategy seeks to maintain a balanced emphasis on both poles of a duality at all times, and, therefore, does not exhibit either strict or soft forms of temporal differentiation.

In summary, a paradox resolution strategy based on limited temporal differentiation is characterized by: (1) an interdependent emphasis on each pole of the duality, (2) a stable relative emphasis over time, (3) a permanent juxtaposition of opposites, and (4) high-frequency cycles of integrative decisions at the project level. In paradox theory terms, limited temporal differentiation equates to a pure “accommodation” strategy.

Table 4-4 summarizes how each resolution strategy compares in terms of their management of NPD-related tensions.

Table 4-4: Characterization of Resolution Strategies

	STRICT TEMPORAL DIFFERENTIATION	SOFT TEMPORAL DIFFERENTIATION	LIMITED TEMPORAL DIFFERENTIATION
Pole Emphasis	Simultaneous at the organizational level. Sequential at the project level. Abrupt shift in relative pole emphasis.	Sequential at the project level. Gradual shift in relative emphasis.	Simultaneous at the project level. No shift in relative pole emphasis.
Pole Juxtaposition	No juxtaposition.	Temporary juxtaposition.	Permanent juxtaposition.
Integrative Decision Pattern	Binary decisions delegated to leadership level. Integration through strategic choices. Low frequency.	Sequence of reinforcing decisions at the project level. Integration through roles & processes. Medium frequency.	Cycles of negotiated decisions at the project level. Integration through negotiated commitments. High frequency.
Illustration	 Temporal differentiation (as a result of structural differentiation) Choosing (A) → Choosing (B)	 Temporal differentiation (with gradual transition) Choosing (A) → Accommodating (A&B) → Choosing (B)	 Behavioral integration Accommodating (A&B)

*Corresponding resolution
strategies from ambidexterity
and paradox theory*

This characterization of resolution strategies has a couple of implications. First, it suggests that the ambidexterity approaches discussed in the literature (i.e., structural, temporal, behavioral) can be seen, at the project level, as variants of temporal differentiation. Based on the three variants identified in this study, a reasonable extrapolation can be made that temporal differentiation approaches lie on a spectrum that can be defined by the “smoothness” of the transition in focus between poles (see **Figure 4-2** for an illustration): on the top end, *strict* temporal differentiation with abrupt transitions in focus between the two poles of a duality; as we move down, increasingly *soft(er)* temporal differentiation characterized by a gradual shift in focus between poles; on the bottom end of the spectrum, *no* temporal differentiation as a simultaneous focus on both poles is maintained at all times.

Second, resolution strategies based on any degree of temporal differentiation can be characterized by a set of measurable constructs that relate to the ways opposing poles of a duality are addressed over time. These constructs, in turn, allow for the development of testable propositions linking the use of specific resolution strategies to their propensity to embed tensions in a given task environment. The next section will put forward five such propositions and build a preliminary conceptual model around them.

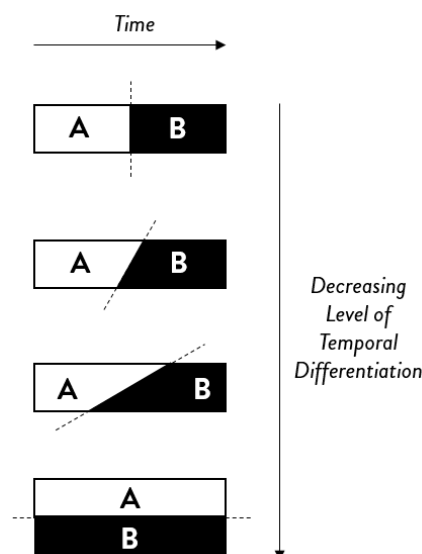


Figure 4-2: Temporal Differentiation Spectrum

4.7 Preliminary Conceptual Model

Paradoxes emerge “when elements that seem logical in isolation but absurd and irrational when appearing simultaneously” (Lewis, 2000: p.760). From this definition, one can infer that it is the *simultaneous appearance* of opposites (i.e., their juxtaposition) that gives rise to paradoxical tensions. The findings from this study support this assertion insofar as informants’ experiences of tension often suggested strong proximity in time or in space between opposing poles of a duality. Indeed, these opposites were often mentioned within the same individual comment: “generate ideas” and “respect industrial constraints,” “be disruptive” and “be profitable,” “design the appropriate solution” and “use the quickest solution.” The first proposition, therefore, postulates that the greater the juxtaposition of opposites (previously defined as the extent to which opposing poles are emphasized *simultaneously* within a given task environment), the greater the level of paradoxical tension.

Proposition 1: The degree of pole juxtaposition is positively related to the level of paradoxical tension.

When relating their experience of paradoxical tensions, informants used verbs such as “negotiate,” “convince,” “spar,” or “collaborate” to describe the interactions between groups of individuals pursuing conflicting objectives (e.g., R&D and marketing, engineering and sales, franchisors and franchisees). These words suggest that tensions arise when equally powerful constituencies pursue equally important goals. This intuition is supported by Hargrave and Van de Ven (2017) who point to the distribution of power between contradictory elements as a key contingency to the management of dualities. When that distribution of power is uneven, they argue, the subordinate element is *assimilated* by the dominant element and “the tension between [them] is not engaged” (p.331). When combined with the previous proposition, this insight suggests that the impact of pole juxtaposition on the level of tension will depend on the extent to which poles are equally emphasized (i.e., given equal attention in terms of effort, time, and resources). Indeed, pole juxtaposition alone may not

be sufficient to sustain tensions in cases where efforts to support a specific pole of the duality clearly dominate. This anticipated moderating effect is captured in the following proposition:

Proposition 2: The relationship between pole juxtaposition and the level of paradoxical tension is moderated by the degree to which poles are equally emphasized. The more equal the emphasis between poles, the stronger the effect of pole juxtaposition on the level of paradoxical tension.

As illustrated in **Table 4-4**, the extent to which poles are juxtaposed or emphasized depends on the particular choice of resolution strategy. More specifically, I argue that pole juxtaposition and relative pole emphasis are mediating variables that are, themselves, dependent on the degree of temporal differentiation and frequency of integrative decisions that characterize these different strategies. Since temporal differentiation denotes “the sequential allocation of attention to divergent goals” (Levinthal and March, 1993:p.98), it logically follows that the greater the degree of temporal differentiation the less the poles are juxtaposed.

Proposition 3: The degree of temporal differentiation is negatively related to the degree of pole juxtaposition.

Temporal differentiation may also negatively impact the equal emphasis of opposites as transitions between periods of focus may be hampered by inertia in the current mode (Gupta, Smith and Shalley, 2006). Additionally, studies of punctuated equilibrium at the organizational (e.g., Tushman and Romanelli, 1985) and project team level (e.g., Gersick, 1988) suggest that transitions between stages that differ in aim and focus are driven by environmental factors rather than carefully planned. This non-deterministic aspect of temporal differentiation approaches may, therefore, jeopardize the balanced pursuit of conflicting objectives, which leads to the following proposition:

Proposition 4: The degree of temporal differentiation is negatively related to the equal emphasis of opposing poles.

While differentiation tactics seek to maximize the unique benefits of opposing poles, integration mechanisms help accentuate their interdependence and accommodate a dual emphasis (Andriopoulos and Lewis, 2009). Integration touchpoints also serve to lessen the competition and foster cooperation between contradictory agendas (Smith and Tushman, 2005). In line with these findings, all resolution strategies discussed in this study included integrative decisions (e.g., portfolio design, initiative planning, review meetings, negotiated commitments) whose aim was to foster a balanced reconciliation of conflicting objectives. These integrative efforts led to a process of mutual adjustment between distinct teams and organizational units, and served to mitigate the tendency of high-differentiation contexts to promote the pursuit of self-interested goals. Importantly, integrative decisions occurred with varying frequencies depending on the devices used to trigger them (e.g., strategic decision-making, roles and processes, ad-hoc negotiations). Based on these findings and the above rationale, I posit that the *frequency* of integrative decisions will have a moderating effect on the relationship between the degree of temporal differentiation and the equal treatment of opposites:

***Proposition 5:** The relationship between the degree of temporal differentiation and equal pole emphasis is moderated by the frequency of integrative decisions. The higher the frequency of integrative decisions, the less negative the impact of temporal differentiation on equal pole emphasis.*

Together, these propositions lead to the development of a preliminary conceptual model shown in **Figure 4-3**, which aims to explain how specific features of resolution strategies cause tensions to be more or less deeply embedded in the project context. Importantly, the model suggests that it is the *interaction* of practices related to “choice” and “accommodation” strategies that causes tensions to become embedded in a given task environment and that this effect operates through basic notions related to the treatment of opposites over time.

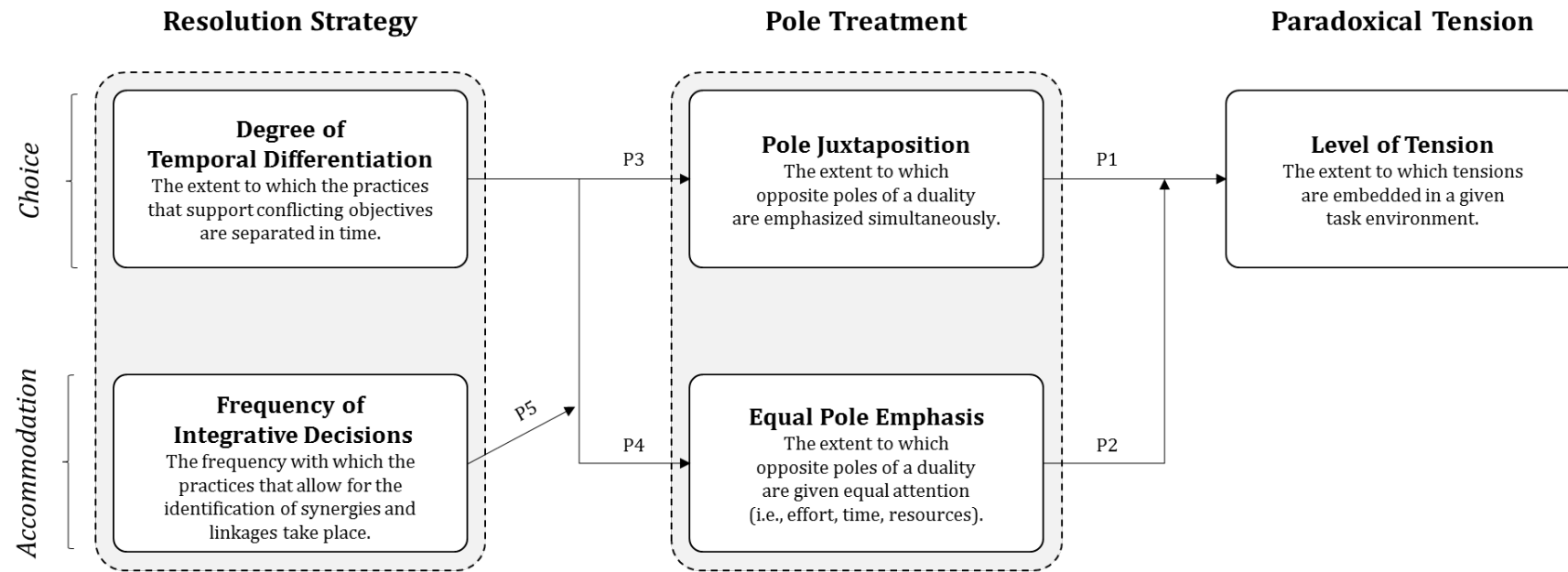


Figure 4-3: Preliminary Conceptual Model

4.8 Discussion

4.8.1 Implications for Theory

The ability to sustain commitment to conflicting objectives is an essential part of effective paradox management (Smith, 2014). While paradox resolution strategies are implemented in response to experienced tensions, these strategies, in turn, influence the degree to which these tensions become embedded within the organizational context (Smith and Lewis, 2011).

In the context of NPD projects, the present study suggests that resolution strategies are endowed with certain features that influence how opposing poles of a given duality are emphasized over time, which will cause tensions to become more or less deeply embedded in the task environment of the project. Given the double-edged nature of paradoxical tensions (Lewis, 2000; Smith and Berg, 1987), there may be benefits to controlling how deeply tensions are embedded in a given context. For example, in situations where paradoxical tensions are likely to be embraced and leveraged, resolution strategies can be selected based on their ability to maintain and foster tensions, whereas in contexts where tensions trigger anxiety and inertia, strategies that reduce or eliminate tensions may be more effective. This insight motivated the investigation of the mechanisms by which resolution strategies embed tensions in the context of NPD projects.

This study's first contribution to paradox theory is to provide a set of measurable constructs to express, in the language of paradox, a variety of resolution strategies from other literatures. In particular, I show how the approaches discussed in ambidexterity research – namely temporal differentiation (whether induced by structural differentiation or not) and behavioral integration – can be characterized, at the meta-theoretical level of paradox, by their different treatment of opposites over time. The constructs identified (i.e., pole emphasis, pole juxtaposition) thus provide an initial lexicon for characterizing resolution strategies discussed in research streams concerned with the management of conflicting objectives (e.g., organizational identity theory, stakeholder theory).

The second contribution to paradox theory comes from the preliminary conceptual model that links the above constructs through a set of testable propositions. Importantly, this conceptual model clarifies the “closing link” of Smith and Lewis's (2011) dynamic equilibrium model by positing the causal mechanisms that explain how resolution strategies, as organizing processes, embed tensions in the context of NPD projects. Acknowledging and specifying the role that resolution strategies play in embedding paradoxical tensions complements Smith's (2015) conclusion that tensions are sustained through “consistently inconsistent” decision patterns of senior leaders. Indeed, the present study suggests that, even at lower organizational levels (e.g., project level) where strategic decision making may be less prevalent, paradoxical tensions can still be sustained through the selection of appropriate resolution strategies. This insight may be especially valuable in time-bound contexts, such as NPD projects, where the ability to sustain paradoxes through shifting patterns of strategic decisions over extended periods of time may be absent or, at least, severely curtailed. In short, the present study suggests that, in more operational contexts, there may be alternative ways of sustaining paradoxes beyond strategic decision making by senior leadership.

Finally, this study makes two contributions to ambidexterity theory by adding to the relatively sparse set of studies that have investigated the topic at the project level (Turner, Swart and Maylor, 2013). First, the findings suggest that, in the context of *time-bound* projects, *time* is an important element in the analysis of ambidexterity strategies. By showing how traditional ambidexterity approaches (i.e., structural differentiation, temporal differentiation, and behavioral integration) can be mapped to variants of temporal differentiation, this study allows for a project-level logic of ambidexterity which incorporates the time dimension at its core.

Second, this study moves beyond the categorical labeling of ambidexterity approaches to provide a unified perspective on these strategies as variants of temporal differentiation. This perspective is useful to project-level ambidexterity research as it facilitates the development of shared constructs that can be used

for comparative analyses across strategies. Indeed, the present study is an illustration of how the use of the temporal differentiation perspective allowed for the definition of shared constructs that could then be used to compare resolution strategies and infer an impact on a specific outcome.

4.8.2 Implications for Practice

While effective NPD processes are central to the long-term success of firms (Cooper, 1993; Ulrich and Eppinger, 1995; Wheelwright and Clark, 1995), they are also fraught with tensions (Dougherty, 1996) that can either benefit or hamper performance (Lewis, 2000). Therefore, depending on the organization's (in)ability to leverage tensions, resolution strategies can provide managers with a valuable tool to control how deeply tensions are embedded in a given task environment. The present study suggests that innovation leaders have at least two means at their disposal to do this: first, the degree of temporal separation between practices that support conflicting objectives; second, the manner and frequency with which individuals or teams interact to reconcile these objectives.

This study offers practitioners some guidance regarding the selection of specific strategies based on the level of tension they are each likely to create. If the aim is to avoid tensions at the project level, leaders may favor a structural separation between teams that pursue conflicting objectives and delegate integrative decision-making to a higher organizational level. This approach ensures a lower level of tension at the team level as there will be little juxtaposition of contradictory demands. Leaders must, however, take on the responsibility for integrating opposites as project teams cannot be expected to unlock the synergistic potential of tensions they no longer experience. Alternatively, in contexts where NPD teams must pursue conflicting objectives whose priority (i.e., emphasis) vary over time, leaders may wish to implement practices that will enact some degree of temporal differentiation to support the desired shift in priority over the life of the project. With these types of strategies, the level of tension experienced by the project team will depend, in part, on the relative priority given to each set of conflicting objectives at any given time. Finally, in situations where reconciling conflicting objectives and unlocking

creative synergies is a central and on-going responsibility of teams, leaders may want to avoid implementing practices that promote temporal differentiation in order to maintain the necessary level of paradoxical tensions within the task environment.

4.9 Limitations and Future Research

This exploratory study has a few methodological limitations. First, the number of informants is relatively small, which could impact the transferability of the findings. Second, the study relies exclusively on retrospective narratives for the inferences it makes about the development of new products over time. Longitudinal studies would offer a more robust approach to the investigation of such contexts. Third, the reliability of the findings would be improved by having additional coders analyze the interview transcripts. Finally, there is potential for informant bias as I did not have the opportunity to cross-validate findings through additional informants or data sources from the organizations included in this study.

The conceptual model developed in this study is still very preliminary. Further research is needed to enrich this model through the identification of additional constructs and the refinement of its propositions. In particular, other “choice” and “accommodation” strategies (beyond temporal differentiation and frequency of integrative decisions) should be added to the model, and their relationships to the treatment of opposites should be examined. To help in this process, it may be helpful to turn to other literatures. Indeed, while ambidexterity approaches have been used to address dualities beyond those associated with paradoxes of *learning*, a variety of other research streams concern themselves more specifically with paradoxes of *organizing* (e.g., Adler, Goldoftas and Levine, 1999; Siggelkow and Levinthal, 2003), *belonging* (e.g., Huy, 2002; Pratt and Foreman, 2000) and *performing* (e.g., Gittell, 2004; Kaplan and Norton, 1996). Additional research might investigate the extent to which the resolution strategies discussed in these other literatures fit into the proposed model.

If, as suggested, paradoxical tensions can be embedded in the project context, then it follows that the responsibility to manage these tensions will fall on the

project team. This poses an interesting question as to the types of teams best equipped to deal with such tensions. While prior studies have shown that the ability to think paradoxically may be an important precondition to the effective management of tensions (e.g., Ingram et al., 2014; Miron-Spektor et al., 2018), these studies focused on the individual level rather than team level of analysis. Therefore, there is still much to discover about the distribution of paradoxical thinking abilities within teams.

Finally, an investigation of the boundary conditions of the proposed model is also needed. Because this study focused exclusively on the analysis of time-bound projects, its validity for non-temporary contexts remains unclear.

4.10 Conclusion

New product development teams experience high levels of paradoxical tensions as they seek to reconcile a wide variety of conflicting objectives. While tensions may fuel creativity and offer potential for synergies, they can also trigger anxiety and paralysis. Whereas existing research has focused mainly on ways to improve the capabilities of *actors* to identify, accept, and manage tensions, this study offers a complementary approach and discusses ways in which the *task environment* can be shaped to exhibit the desired level of tension. Specifically, it highlights the role that paradox resolution strategies play in embedding paradoxical tensions in NPD projects and discusses the causal mechanisms at play.

4.11 References

- Adler, P.S., Goldoftas, B. and Levine, D.I. (1999) 'Flexibility versus efficiency? A case study of model changeovers in the Toyota production system.', *Organization Science*, 10(1), pp. 43–68.
- Ancona, D.G. and Caldwell, D.F. (1992) 'Bridging the boundary: External activity and performance in organizational teams.', *Administrative Science Quarterly*, 37(4) Administrative Science Quarterly, pp. 634–665.
- Andriopoulos, C. and Lewis, M.W. (2009) 'Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation.', *Organization Science*, 20(4), pp. 696–717.
- Atuahene-Gima, K. and Murray, J.Y. (2007) 'Exploratory and exploitative learning in new product development: A social capital perspective on new technology ventures in China.', *Journal of International Marketing*, 15(2), pp. 1–29.
- Benner, M.J. and Tushman, M.L. (2003) 'Exploitation, exploration, and process management: The productivity dilemma revisited.', *Academy of Management Review*, 28(2), pp. 238–256.
- Birkinshaw, J. and Gibson, C. (2004) 'Building ambidexterity into an organization.', *MIT Sloan Management Review*, 45(4) Sloan Management Review, pp. 47–55.
- Birkinshaw, J. and Gupta, K. (2013) 'Clarifying the distinctive contribution of ambidexterity to the field of organization studies.', *Academy of Management Perspectives*, 27(4), pp. 287–298.
- Boumgarden, P., Nickerson, J. and Zenger, T.R. (2012) 'Sailing into the wind: Exploring the relationships among ambidexterity, vacillation, and organizational performance.', *Strategic Management Journal*, 33(6), pp. 587–610.
- Bradach, J.L. (1997) 'Using the plural form in the management of restaurant chains.', *Administrative Science Quarterly*, 42(2), pp. 276–303.

Brown, S.L. and Eisenhardt, K.M. (1997) 'The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations.', *Administrative Science Quarterly*, 42(1), pp. 1–34.

Brown, S.L. and Eisenhardt, K.M. (1995) 'Product development : Past research , present findings , and future directions.', *Academy of Management Review*, 20(2), pp. 343–378.

Burns, T. and Stalker, G.M. (1961) *The management of innovation*. London: Tavistock.

Cameron, K. and Lavine, M. (2006) *Making the impossible possible: Leading extraordinary performance*. San Francisco: Berrett-Koehler.

Cameron, K. and Quinn, R. (1988) 'Organizational paradox and transformation.', in Cameron, K. and Quinn, R. (eds.) *Paradox and transformation: Toward a theory of change in organization and management organization and management*. Cambridge, MA: Ballinger Publishing Company.

Chandler, A. (1977) *The visible hand*. Cambridge, MA: Harvard University Press.

Christensen, C.M. (1998) *The innovator's dilemma*. Cambridge, MA: Harvard Business School Press.

Clark, K.B. and Fujimoto, T. (1990) 'The power of product integrity.', *Harvard Business Review*, 68(6), pp. 107–118.

Clegg, S.R., Vieira Da Cunha, J. and Pina E Cunha, M. (2002) 'Management paradoxes: A relational view.', *Human Relations*, 55(5), pp. 483–503.

Cooper, R.G. (1990) 'Stage-gate systems: A new tool for managing new products.', *Business Horizons*, 33(3), pp. 44–54.

Cooper, R.G. (1993) *Winning at New Products: Accelerating from Idea to Launch*. 2nd edn. Addison-Wesley.

Dearborn, D. and Simon, H. (1958) 'Selective perception: A note on the departmental identifications of executives.', *Sociometry*, 21(2), pp. 140–144.

Dougherty, D. (1996) 'Organizing for innovation.', in Clegg, S. R., Hardy, C. and Nord, W. R. (eds.) *Handbook of organization studies*. Thousand Oaks, CA: Sage, pp. 424–439.

Dougherty, D. (1992) 'A practice-centered model of organizational renewal through product innovation.', *Strategic Management Journal*, 13(1 S), pp. 77–92.

Duncan, R.B. (1976) 'The ambidextrous organization: Designing dual structures for innovation.', in *The management of organization design - Strategies and Implementation*. New York: North Holland, pp. 167–189.

Eisenhardt, K.M. (2000) 'Paradox, spirals, ambivalence: The new language of change and pluralism.', *Academy of Management Journal*, 25(4), pp. 703–705.

Eisenhardt, K.M. and Graebner, M.E. (2007) 'Theory building from cases: Opportunities and challenges.', *Academy of Management Journal*, 50(1), pp. 25–32.

Eisenhardt, K.M. and Westcott, B. (1988) 'Paradoxical demands and the creation of excellence: The case of just-in-time manufacturing.', in Quinn, R. E. and Cameron, K. S. (eds.) *Paradox and transformation: Toward a theory of change in organization and management organization and management*. Cambridge, MA: Ballinger, pp. 169–194.

Farjoun, M. (2002) 'The dialectics of institutional development in emerging and turbulent fields: The history of pricing conventions in the on-line database industry.', *Academy of Management Journal*, 45(5), pp. 848–874.

Gavetti, G. and Levinthal, D. (2000) 'Looking forward and looking backward: Cognitive and experiential search.', *Administrative Science Quarterly*, 45(1), pp. 113–137.

Gersick, C.J.G. (1988) 'Time an transition in work teams: Toward a new model of group development.', *Academy of Management Journal*, 31(1), pp. 9–41.

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

Gilbert, C.G. (2005) 'Unbundling the structure of inertia: Resource versus routine rigidity.', *Academy of Management Journal*, 48(5), pp. 741–763.

Gioia, D.A., Corley, K.G. and Hamilton, A.L. (2013) 'Seeking qualitative rigor in inductive research: Notes on the gioia methodology.', *Organizational Research Methods*, 16(1), pp. 15–31.

Gittell, J.H. (2004) 'Paradox of coordination and control.', *California Management Review*, 42(3), pp. 101–117.

Graetz, F. and Smith, A. (2005) 'Organizing forms in change management: The role of structures, processes and boundaries in a longitudinal case analysis.', *Journal of Change Management*, 5(3), pp. 311–328.

Griffin, A. and Hauser, J.R. (1996) 'Integrating R&D and marketing: A review and analysis of the literature.', *Journal of Product Innovation Management*, 13(3), pp. 191–215.

Gupta, A.K., Raj, S.P. and Wilemon, D. (1985) 'The R&D-marketing interface in high-technology firms.', *The Journal of Product Innovation Management*, 2(1), pp. 12–24.

Gupta, A.K., Raj, S.P. and Wilemon, D. (1986) 'A model for studying R&D-marketing interface in the product innovation process.', *Journal of Marketing*, 50(2), pp. 7–17.

Gupta, A.K., Smith, K.G. and Shalley, C.E. (2006) 'The interplay between exploration and exploitation.', *Academy of Management Journal*, 49(4), pp. 693–706.

Hargrave, T.J. and Van de Ven, A.H. (2017) 'Integrating dialectical and paradox perspectives on managing contradictions in organizations.', *Organization Studies*, 38(3–4), pp. 319–339.

Huy, Q.N. (2002) 'Emotional balancing of organizational continuity and radical change: The contribution of middle managers.', *Administrative Science Quarterly*, 47(1), p. 31.

Ingram, A.E., Lewis, M.W., Barton, S. and Gartner, W.B. (2014) 'Paradoxes and innovation in family firms: The role of paradoxical thinking.', *Entrepreneurship: Theory and Practice*, 40(1), pp. 161–176.

Kaplan, R.S. and Norton, D.P. (1996) 'Using the balanced scorecard as a strategic management system.', *Harvard Business Review*, 74(1), pp. 75–85.

Katz, R. (1982) 'The effects of group longevity on project communication and performance.', *Administrative Science Quarterly*, 27(1), p. 81.

Kauppila, O.-P. (2010) 'Creating ambidexterity by integrating and balancing structurally separate interorganizational partnerships.', *Strategic Organization*, 8(4), pp. 283–312.

Khurana, A. and Rosenthal, S.R. (1998) 'Towards holistic “front ends” in new product development.', *Journal of Product Innovation Management*, 15(1), pp. 57–74.

Kim, J. and Wilemon, D. (2002) 'Focusing the fuzzy front-end in new product development.', *R and D Management*, 32(4), pp. 269–279.

Laufer, A. (1997) *Simultaneous management: Managing projects in a dynamic environment*. Boston: AMACOM.

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

Lewis, M.W. (2000) 'Exploring paradox : Toward a more comprehensive guide.', *The Academy of Management Review*, 25(4), pp. 760–776.

Lewis, M.W., Ann Welsh, M., Dehler, G.E. and Green, S.G. (2002) 'Product development tensions: Exploring contrasting styles of project management.', *Academy of Management Journal*, 45(3), pp. 546–564.

- Lewis, M.W. and Smith, W.K. (2014) 'Paradox as a metatheoretical perspective: Sharpening the focus and widening the scope.', *Journal of Applied Behavioral Science*, 50(2), pp. 127–149.
- Locke, K., Golden-Biddle, K. and Feldman, M.S. (2008) 'Perspective—Making doubt generative: Rethinking the role of doubt in the research process.', *Organization Science*, 19(6), pp. 907–918.
- Losada, M. and Heaphy, E. (2004) 'The role of positivity and connectivity in the performance of business teams: A nonlinear dynamics model.', *Journal of Applied Behavioral Science*, 47(6), pp. 740–765.
- Lovas, B. and Ghoshal, S. (2000) 'Strategy as guided evolution.', *Strategic Management Journal*, 21(9), pp. 875–896.
- Maidique, M.A. and Hayes, R.H. (1984) 'The art of high-technology management.', *Sloan Management Review*, 25(2), pp. 17–31.
- Mantere, S. and Ketokivi, M. (2013) 'Reasoning in organization science.', *Academy of Management Review*, 38(1), pp. 70–89.
- March, J.G. (1991) 'Exploration and exploitation in organizational learning.', *Organization Science*, 2(1), pp. 71–87.
- Minoja, M. (2012) 'Stakeholder management theory, firm strategy, and ambidexterity.', *Journal of Business Ethics*, 109(1), pp. 67–82.
- Miron-Spektor, E., Ingram, A., Keller, J., Smith, W.K. and Lewis, M.W. (2018) 'Microfoundations of organizational paradox: The problem is how we think about the problem.', *Academy of Management Journal*, 61(1), pp. 26–45.
- O'Reilly, C.A. and Tushman, M.L. (2004) 'The ambidextrous organization.', *Harvard Business Review*, 82(4), pp. 74–81.
- O'Reilly, C.A. and Tushman, M.L. (2013) 'Organizational ambidexterity: Past, present, and future.', *Academy of Management Perspectives*, 27(4), pp. 324–338.

- O'Reilly, C.A. and Tushman, M.L. (2008) 'Ambidexterity as a dynamic capability: Resolving the innovator's dilemma.', *Research in Organizational Behavior*, 28, pp. 185–206.
- Papachroni, A., Heracleous, L. and Paroutis, S. (2015) 'Organizational ambidexterity through the lens of paradox theory: Building a novel research agenda.', *Journal of Applied Behavioral Science*, 51(1), pp. 71–93.
- Pierce, J.R. and Aguinis, H. (2013) 'The too-much-of-a-good-thing effect in management.', *Journal of Management*, 39(2), pp. 313–338.
- Pratt, M.G. and Foreman, P.O. (2000) 'Classifying managerial responses to multiple organizational identities.', *Academy of Management Review*, 25(1), pp. 18–42.
- Qiu, J., Donaldson, L. and Luo, B.N. (2012) 'The benefits of persisting with paradigms in organizational research.', *The Academy of Management Perspectives*, 26(1), pp. 93–104.
- Quinn, R.E. (1988) *Mastering the paradoxes and competing demands of high performance*. San Francisco: Jossey-Bass.
- Raisch, S. and Birkinshaw, J. (2008) 'Organizational ambidexterity: Antecedents, outcomes, and moderators.', *Journal of Management*, 34(3), pp. 375–409.
- Ritzer, G. (2001) *Explorations in social theory: From metatheorizing to rationalization*. London: Sage.
- Rosenbloom, R.S. (2000) 'Leadership, capabilities, and technological change: The transformation of NCR in the electronic era.', *Strategic Management Journal*, 21(10–11), pp. 1083–1103.
- Rothaermel, F.T. and Deeds, D.L. (2004) 'Exploration and exploitation alliances in biotechnology: A system of new product development.', *Strategic Management Journal*, 25(3), pp. 201–221.

Rothenberg, A. (1979) *The emerging goddess*. Chicago: University of Chicago Press.

Seo, M.-G., Putnam, L. and Bartunek, J.M. (2004) 'Dualities and tensions of planned organizational change.', in Poole, S. and Van de Ven, A. (eds.) *Handbook of organizational change*. Oxford: Oxford University Press, pp. 73–107.

Sheremata, W.A. (2000) 'Centrifugal and centripetal forces in radical new product development under time pressure.', *Academy of Management Review*, 25(2) Academy of Management, pp. 389–408.

Siggelkow, N. and Levinthal, D.A. (2003) 'Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation.', *Organization Science*, 14(6), pp. 650–669.

Smith, K.K. and Berg, D.N. (1987) *Paradoxes of group life : understanding conflict, paralysis, and movement in group dynamics*. San Francisco: Jossey-Bass.

Smith, P.G. and Reinertsen, D.G. (1992) 'Shortening the product development cycle.', *Research Technology Management*, 35(3), pp. 44–49.

Smith, W.K. (2014) 'Dynamic decision making: A model of senior leaders managing strategic paradoxes.', *Academy of Management Journal*, 57(6), pp. 1592–1623.

Smith, W.K. and Lewis, M.W. (2011) 'Toward a theory of paradox: A dynamic equilibrium model of organizing.', *Academy of Management Review*, 36(2), pp. 381–403.

Smith, W.K. and Tushman, M.L. (2005) 'Managing strategic contradictions: A top management model for managing innovation streams.', *Organization Science*, 16(5), pp. 522–536.

Tripsas, M. (1997) 'Surviving radical technological change through dynamic capability: Evidence from the typesetter industry.', *Industrial and Corporate Change*, 6(2), pp. 341–377.

Turner, N., Swart, J. and Maylor, H. (2013) 'Mechanisms for managing ambidexterity: A review and research agenda.', *International Journal of Management Reviews*, 15(3) Wiley-Blackwell, pp. 317–332.

Turner, N., Swart, J., Maylor, H. and Antonacopoulou, E. (2016) 'Making it happen: How managerial actions enable project-based ambidexterity.', *Management Learning*, 47(2), p. 1350507615610028-.

Tushman, M.L. and O'Reilly, C.A. (1996) 'Ambidextrous organizations: Managing evolutionary and revolutionary change.', *California Management Review*, 38(4), pp. 8–30.

Tushman, M.L. and Romanelli, E. (1985) 'Organizational evolution: A metamorphosis model of convergence and reorientation.', *Research in organizational behavior*, 7, pp. 171–222.

Ulrich, K. and Eppinger, S. (1995) *Product design and development*. McGraw Hil. New York: McGraw-Hill Inc.

Van De Ven, A.H. and Polley, D. (1992) 'Learning while innovating.', *Organization Science*, 3(1), pp. 92–116.

Wang, Z., Huang, J. and Tan, B. (2013) 'Managing organizational identity in the e-commerce industry: An ambidexterity perspective.', *Information and Management*, 50(8), pp. 673–683.

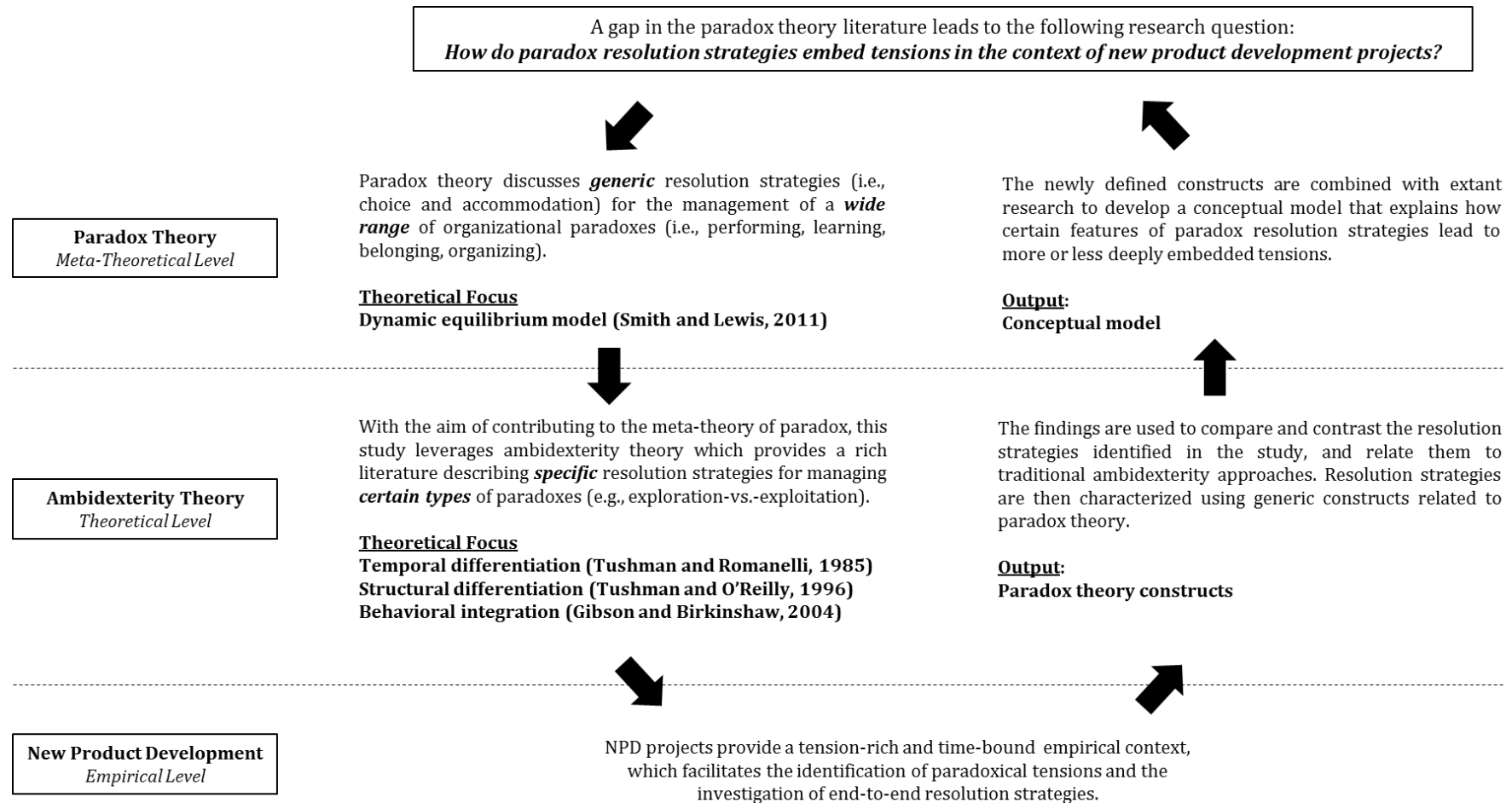
Weick, K.E. and Quinn, R.E. (1999) 'Organizational change and development.', *Annual Review of Psychology*, 50, pp. 361–386.

Weick, K.E., Sutcliffe, K.M. and Obstfeld, D. (1999) 'Organizing for high reliability: Processes of collective mindfulness.', *Research in Organizational Behavior*, 1(1), pp. 81–123.

Wheelwright, S. and Clark, K. (1995) *Leading product development*. Free Press.
New York: Free Press.

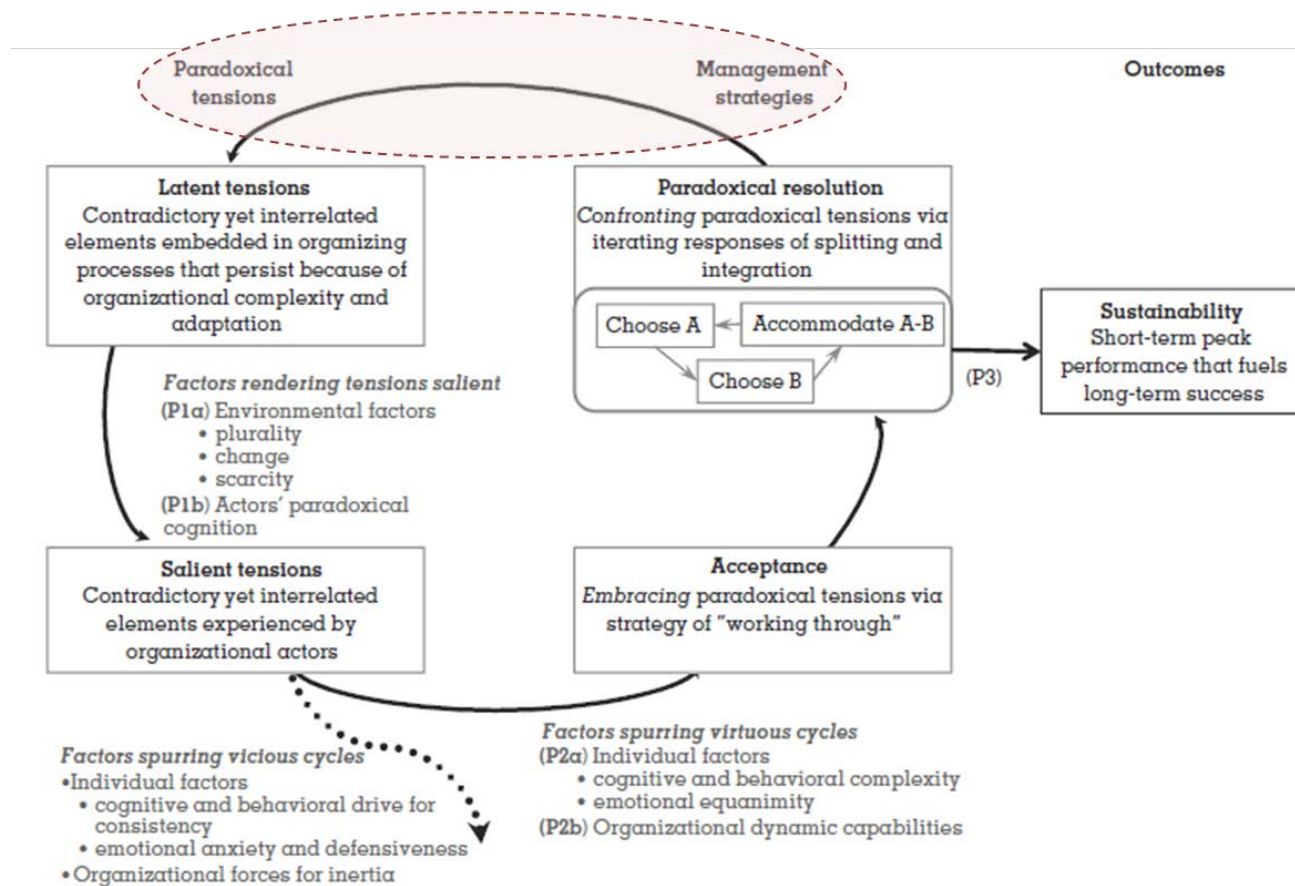
4.12 Appendices

Appendix 4-1: Methodological Approach



Appendix 4-2: Dynamic Equilibrium Model (Smith and Lewis, 2011)

How do paradox resolution strategies embed tensions in the context of new product development projects?



Appendix 4-3: Research Project Teaser Sent to Prospective Informants



THE RESEARCH PROJECT

WHO AM I?
My name is Frédéric Delley, and I am a senior lecturer of innovation management at the Ecole hôtelière de Lausanne (Switzerland). I am also currently pursuing my Doctorate in Business Administration at the Cranfield School of Management in the U.K.

WHAT AM I INVESTIGATING?
I would like to engage with senior innovation leaders to discuss the kinds of tensions and conflicting objectives that arise in the context of new product development projects, as well as how these tensions are managed over time.

MY REQUEST

To gain insight into this question, I am conducting one-on-one interviews with senior managers who have strategic and innovation responsibilities.

The interview will...

- ... last about **45 minutes**.
- ... take place **in person or on the phone/skype** based on the interviewee's preference.
- ... be conducted **in English or French** based on the interviewee's preference.
- ... be **audio recorded** for later analysis.
- ... remain completely **anonymous** (no person or organization will be identified by name).

Research findings may later be published in academic and/or practitioner journals.

WHAT'S IN IT FOR YOU?

One of my objectives is to make this research relevant and valuable to practitioners. Consequently, upon completion of the research, I will...

- ...share with you the key research findings in the form of an **executive summary** that you will be free to disseminate within your organization.
- ...make myself available to you and/or your organization as a **guest speaker** and/or **workshop moderator**.



frederic.delley@ehl.edu **+41 21 785 15 00**

Appendix 4-4: Interview Guide

To get us started, would you mind telling me a little bit about your job as well as your responsibilities when it comes to the development of new products?

How long have you been working in the area of new product development, and could you estimate how many new product development projects you have been directly involved in over your career?

Could you start by describing what the typical process looks like for developing new products?

Ask whether a stage-gate process is used. Ask for names of stages and gates.

Ask for the length of the NPD process.

Ask what kinds of people and teams are typically involved in the NPD process.

I would like now to understand more about the types of tensions that arise in the process of developing new products. In particular, I am interested in tensions that relate to having to satisfy competing demands or achieve conflicting objectives.

Do you have examples of such tensions that come to mind?

Ask for illustration, example, story.

Ask to specify when the tension is most acute.

So, if I understand correctly, the tension is between [A] and [B]. (Ask to confirm.)

How is this tension between [A] and [B] being managed?

Ask what people, tools, processes, etc. are most helpful to manage this tension.

Ask when in the NPD process, these people, tools, processes, etc. are used to manage this tension.

Ask what the main challenges are when managing this tension.

[GO BACK TO 3 UNTIL NO MORE TENSIONS ARE MENTIONED OR END OF INTERVIEW TIME]

We are getting near the end of this interview, but I wanted to ask you one last question:

Is there anything that you think – because of your particular position or because of your specific industry – is unique or distinctive about the topic we've discussed?

Anything that you feel I am unlikely to hear in other interviews?

5 RESEARCH IMPACT ASSESSMENT

This chapter fulfills the requirement of all DBA theses to demonstrate engagement with, and impact on, practice. Specifically, it seeks to achieve the following four objectives:

- Provide evidence of my engagement with practitioners throughout the doctoral process, and explain how this engagement has shaped my research;
- Identify the key learnings from the research and explain how they have affected my own practice;
- Describe a plan for the future dissemination and exploitation of my research;
- Reflect on the impact that the wider doctoral process has had on my own practice and organization.

Appendix 5-1 provides a high-level illustration of engagement and dissemination opportunities throughout the DBA process.

5.1 Engagement with Practitioners during the Research Process

In the course of the past four years, I have engaged with practitioners at various stages of the research process, from the formulation of a practical business problem to the design and conduct of my empirical studies.

Appendix 5-2 lists the people I have interacted with at specific stages of the doctoral process. The following sections describe how I have sought inputs and suggestions from professionals throughout the DBA project, as well as discusses the significant redirection in research focus that resulted from the simultaneous engagement with both practice and theory. As such, the following sections are also the story of the shift in research focus from franchise organizations to innovation teams.

5.1.1 Problem Formulation

My professional interest lies in the field of innovation management. While my educational and professional background is in data communication systems, for the past nine years I have been working at a leading hospitality school in Switzerland where I supervise junior consulting projects and teach an elective course on innovation management. Over the years, I have supervised the development of more than 150 innovation projects for all types of organizations in the hospitality and related sectors. As a result, I have had numerous interactions with industry professionals, out of which a strikingly consistent message emerged: the age-old hospitality sector suffers from deeply ingrained mental models and rigid structures that render more difficult the adaptation process to the on-going disruption created by the arrival of such companies as Airbnb and Booking.com. This adaptation challenge is particularly acute for large established organizations. An interesting feature of these companies is their broad use of franchising as an organizational form. While franchising, as a business model, has achieved considerable success, this way of organizing creates its own permanent struggle between uniformity and adaptability. Specifically, practitioners emphasize certain features of franchise systems that simultaneously support and hamper the organization's ability to innovate. These concerns translate into pragmatic business questions such as:

- To what extent should franchisors rely on franchisees as the primary source of innovative ideas?
- How can franchisors convince franchisees to adopt innovations, and deploy them in an effective and timely manner?
- How does a franchise organization keep innovating without compromising the coherence and uniformity of the customer experience?

Adaptation challenges are particularly acute for franchise organizations as they operate two fundamentally different business models concurrently: that of the franchisor and that of the franchisees. The former focuses on rapid expansion, economies of scale, and brand building, while the latter is designed to optimize the operational efficiency and profitability of individual outlets. While a franchisor

and its franchisees are both interested in the success of the franchise brand as a whole, each is driven by different – often conflicting – incentives; what is good for the franchisor is not always good for the franchisees and vice versa – yet, both depend on the other for their success. These practitioners' insights into the innovation challenges inherent in the franchise organizational form provided the original context for my research project. From there, I proceeded to conduct a scoping study to get a better sense for the work that had already been done on these issues, identify potential theoretical frameworks of interest, and uncover opportunities for theoretical contributions to the field of franchising and innovation research.

I started to explore the academic literature on franchising and organizational adaptation and came across theories and concepts such as dynamic capabilities, ambidexterity, and absorptive capacity. While realizing the necessity to immerse myself more fully in the academic literature, I sustained my engagement with professionals to ensure the continued relevance of my research. To do so, I conducted several meetings with the top management team of the franchise organization I had identified for my empirical research. During these meetings, I presented my findings and intended research focus, which allowed me to gauge the relevance of the various theoretical lenses I was considering, as well as to clarify with my interlocutors the core practical problem my research should address. It was through this back-and-forth process between theory and practice that I was able to refine my research focus to an investigation of how franchise organizations can effectively explore and exploit. Before embarking on a more extensive review of the literature, my supervisor and I discussed the possibility of further narrowing the theoretical scope while simultaneously broadening the range of possible empirical contexts. We agreed that the literature review should focus on the nature and effectiveness of integration mechanisms used in the management of the exploration and exploitation duality (a more specific theoretical angle yet still relevant to franchise organizations). We also decided that, depending on the outcome of the literature review, I should remain open to empirical contexts beyond franchising.

The systematic literature review was an important turning point in my doctoral project as it revealed an opportunity to investigate the integration of exploration and exploitation efforts *through the lens of paradox theory*, the perspective that was to underpin the two empirical studies that followed. The review revealed a gap in the paradox theory literature, namely the relative lack of theorization and empirical work *at the team level of analysis*. As anticipated, addressing this gap required that I consider empirical contexts other than those of franchise organizations, namely, contexts that were better suited to the analysis of teams and their ability to manage paradoxical tensions.

Fifty percent of my current work responsibilities involves coaching student teams who develop innovative projects for organizations and entrepreneurs active in the hospitality industry. I realized that a scholarly investigation of how teams manage and leverage paradoxical tensions could have a real impact not only on my current practice and institution but also on companies that primarily rely on them to conduct innovation work. I discussed the practical relevance of such a research project with several colleagues, from the Ecole hôtelière de Lausanne (EHL) as well as the University of Lausanne (UNIL), with extensive experience in team coaching. They all confirmed the value of a systematic investigation into the factors that contribute to greater team innovativeness. Finally, I gauged the interest of twenty prospective informants from the world of practice by sending them a short flyer describing the purpose of the research and inviting them to participate in my study. Because the recipients of my solicitation were senior-level innovation leaders with busy schedules, I did not expect a high acceptance rate. However, sixteen of the prospects I contacted showed a keen interest in the topic and accepted my request to be involved in the research whenever I was ready.

5.1.2 Study Design and Data Collection

The selection and design of the empirical studies were mostly guided by the theoretical gaps identified in the literature review. Still, I made sure to seek out the feedback from practitioners and soon-to-be graduates, particularly as it related to the clarity of the data collection tools I planned to use. Because

notions of paradox mindset, paradoxical tensions, and paradox resolution strategies can be fairly abstract and lead to personal interpretation, I conducted preliminary checks to ensure that the wording used in the measurement scales to be used in my surveys, as well as in the questions contained in my interview guide, was understandable and relevant to the daily responsibilities of practitioners and project contributors. I also collected feedback on the design of the study and associated surveys from EHL and UNIL colleagues with research experience in a variety of fields unrelated to paradox research (to avoid potential biases that may have come from prior knowledge) including small- and medium-sized enterprises, consumer behavior, internet and communication technologies, and project management. I also consulted with two team innovation researchers from UNIL to identify additional control variables that may affect project team performance.

Finally, practitioners were directly involved in both empirical studies. 250 soon-to-be graduates with at least one year of work experience constituted the target sample of the quantitative study while 16 senior-level managers were the key informants in the qualitative study.

5.2 Key Learnings and Impact on Practice

5.2.1 Key Learnings

Paradoxes are everywhere. My training and early professional experience in engineering have promoted, over the years, a rather linear way of thinking, one that views the world as a sequence of deterministic causal relationships. The research I have conducted on organizational paradoxes has challenged this “if this, then that” mindset by revealing the complexity of the reality we live in. We are all, individually or collectively, pursuing multiple and conflicting goals in our personal as well as organizational lives. We nurture our social ties while trying to advance our professional careers; we seek to shine as individuals while remaining good team players; we strive to remain open to new ideas while adhering to existing rules. While this reality seems obvious when expressed in these terms, the implications are often overlooked. I believe that this doctoral journey into paradox theory has contributed to a shift in my own mindset. I now

feel better equipped to identify and embrace the multiplicity of objectives that arise in my personal as well as professional life. Through my many conversations with colleagues, practitioners, and participants in my research, I now realize that the idea of organizational paradox, while somewhat foreign at first, resonates with most people. The ubiquity and relevance of the concept found further support in the empirical studies I have conducted for this doctoral work. Indeed, the participants involved – be they, students or senior managers – could readily recount (in interviews) and report (in surveys) many instances of having experienced paradoxical tensions in their work.

Paradoxes can be good or (mostly?) bad. The literature suggests the dual nature of paradoxes as both inhibitors or enablers of higher creativity and innovativeness. While intellectually appealing, this double-edged aspect of paradoxes enjoys, to this day, limited empirical support. The results of my research – more specifically of my quantitative study – provide some evidence of the dual nature of paradoxes. The results, however, also suggest that the impact of paradoxical tensions is, in most cases, a negative one. Indeed, only a small minority of highly diverse teams (in terms of paradox mindset) were able to tap into the creative potential of paradoxes. If true, this finding implies that the default option should be to actively strive to identify and manage paradoxical tensions, rather than ignore them and hope for the best. Our propensity for “either-or” thinking, however, often hides the mutual relatedness of conflicting objectives and leaves paradoxes undetected and unmanaged. The realization that organizational choices about structure, process, and objectives create their own paradoxes that we ignore at our perils is one of my most salient takeaways from this DBA project.

Paradoxes are managed, not solved. Another important learning – not immediately intuitive to me before this research – is the idea that the effective management of paradoxes does not imply a final resolution. In the literature, paradoxes are permanent features of organizations and require constant attention. Rather than settling for unsatisfying compromises and trade-offs, managers are encouraged to embrace inconsistency in decision-making and

focus on response patterns over time. Yet the contingency mindset that prevails in most organizations today is at odds with the consistently inconsistent decision patterns discussed in the paradox literature. This aspect of paradox management has influenced my thinking insofar as it has led me to reflect on the many decisions that my team and I make; decisions that often have at their core the reconciliation of conflicting objectives. Looking back on our choices and decision process, I am acutely aware of the difficulties of putting scholarly advice into practice when it comes to the mindful management of contradictory demands. If anything, this gap has furthered my interest in researching the practical options that teams may have at their disposal to cope effectively with paradoxes.

As I will now describe, I have been applying these findings to my own practice, mostly in an attempt to shape the experience of paradoxical tensions in a way that is most beneficial to the actors involved.

5.2.2 Impact on My Own Practice

Every year I follow and coach 20 to 25 student project teams who have been entrusted with consulting mandates by external organizations active in the hospitality sector and related industries. Client organizations, who each pay USD 10,000 per mandate, come to us with a particular business challenge that they hope to solve through the creativity and fresh perspectives of our students. Consequently, any knowledge of the factors that can increase the innovativeness of the work delivered by the teams I supervise is extremely valuable. The empirical studies I have conducted in my doctoral work have yielded important insights that I have started to apply in my coaching responsibilities. In particular, I now pay closer attention to the sources of paradoxical tensions that may manifest themselves in the course of these nine-week projects. As discussed previously, identifying sources of paradoxical tensions is a critical first step which, if skipped, may lead most project teams to underperform, especially under climates of high paradoxical tension. So far I have identified three sources of tension in the projects that I oversee: (1) the clarity and consistency of stated project objectives, (2) the degree to which

team members view these objectives as appropriate and achievable, and (3) the degree of overlap between exploratory and exploitative activities. This knowledge, which I have shared with my colleagues, has led us to adapt our own practice in the following ways.

Clarifying expectations. To address the issue of clarity and achievability of objectives, my colleagues and I now devote significantly more effort in defining the project scope and mission with the client organizations prior to the start of a project session. Each of us now spends an hour or more defining these elements with the client through direct face-to-face or phone interactions. This early scope definition ensures that the objectives of each project are both clear and achievable, at least based on our experience. We also ask clients to provide the context that led their organization to mandate a specific project; we found that this information helps teams better understand the relevance, and therefore appropriateness, of the clients' expectations. Following our scoping meeting, my colleagues and I take the additional step of summarizing information about project context, mission, and scope, in a one-page document that is submitted to the client for validation. Overall, we have found this process to be very effective in ensuring that student teams are given clear objectives that they feel are both appropriate and achievable in the given timeframe, thus reducing potential sources of tensions later in the project.

Sequencing conflicting activities. In line with the findings from my research, I now encourage teams to more clearly separate and sequence the activities linked to the acquisition and analysis of new information from those focused on the application and exploitation of newly acquired knowledge. This advice stems directly from the results of my quantitative study that show that the overlap between exploratory and exploitative activities negatively impacted innovativeness through the higher level of tension it generates. Some amount of overlap, however, is inevitable as all teams seek greater efficiency through the parallelization of potentially conflicting tasks. Consequently, during the project planning process, I emphasize the likely benefits of having all team members

perform similar types of activities (i.e., exploratory or exploitative) at any given time.

Assessing team composition. The main insight from my research relates to the importance of having a diversity of paradox mindsets within teams. Unfortunately, because students are free to form their own teams, we cannot create the project teams based on the paradoxical thinking abilities of their members. Still, I do request that all team members fill out a paradox mindset questionnaire at the beginning of each project, which gives me some information about the level of diversity within each team. While the results of these surveys do not dictate my coaching style nor fundamentally change the general principles discussed above, it does give me some idea of each team's potential ability to unlock the creative power of tensions or be hurt by them.

5.3 Dissemination and Exploitation

5.3.1 Beneficiaries and Opportunities for Impact

Because paradoxes are ubiquitous across organizations of all types, any knowledge that informs the effective management of related tensions is therefore relevant to a wide variety of industries and business contexts. Accordingly, the range of practitioner segments that may benefit from the findings of my doctoral research is broad. For the sake of greater focus and potential impact, I have identified a list of primary beneficiaries from the various networks to which I have privileged access (see **Appendix 5-3**). What follows is an inventory of the dissemination opportunities and associated actions that I have undertaken or plan to undertake to achieve impact with the identified segments of beneficiaries. **Appendix 5-4** details the specific activities targeting each segment, and **Appendix 5-2** includes a list of organizations and associated contact persons that will be used for “research dissemination” (stage 4). While I cannot guarantee that all avenues will be successful, I intend to pursue these opportunities in the hope that some satisfactory proportion will materialize soon after the completion of my DBA.

5.3.2 Ecole Hôtelière de Lausanne

Founded in 1893, the Ecole hôtelière de Lausanne (EHL) is a leading academic institution in the field of hospitality management. As a university of applied sciences, EHL develops and maintains deep ties with the industry through research partnerships, consulting services, executive education programs, as well as through its alumni community. This extensive network of organizations and individuals offers many opportunities for engagement.

5.3.2.1 Corporate Partners (planned)

Among the organizations that collaborate with EHL, I shall primarily focus on those that seek a relationship with the school for the specific purpose of improving their innovation capabilities – the rationale being that these companies will be more receptive to the central theme of my research.

The first of these organizations is the Metro Group, Europe's largest cash-and-carry company, who has recently signed an agreement to provide financial support for the activities of EHL's newly created Institute of Business Creativity. The two main mandates of this institute are (1) to conduct applied research on the digitalization process of the HoReCa sector (i.e., hotels, restaurants, cafeterias), and (2) to develop and deliver custom training modules to METRO's top management teams.

The second organization is the Saviva Group, the wholesale trade branch of the leading retailer in Switzerland. The Saviva Group is financing EHL's Food & Beverage Innovation chair whose mission is to investigate the new trends in sustainable development as well as assess their likely impact on the foodservice industry.

Dissemination opportunities. Both corporate partnerships described above center on the analysis of large-scale changes taking place in the partners' respective industries. Issues pertaining to organizational adaptation, therefore, constitute the main focus of these partnerships and align well with the themes of my research. Consequently, there are various opportunities for me to discuss

and share my research findings with these corporations through workshops, executive education modules, management seminars, and white papers.

5.3.2.2 Industry Relations (planned)

EHL's alumni network (AEHL) is one of the largest and most active communities of hospitality management graduates. AEHL comprises 25,000 alumni living and working in over 120 countries. It has 70 alumni chapters across the world, each responsible for fostering deep social and professional ties among graduates, as well as for maintaining the relationship between graduates and the school.

Dissemination opportunities. EHL's Alumni department uses a number of media to disseminate content to its community. In particular, there is the opportunity for me to post short content pieces through our recruiters' database (7,000 organizations), Alumni LinkedIn page (4,000 subscribers) and Facebook page (4,500 subscribers), as well as in the bi-annual Alumni newsletters (9,000 subscribers). In addition, EHL's Industry Relations department organizes events in which I may be able to participate as a guest speaker; such events include TEDxEHL, the annual International Advisory Board meeting, as well as a variety of theme-based conferences regularly held on campus.

5.3.2.3 Online MBA Program (completed)

The Ecole hôtelière de Lausanne offers an online MBA program to senior executives in the hospitality sector. From April 30th to May 4th, 2018, 18 professionals enrolled in this program came to our campus in Lausanne, Switzerland, for a week of lectures and meetings with experts on the topics of scenario planning, concept design, brand development, and hotel operations. In addition, all participants worked in teams on a week-long project that consisted of creating an innovative hotel concept around a non-hospitality brand (e.g., Porsche, Hermès, etc.). The project comprised a series of four distinct assignments related to scenario planning, brand selection, guest experience design, and concept integration. Throughout the week, renowned experts in these areas gave morning lectures on key concepts and theories, coached the teams as they worked on their assignment in the afternoon, and assessed the

quality of their outputs the following day. On the final day, each group presented their hotel concepts to the CEO of citizenM.

Purpose of the engagement. This “Meet The Experts” week of the MBA program provided an opportunity for me to interact with experienced professionals and introduce them to the concepts of paradox management and paradox mindset. Specifically, I set out to achieve the following two objectives:

- Share with industry professionals my research findings regarding the relationship between the paradox mindset diversity of teams and their ability to innovate
- Uncover insights about potential differences in the dynamic between teams with distinct paradox mindset profiles

Description of the engagement. Before arriving on campus, each participant filled out a paradox mindset questionnaire. I used this information to create both homogenous and heterogeneous teams in terms of paradoxical thinking abilities. As shown in **Figure 5-1**, I created one “maximum diversity” team (#1) by selecting the two participants who scored the highest on the paradox mindset scale and pairing them with the two participants who scored the lowest. I then formed three homogeneous teams, each with a different average paradox mindset score.

	AVERAGE PM SCORE	PM DIVERSITY
TEAM #1	5.00	1.16
TEAM #2	4.63	0.13
TEAM #3	5.22	0.18
TEAM #4	5.64	0.13

Figure 5-1: Team Paradox Mindset (PM) Profiles

Each day, the teams were given a specific assignment (i.e., scenario planning, brand selection, guest experience design, and concept integration). Upon

completion of each daily assignment, I asked each member to fill out a questionnaire to indicate the extent to which they had experienced paradoxical tensions while completing their assignment. At the end of the week, I conducted separate debrief sessions with each team. The purpose of these sessions was to let participants share their experience of paradoxical tensions, discuss the reasons why certain assignments created more or fewer tensions, and describe how the team went about developing solutions and making decisions. I recorded these sessions in the hope that their subsequent analysis would give some clues as to whether teams with distinct paradox mindset profiles take different approaches to solving problems and making decisions. I ended each session with a 15-minute presentation on paradox management during which I introduced the participants to the concepts of organizational paradoxes, paradoxical tensions, and paradox mindsets. I also presented my DBA research findings on the impact of paradox mindset diversity on team innovativeness and ended by highlighting a few important managerial implications these professionals could take back to their organizations. The participants seemed genuinely intrigued by the topic of paradox management – a concept that was completely new to them – and shared encouraging feedback about their interest and perceived value of such discussions (see **Figure 5-2**). Introducing MBA participants to the basic concepts of paradox management, as well as creating assignment teams based on the paradox mindset of individual members, was an experiment that had never conducted before in the context of EHL's online MBA program. The interest shown by participants proved the relevance of the topic to hospitality industry professionals. Building on this early success, I suggested to the MBA program managers that we should conduct these discussions again with future cohorts.

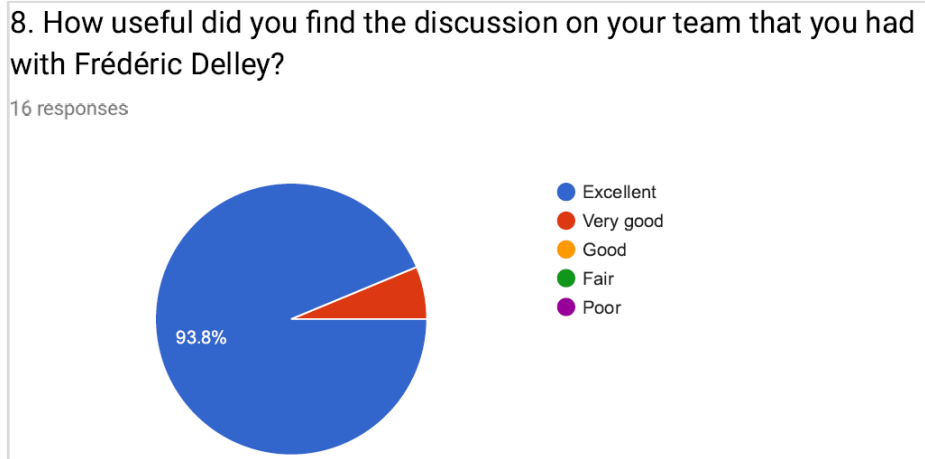


Figure 5-2: Feedback on Paradox Management Discussion

5.3.2.4 Lausanne Hospitality Consulting (planned)

Lausanne Hospitality Consulting (LHC) is the consulting and executive education arm of the Ecole hôtelière de Lausanne. LHC provides advisory services to hospitality and service-oriented organizations while also delivering executive education programs to managers and leaders in a variety of sectors such as hospitality, luxury retail, airlines, banking and insurance, and health and wellness.

Dissemination opportunities. I have developed close relationships with LHC's team of consultants and have already been a contributor to their executive education courses. In future, I plan to leverage these connections to increase the visibility of my research with professionals from the sectors mentioned above by (1) providing LHC with white papers on the topic of paradox management, (2) participating as a guest speaker to their annual 'Windows to the Future' conference, and (3) contributing to their executive education programs.

5.3.3 Industry

My affiliation with EHL opens the door to other collaborations with external companies, professional associations, and hospitality media outlets that are not directly part of the school nor in direct partnership with it. In the following sections, I describe the on-going project with the Hyatt Group and list specific associations and outlets that should be receptive to the topic of paradox management.

5.3.3.1 Hyatt Group (in progress)

Description of the engagement. When asked to conduct consulting work, I now try to identify early on whether there may be opportunities to introduce companies and their executives to the topic of paradox management. One such opportunity presented itself this past year when the Hyatt group, one of the largest hotel chains in the world, ask an EHL colleague of mine to develop a strategic planning guide for several of its EMEA properties. I have contributed to the development of this guide which, in October 2018, will be used by the management teams of 70 properties across the EMEA region to develop three-year strategic plans for their respective hotels. All property-level management teams will then submit the strategies they will have developed with the help of this guide to Hyatt's EMEA headquarters. The latter will assess the strategies on various criteria that we have defined in collaboration with Hyatt's top management. Over the subsequent months, the properties will implement their strategies as well as track various performance metrics that will be reported periodically to Hyatt's headquarters.

Purpose of the engagement. While developing this strategic planning guide, I introduced the lead consultant on this project to the topic of paradox management and highlighted the relevance of this theoretical lens to strategic-decision making. We agreed that we would recommend Hyatt's top management for EMEA to run a study looking at the impact of paradox mindset diversity on the perceived quality and actual performance of strategic plans. We briefed them on the main ideas behind paradox management and paradoxical thinking and suggested that to collect information about the profiles of the local

teams involved in the strategic planning process. We convinced Hyatt's management that strategy development is a process likely to create high levels of paradoxical tensions, and that, therefore, insights into the types of teams who can conduct this process most effectively could be useful for future strategy development efforts. As consultants and researchers, our primary objective is to quantify the effect of team composition – specifically as it relates to paradox mindset – on the quality and effectiveness of strategic plans. Upon completion of this research, we will share our findings with Hyatt's management and advise them on optimal team configuration in the context of strategy making.

5.3.3.2 Professional Associations (planned)

I have identified several hospitality industry associations suitable for the dissemination of paradox research findings. Most of the leading associations described in this section have online platforms that regularly publish general management content on organizational change, innovation leadership, and related topics. To facilitate the dissemination effort, I have secured direct access with high-ranking members in all of the following associations. The first is the *Master Innholders* whose mission is to promote the consideration, study, discussion and research in the areas affecting hotel management; it is composed of 120 members who sit on senior councils and committees of virtually every hospitality industry body, often as chairmen or presidents. The second is the *European Hotel Managers Association - EHMA* which provides a platform that facilitates the sharing of collective knowledge between hotel managers of 4- and 5-star properties in Europe; its members include 424 general managers operating in 28 countries. The third is the *Hotel Technology Next Generation (HTNG)*, a global not-for-profit trade association that fosters collaboration and partnership between hoteliers and technology providers. The fourth and last association is the *Hospitality Financial and Technology Professionals (HFTP)*, a global nonprofit hospitality association with 5,200 members who represent the finance and technology segments of the hospitality industry.

Dissemination opportunities. The most straightforward and effective way of making an impact on the members of these associations is through short articles in their periodic newsletters and by being invited as a guest speaker at their conferences.

5.3.3.3 Publication Outlets (completed)

In July 2018 I submitted a short content piece on teams and paradoxical tensions on EHL's Hospitality Insights platform, the institution's main communication platform to reach hospitality professionals. Hospitality Insights acts as a "newsfeed" to other popular industry media platforms that pull content directly from it. These other outlets include *HospitalityNet (HN)* which is among the most popular websites for hospitality-related news and opinion papers. Posts on HN's website are automatically converted to tweets on its Twitter account which currently has 20,000 followers. *eHotelier* is another global portal for hospitality professionals that provides the latest industry news and insights. It has a daily newsletter that goes out to 90,000 subscribers. The *Hotel Yearbook* is a family of publications discussing the key trends and developments that are likely to impact the future of the hotel industry. This outlet targets a wide-ranging group of senior executives, analysts, consultants and opinion leaders across the world. Finally, the *Bottomline* is HFTP's quarterly journal and features articles on best practices in the field of finance and technology, industry research reports, and general management pieces.

Dissemination opportunities. In the span of two months, this short article has already received more than 2,500 views. EHL's communication department has also produced a teaser video related to the article, which has been viewed 4,796 times.

5.4 Impact of the Doctoral Process

As a faculty member at EHL, my doctoral experience will have a number of direct benefits both to my own practice as well as to my organization.

5.4.1 Impact on My Own Practice

5.4.1.1 Improved Teaching

Twice a year, I teach an elective course on innovation management to final year Bachelor students. The research conducted in the context of this DBA has allowed me to enrich the content of my course with the many theories and concepts that I have encountered during the doctoral process. For example, students in my class are now exposed to concepts such as, among others, the paradox of exploration and exploitation, organizational ambidexterity, and absorptive capacity. The theoretical knowledge I have acquired in the course of this DBA has helped me anchor my case-based teaching approach in stronger academic bases. Judging by the positive comments received during EHL's official course evaluation surveys, I have some encouraging evidence that students are receptive to this blend of deeper theory applied to practical business problems.

5.4.1.2 Improved Coaching

Twenty weeks out of the year I am supervising between 20 and 25 teams of students working on junior consulting projects that, in the majority of cases, require in-depth market research. These teams make use of a variety of qualitative and quantitative methods to conduct their research. As all doctoral candidate, I have acquired deeper knowledge in research methods through academic readings, doctoral courses, and online resources. This knowledge has increased my level of comfort – and, hopefully, competence – in advising student teams on the selection of proper methodological approaches, and on the identification of their inherent limitations. Also, the extensive critical reading required for doctoral research has improved my ability to advise students on topics such as clear writing, sound argumentation, and structured reporting of findings. I have had many opportunities to share these learnings in weekly team

coaching sessions as well as through the templates and guidelines I have developed to help students deliver impactful consulting reports. Finally, my experience of receiving feedback at various stages of my doctoral research has made me a better and more constructive reviewer of students' work.

5.4.1.3 Access to New Opportunities

The competencies I have developed over the course of this doctoral project will open new doors in my institution. In a few weeks' time, I will discuss career choices in my upcoming portfolio meeting with the deanship of the school. In that meeting, I will be asked to choose between two options: either join the faculty research track as an assistant professor; or pursue a practice-oriented track as a professor of practice. Both options provide new opportunities that I would not have been offered without the skills and knowledge developed in the course of the doctoral process. Beyond the opportunity to conduct academic research, a doctoral degree will also allow me to teach in the growing number of master-level programs taught at our school, as well as supervise student dissertations at the bachelor level.

5.4.2 Impact on My Organization

EHL is an institution of higher learning and, accordingly, the impact of this doctoral research on my organization is mainly an academic one.

First, the work performed in the context of this DBA contributed to increasing the visibility of my institution in the academic community. This increased visibility materialized mostly through the parts of my doctoral work that were submitted to and accepted at the following conferences:

- SMS Houston, 2017
- EGOS Tallinn, 2018
- AOM Chicago, 2018
- SMS Paris, 2018

Second, I am planning to submit full-length articles to academic journals which, if accepted, will raise EHL's visibility in outlets that are not the typical targets of

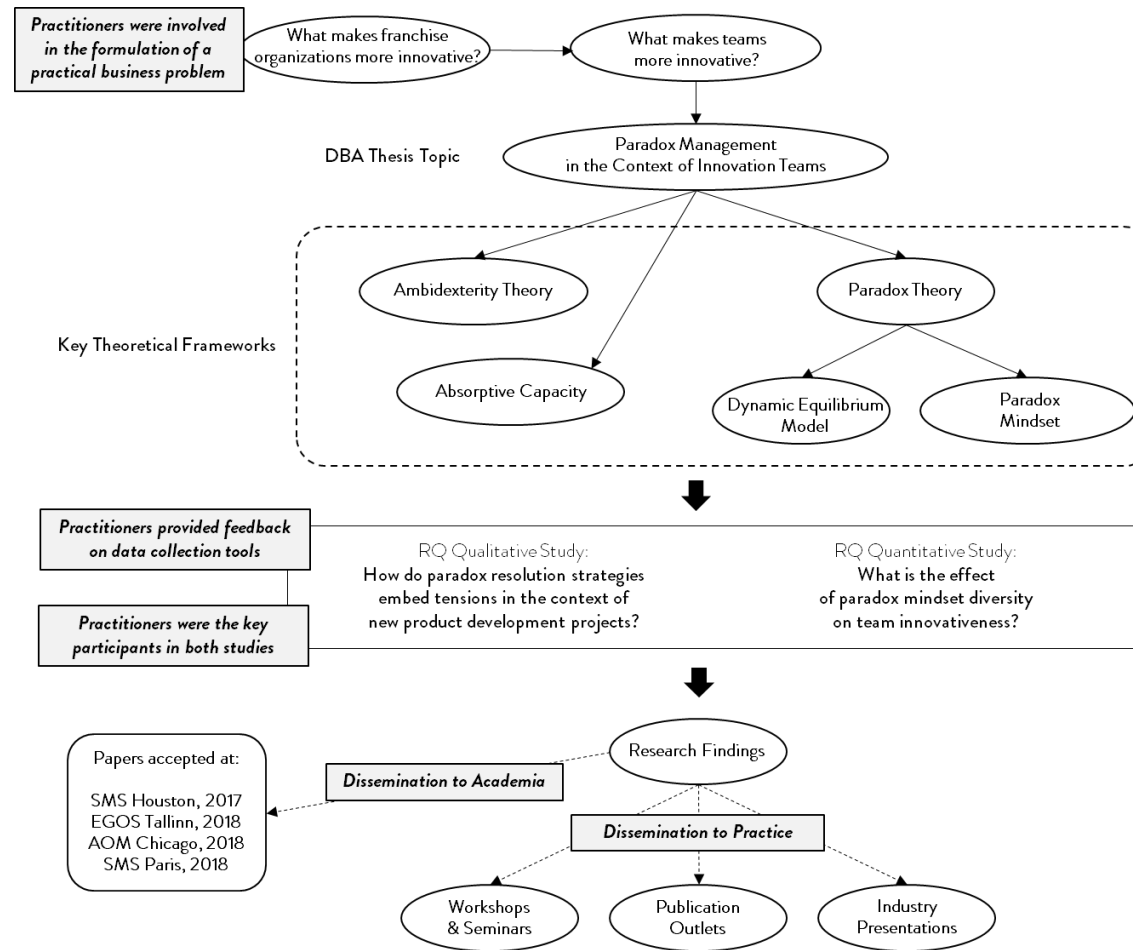
our current research faculty. Indeed, EHL research is mostly active in academic publications related to hospitality and tourism, and much less in journals focused on strategic management and innovation such as those I intend to target.

Third, starting five years ago, EHL has deployed significant resources toward the recruitment of faculty holding doctoral degrees. This effort was driven in large part by the need to achieve greater differentiation among the growing number and quality of hospitality schools across the globe. My personal investment and commitment to pursuing a DBA is a small contribution to this quest as it will contribute to raising the ratio of doctorate holders within the faculty body.

Finally, given the focus of my DBA on paradox management and innovation teams, I have developed some knowledge and expertise in research areas not typically pursued at my institution. Should I choose to join the research faculty track, I may, therefore, contribute to extending EHL's research efforts beyond its traditional fields of investigation, thus widening the opportunities to raise academic research funding and develop applied research projects in collaboration with industry players. Finally, EHL is in the process of developing an innovation hub that will host hospitality startups and develop relationships with innovative companies in the hospitality sector. I may be able to contribute to the development of this new center by providing a set of research and consulting skills that align well with its mission

5.5 Appendices

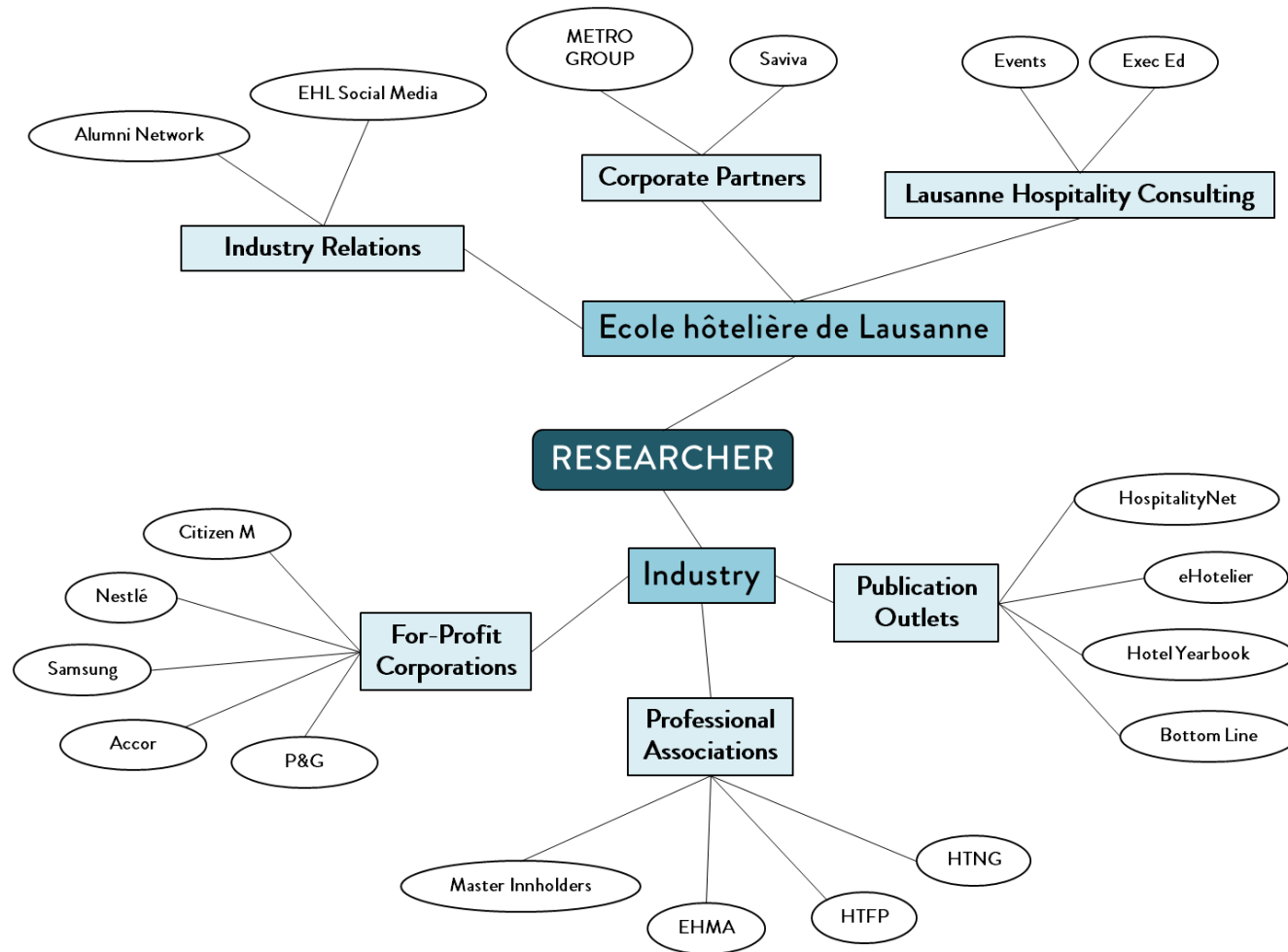
Appendix 5-1: Engagement with Practitioners from Problem Formulation to Dissemination



Appendix 5-2: Practitioners and Corresponding Stages of Engagement

Organization	Last Name	First Name	Position (at time of interaction)	1. Problem Formulation	2. Study Design	3. Data Collection	4. Research Dissemination
1 Groupe La Pataterie	Maizoué	Alexandre	CEO	X			
2 Groupe La Pataterie	Rechsteiner	Philippe	CFO	X			
3 Fleming's Hotel Management	Schröder	Hartmut	CEO	X			
4 Dorchester Collection	Patel	Rakhee	People and Talent Manager	X			
5 Ritz-Carlton Hotels & Resorts	Leuenberger	Richard	General Manager	X			
6 Metro Group	Schwabedal	Kay	General Manager of HoReCa Digital	X			
7 Ecole hôtelière de Lausanne	Millar	Ian	Senior Lecturer Information Technology, Team Coach	X	X		
8 Ecole hôtelière de Lausanne	Demien Meier	Christine	Associate Professor of SME Strategies, Team Coach	X	X		
9 Ecole hôtelière de Lausanne	Hebali	Jamil	Assistant Professor of Market Research, Team Coach	X	X		
10 TeamAlignment.Co	Mastriogiacomo	Stefano	Agile Tools Designer, Team Alignment Expert	X	X		
11 Université de Lausanne	Missonier	Stéphanie	Professor of Information Systems	X	X		
12 Université de Lausanne	Avdiji	Hazbi	PhD Student (Cross-Boundary Teams)	X	X		
13 EPFL	Packham	Jeremy	Program Manager			X	
14 Henniez	Schaller	Maria	Brand Manager			X	
15 Nespresso	Cornet	Antoine	Retail Innovation Manager			X	
16 Nestlé Professional	Manser	Daniel	Global Business Stream Leader			X	
17 Philip Morris	Preisler	Jacob	Director Reduced Risk Products Planning & Governance			X	
18 Nestlé (Purina)	Varanne	Marie-Laure	European Strategy Portfolio Leader			X	
19 Procter & Gamble	Khalife	Mo	Innovation Brand Manager			X	
20 Accor	Esseryk	David	Vice-President Guest Technology & Innovation			X	
21 Hospitality Technology Network	Rice	Douglas	Managing Director of Hospitality Technology Network			X	
22 Hyatt	Harris-Kirby	Jennifer	Managing Director of Innovation			X	
23 citizenM	De Jong	Lennert	Chief Commercial Officer			X	
24 Ferring	Harris	Alan	Senior Vice-President Global R&D			X	
25 Good Technologies	Severinek	Stephen	Software Developer			X	
26 Bühler Group	Boehni	Peter	Innovation Unit Managing Director			X	
27 Samsung	Lipiec	Piotr	Senior Business Development Manager			X	
28 Transports Fribourgeois	Ramuz	Grégoire	IT Director			X	
29 Master Innholders	Rossiter	Philippe	General Secretary				X
30 EHMA	Koch	Hans	President				X
31 HFTP	Wolfe	Frank	Chief Executive Officer				X
32 HTNG	Sjolander	David	Chief Operation Officer				X
33 Hospitality Technology Network	Rice	Douglas	Managing Director				X
34 HospitalityNet	Roelings	Henry	Founder				X
35 eHotelier	Gubler	Fritz	President				X
36 Hotel Yearbook	Roelings	Henry	Founder				X
37 Bottom Line	Wolfe	Frank	Chief Executive Officer				X
38 Ecole hôtelière de Lausanne	Brazzola	Meloney	Head of Communication				X
39 Ecole hôtelière de Lausanne	Mamdouh	Sherif	External Communication Manager				X
40 Ecole hôtelière de Lausanne	Sozzi	Amélie	Digital Communications Manager				X
41 Lungarno Collection	D'Alessandro	Simone	Corporate Food and Beverage Manager				X
42 Novotel	Dhondoo	Anoopkhar	General Manager				X
43 Jumeirah	Pfister	Tobias	Executive Chef				X
44 Movenpick	Jones	Phillip	General Manager				X
45 Intercontinental Hotels Group	Sehgal	Shankey	Revenue Manager and Director of Sales and Marketing				X
46 Nanyang Polytechnic	Lim	Linda	Assistant Manager and Senior Lecturer				X
47 Parker Palm Springs	Kapichin	Oleksii	Director of Revenue and Reservations				X
48 Swiss Education Group	Kouatlis	Tarek	Director of Marketing and Development				X
49 Kustom Hotels	Gagliardi	Helene	Brand and Franchise Concept Strategist				X
50 Regal	Kim	Renee	Deputy General Manager				X
51 SIR NAFTI	Kolahdouzan	Mohammad	General Manager				X
52 AMANPURI	McBride	Alexander	Executive Assistant Manager				X
53 Six Senses	McGrath	Aaron	General Manager				X
54 Nestlé Switzerland	Bergundthal	Mathias	Senior Manager Swiss Public Affairs				X
55 Escapes International DMC	Hobeika	Dima	Operations Director				X
56 The Ritz-Carlton Company	Marghalani	Mohammed	Director of Finance				X
57 Swiss Education Group	Bélizaire	Alain	Executive Director of Marketing and Development				X
58 Intercontinental Hotels Group	Bahraoui	Khalid	Global Implementation Manager				X

Appendix 5-3: Researcher's Network



Appendix 5-4: Planned Dissemination Activities

		Publications & Communication	Event Presentations	Seminars & Courses	Workshops	Direct Engagement during Research
Ecole hôtelière de Lausanne	Corporate Partners <i>(Metro Group, Saviva)</i>	White Paper	Metro Annual Strategic Seminar	Metro Corporate Seminars	Innovation Team Workshops	Interviews & Summary of Findings
	Industry Relations <i>(Alumni Network, Industry Platforms)</i>	Short Article Postings	TEDxEHL IAB Meeting Young Hotelier Summit			
	Lausanne Hospitality Consulting	White Paper of Research & Findings	‘Windows to the Future’ Conference	Executive Education Modules		
Industry	For-Profit Organizations <i>(Citizen M, Nestlé, Samsung, Accor, P&G)</i>	White Paper		Corporate Seminars	Innovation Team Workshops	Interviews & Summary of Findings
	Professional Associations <i>(Master Innholders, EHMA, HFTP, HTNG)</i>	Newsletters	Conference Presentation			
	Publication Outlets <i>(HospitalityNet, eHotelier, Hotel Yearbook, Bottom Line)</i>	Short Article Postings				

6 Conclusion

In this final chapter, I take a step back and examine the broader implications of this doctoral thesis by reviewing its main findings collectively. I reflect on the research theme that gives this project its coherence and discuss how future scholarly investigations may build on the present work. I identify some of the limitations of my research and conclude by summarizing its main contributions to theory.

6.1 Research Theme

The common theme that runs through the thesis' three papers is the effective integration of paradoxical elements. Each paper approaches this theme from a unique perspective and methodology, thus casting its own light on the research problem. Paper #1, through a thematic synthesis of the literature, conceptualizes the ability of firms to integrate exploratory and exploitative knowledge. Paper #2 quantifies the impact of paradox mindset on the team's ability to leverage the tensions created by the simultaneous engagement in exploratory and exploitative activities. Finally, Paper #3 utilizes expert interviews to explore the different ways in which paradoxical elements can overlap – whether by design or not – while developing new products or services.

6.2 Key Findings

Integration, in the context of this thesis, is about bringing conflicting elements together in value-adding ways (e.g., Andriopoulos and Lewis, 2009; Lewis, 2000; Rothenberg, 1979; Smith, 2015; Smith and Tushman, 2005). According to this definition, the integration process can be divided into a “bringing together” part and a “value adding” part. In more formal terms, this means that two sets of factors contribute to integration: those that *foster* (i.e., promote, encourage, enable) and those that *leverage* (i.e., tap into, take advantage of, profit from) the juxtaposition of paradoxical elements. Each paper's main findings are now summarized in light of this distinction (see **Table 6-1** for a summary).

Table 6-1: Summary of Findings

	INTEGRATION OF PARADOXICAL ELEMENTS	
	Factors that <i>foster</i> the juxtaposition of paradoxical elements	Factors that <i>leverage</i> the juxtaposition of paradoxical elements
Paper #1 – Systematic Review <u>Unit of Analysis:</u> Multilevel <u>Duality:</u> Exploration-Exploitation	The ability to create an environment in which individuals, groups, and organizations can successfully connect and combine knowledge from conflicting domains (i.e., enabling capability). The ability to establish knowledge flows between conflicting knowledge domains (i.e., connecting capability).	The ability to recognize and reconcile the needs of conflicting knowledge domains (i.e., unifying capability). The ability to synthesize knowledge from conflicting domains in value-adding ways (i.e., combinative capability).
Paper #2 – Quantitative Study <u>Unit of Analysis:</u> Project/Team <u>Duality:</u> Exploration-Exploitation	The simultaneous engagement in exploratory and exploitative activities.	The creation of teams that are diverse in terms of the paradox mindset of their members.
Paper #3 – Qualitative Study <u>Unit of Analysis:</u> Project/Team <u>Dualities:</u> Exploration-Exploitation Plurality-Alignment Novelty-Feasibility	The degree of temporal differentiation.	The type and frequency of integration touchpoints: • Strategic decisions / Low frequency • Formal roles and processes / Medium frequency • Cycles of negotiations / High frequency

The central argument of Paper #1 is that the ability to integrate exploration and exploitation should be viewed as a strategic capability that can be developed at any level of the organization. The findings suggest that this ability can be conceptualized as a four-dimensional construct whereby each dimension (i.e., sub-capability) belongs to one of the twin factors that support integration. While the distinction is not strictly binary, the *enabling* and *connecting* sub-capabilities primarily foster the juxtaposition of paradoxical elements, while the *unifying* and *combining* sub-capabilities aim to tap into the generative potential created by this juxtaposition.

The three main findings of Paper #2 can be summarized as follows: The simultaneous engagement in exploratory and exploitative activities creates paradoxical tensions (finding 1) that will be detrimental to the innovativeness of most project teams (finding 2), unless these teams exhibit a sufficient diversity of paradox mindsets among their members (finding 3). These findings also corroborate the distinction between integration factors that foster the juxtaposition of paradoxical elements (in this case, the simultaneous engagement in conflicting tasks) and those that help leverage this juxtaposition (in this case, high paradox mindset diversity).

Finally, Paper #3 posits that the way paradoxical elements are juxtaposed over time can be purposefully managed in order to regulate the level of paradoxical tensions in a given task environment. In particular, the findings suggest that, in the context of innovation projects, the desired level of juxtaposition can be achieved through the use of resolution strategies that provide the appropriate degree of temporal differentiation. The paper also highlights how, in the context of product innovation, paradoxical elements are reconciled through integrative touchpoints that vary in type and frequency.

6.3 Integrating Paradoxical Elements

A novel conceptualization of integration emerges when the three papers' aggregated findings are examined against the extant literature. This conceptualization does not purport to be the definitive word on the integration of paradoxical elements. Rather, it intends to provide a more precise understanding of integration, which can serve as the basis for further investigations.

The proposed conceptualization is based on the aforementioned premise that integration rests on two sets of factors: those that foster and those that leverage the juxtaposition of paradoxical elements. There is a temporal dependency between these two categories of factors because the juxtaposition of paradoxical elements must be fostered before it can be leveraged.

The factors that foster the juxtaposition of these paradoxical elements generate tensions. This is because the paradoxical nature of contradictory yet interrelated elements is revealed when these elements appear simultaneously (Lewis, 2000). Such tensions act as the generative mechanism that explains how value can be created when paradoxical elements are integrated.

However, paradoxical tensions are a double-edged sword which, absent contextual attributes such as paradoxical cognition (Lewis, 2000; Smith and Tushman, 2005), emotional equanimity (Calabretta, Gemser and Wijnberg, 2017) and effective team configuration (Miron-Spektor, Erez and Naveh, 2011), tend to generate negative externalities (Ingram et al., 2014; Miron-Spektor et al., 2018; Smith and Berg, 1987; Vince and Broussine, 1996). On the other hand, the effective management of paradoxical tensions can lead to positive outcomes such as organizational performance (Tushman et al., 2010), high-performing groups (Murnighan and Conlon, 1991), and career success (O'Mahony and Bechky, 2006). Therefore, the aforementioned contextual attributes are essential to unlocking the potential benefits of tensions and thus belong to the second set of integration factors, namely those that leverage (rather than foster) the juxtaposition of paradoxical elements.

The resulting conceptual model is shown in **Figure 6-1**. This model also provides an insight into why integration may pose a potentially greater challenge than differentiation in the management of paradoxes. The challenge is due to the fact that the synergistic integration of paradoxical elements relies on the creation of necessary yet potentially harmful tensions. Successful integration, therefore, depends largely on the ability to effectively manage these paradoxical tensions. Ensuring that this ability is sufficiently developed before attempting integration is a critical step toward securing the benefits, and avoiding the potential side-effects, of integration.

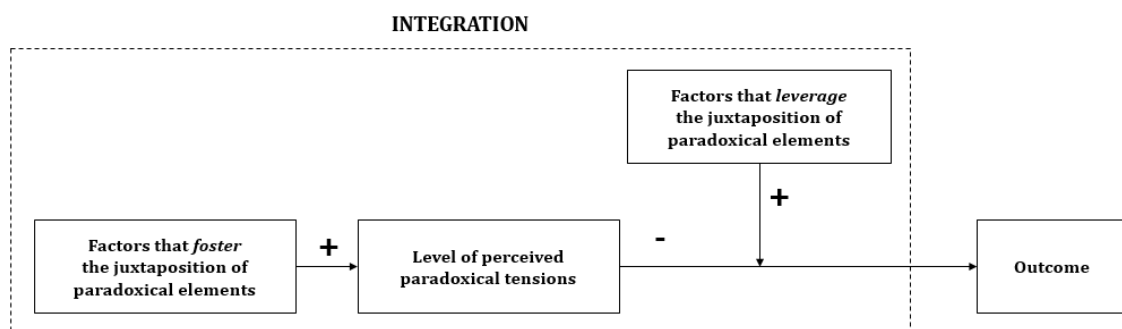


Figure 6-1: Conceptual Model for the Integration of Paradoxical Elements

6.4 Relevance to Other Fields of Research

While highly simplified, this conceptualization of integration can provide a useful lens for various research streams. Absorptive capacity scholars may use it as a way to bring paradoxical tensions into their discussions of knowledge “assimilation” and “transformation” (Zahra and George, 2002). Organizational learning researchers may want to do the same when unpacking the “integrating” phase of Crossan and colleagues’ (1999) 4I framework. Ambidexterity scholars interested in the more integrative approaches to the management of the exploration-exploitation duality (e.g., Birkinshaw and Gibson, 2004; Smith and Tushman, 2005) can leverage the proposed model and provide integration issues with a more prominent place in their analyses. Finally, building on the works of Andriopoulos and Lewis, (2009) and Smith (2015), paradox theorists who wish to more closely examine the central role of integration and differentiation in the management of paradoxes can test some of the ideas

developed in this thesis or, alternatively, conduct similar work on the ability of organizations to effectively *differentiate*.

6.5 Limitations

A doctoral thesis is primarily the work and analyses of a single individual. As such, and in spite of every precaution, the present work cannot do away entirely with the subjectivity inherent in the interpretation process nor with the constraints of limited access and resources.

Paper #1 is a systematic review of the literature on integration mechanisms. Systematic reviews, in contrast to narrative reviews, place a premium on providing a transparent, unbiased, and justified account of the review process so that the latter can be replicated if needed (Denyer and Tranfield, 2009; Tranfield, Denyer and Smart, 2003). Through a rigorous adherence to the process, I hope to have safeguarded some satisfactory level of objectivity in the course of developing this review. However, the thematic synthesis at the core of the paper – a technique adapted from qualitative research – requires some level of interpretation on the part of the researcher. While I cannot ensure that other scholars would have arrived at identical conclusions, I trust that the analysis process was described in sufficient details so that potential areas of divergence can be easily identified.

Paper #2 is a quantitative study that relies on conventional data gathering tools, validated measurement scales, and well-established analysis techniques. Together, these methodological aspects provide for more objective findings. Instead, the study's main limitation resides in the nature of the sample and its potential implications on generalizability. The choice of student rather than professional innovation teams was the result of a compromise between retaining a certain level of control and maximizing the representativeness of the sample. The primary benefits of the chosen sample were that it provided a reasonably realistic context in which the relationships being investigated could be adequately isolated, and would as well remain free of many extraneous variables. The associated downside, of course, was that this empirical setting was not perfectly representative of the product innovation contexts that prevail

in business organizations. Despite this methodological weakness, the groundwork provided makes conducting replication studies in more realistic settings relatively straightforward.

Finally, Paper #3 is an exploratory qualitative study which, although valuable in stimulating my thinking on paradoxical tensions and integration, faces similar limitations as the first two papers. Specifically, its findings and conceptual outputs arose from an interpretive analysis of interview responses, which poses some challenges to the reliability and validity of the findings. Also, the sample of informants was rather small because of the difficulty in securing interviews with individuals in senior product innovation positions who would be able to provide both strategic and operational insights in the context of large multinational corporations. While these concerns were partially addressed through the detailed descriptions of the coding and analysis processes and post-validation of the findings with informants, this paper remains a preliminary investigation of how resolution strategies embed paradoxical tensions in the task environment of new product development projects.

6.6 Main Contributions

These various limitations notwithstanding, this doctoral thesis makes a number of theoretical contributions.

Paper #1 organizes and makes sense of more than 100 integration mechanisms studied in the context of the exploration-exploitation duality. The paper introduces the concept of “integrative capacity,” and discusses its strategic role, multidimensional nature, and relevance across all levels of the organization.

Paper #2 adds to the limited set of studies investigating paradoxes at the team level of analysis. This study provides empirical evidence of the dual nature of paradoxical tensions, identifies an important source of paradoxical tensions in innovation projects, and discusses for the first time in the literature the notion of paradox mindset diversity.

Finally, Paper #3 offers a conceptualization of paradox resolution strategies based on how dualities are addressed over time. The paper also suggests a rationale for how tensions may become embedded in a given task environment as a result of applying strategies characterized by different degrees of temporal differentiation. In doing so, it clarifies an important link in Smith and Lewis's (2011) dynamic equilibrium model when applied to NPD project teams.

Effective integration is central to unlocking synergies between paradoxical elements; yet, it is also difficult to achieve. This challenge provides continued opportunities for paradox researchers to keep exploring the inner workings of integration in order to provide useful managerial guidance concerning the reconciliation of conflicting objectives. This thesis was an attempt in that direction.

REFERENCES

- Adler, P.S., Goldoftas, B. and Levine, D.I. (1999) 'Flexibility versus efficiency? A case study of model changeovers in the Toyota production system.', *Organization Science*, 10(1), pp. 43–68.
- Amabile, T.M. (2000) 'Stimulate creativity by fueling passion.', in *Handbook of principles of organizational behavior*. E. Locke. Malden, MA: Blackwell, pp. 331–341.
- Amabile, T.M. (1988) 'A model of creativity and innovation in organizations.', *Research in Organizational Behavior*, 10(1), pp. 123–167.
- Ancona, D.G. and Caldwell, D.F. (1992) 'Bridging the boundary: External activity and performance in organizational teams.', *Administrative Science Quarterly*, 37(4) *Administrative Science Quarterly*, pp. 634–665.
- Andriopoulos, C. and Lewis, M.W. (2009) 'Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation.', *Organization Science*, 20(4), pp. 696–717.
- Andriopoulos, C. and Lewis, M.W. (2010) 'Managing innovation paradoxes: Ambidexterity lessons from leading product design companies.', *Long Range Planning*, 43(1), pp. 104–122.
- Benner, M.J. and Tushman, M.L. (2003) 'Exploitation, exploration, and process management: The productivity dilemma revisited.', *Academy of Management Review*, 28(2), pp. 238–256.
- Birkinshaw, J. and Gibson, C. (2004) 'Building ambidexterity into an organization.', *MIT Sloan Management Review*, 45(4) *Sloan Management Review*, pp. 47–55.
- Birkinshaw, J. and Gupta, K. (2013) 'Clarifying the distinctive contribution of ambidexterity to the field of organization studies.', *Academy of Management Perspectives*, 27(4), pp. 287–298.

Bledow, R., Frese, M., Anderson, N., Erez, M. and Farr, J. (2009) 'A dialectic perspective on innovation: Conflicting demands, multiple pathways, and ambidexterity.', *Industrial & Organizational Psychology*, 2(3) Cambridge University Press, pp. 305–337.

Brown, S.L. and Eisenhardt, K.M. (1997) 'The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations.', *Administrative Science Quarterly*, 42(1), pp. 1–34.

Calabretta, G., Gemser, G. and Wijnberg, N.M. (2017) 'The interplay between intuition and rationality in strategic decision making: A paradox perspective.', *Organization Studies*, 38(3–4), pp. 365–401.

Chang, Y.C., Yang, P.Y. and Chen, M.H. (2009) 'The determinants of academic research commercial performance: Towards an organizational ambidexterity perspective.', *Research Policy*, 38(6), pp. 936–946.

Chung, C.C. and Beamish, P.W. (2010) 'The trap of continual ownership change in international equity joint ventures.', *Organization Science*, 21(5), pp. 995–1015.

Clark, K.B. and Wheelwright, S.C. (1993) *Managing new product and process development: Text and cases*. Free Press. New York.

Clegg, S.R., Vieira Da Cunha, J. and Pina E Cunha, M. (2002) 'Management paradoxes: A relational view.', *Human Relations*, 55(5), pp. 483–503.

Cooper, R.G. (1990) 'Stage-gate systems: A new tool for managing new products.', *Business Horizons*, 33(3), pp. 44–54.

Cooper, R.G. (1993) *Winning at New Products: Accelerating from Idea to Launch*. 2nd edn. Addison-Wesley.

Crossan, M.M., Lane, H.W. and White, R.E. (1999) 'An organizational learning framework: From intuition to institution.', *Academy of Management Review*, 24(3), pp. 522–537.

Denyer, D. and Tranfield, D. (2009) 'Producing a systematic review.', in *The Sage Handbook of Organizational Research Methods*. London: Sage, pp. 671–689.

Dougherty, D. (1996) 'Organizing for innovation.', in Clegg, S. R., Hardy, C. and Nord, W. R. (eds.) *Handbook of organization studies*. Thousand Oaks, CA: Sage, pp. 424–439.

Eisenhardt, K.M. and Tabrizi, B.N. (1995) 'Accelerating adaptive processes: Product innovation in the global computer industry.', *Administrative Science Quarterly*, 40(1), pp. 84–110.

Fairhurst, G.T., Smith, W.K., Banghart, S.G., Lewis, M.W., Putnam, L.L., Raisch, S. and Schad, J. (2016) 'Diverging and converging: Integrative insights on a paradox meta-perspective.', *Academy of Management Annals*, 10(1), pp. 173–182.

Gersick, C.J.G. (1991) 'Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm.', *Source: The Academy of Management Review Academy of Management Review*, 16(1), pp. 10–36.

He, Z.-L. and Wong, P.-K. (2004) 'Exploration vs. exploitation: An empirical test of the ambidexterity hypothesis.', *Organization Science*, 15(4), pp. 481–494.

Holmqvist, M. (2004) 'Experiential learning processes of exploitation and exploration within and between organizations: An empirical study of product development.', *Organization Science*, 15(1), pp. 70–81.

Ingram, A.E., Lewis, M.W., Barton, S. and Gartner, W.B. (2014) 'Paradoxes and innovation in family firms: The role of paradoxical thinking.', *Entrepreneurship: Theory and Practice*, 40(1), pp. 161–176.

Jansen, J.J.P., Tempelaar, M.P., van den Bosch, F.A.J. and Volberda, H.W. (2009) 'Structural differentiation and ambidexterity: The mediating role of integration mechanisms.', *Organization Science*, 20(4), pp. 797–811.

Jelinek, M. and Schoonhoven, C.B. (1990) *The innovation marathon: Lessons from high technology firms*. Jossey-Bas. San Francisco.

Junni, P., Sarala, R.M., Taras, V. and Tarba, S.Y. (2013) 'Organizational ambidexterity and performance: A meta-analysis.', *The Academy of Management Perspectives*, 27(4), pp. 299–312.

Klarner, P. and Raisch, S. (2013) 'Move to the beat — Rhythms of change and firm performance.', *Academy of Management Journal*, 56(1), pp. 160–184.

Lavie, D., Stettner, U. and Tushman, M.L. (2010) 'Exploration and exploitation within and across organizations.', *The Academy of Management Annals*, 4(1), pp. 109–155.

Lewis, M.W. (2000) 'Exploring paradox : Toward a more comprehensive guide.', *The Academy of Management Review*, 25(4), pp. 760–776.

Lewis, M.W., Ann Welsh, M., Dehler, G.E. and Green, S.G. (2002) 'Product development tensions: Exploring contrasting styles of project management.', *Academy of Management Journal*, 45(3), pp. 546–564.

Lewis, M.W. and Smith, W.K. (2014) 'Paradox as a metatheoretical perspective: Sharpening the focus and widening the scope.', *Journal of Applied Behavioral Science*, 50(2), pp. 127–149.

Liu, J., Chen, J. and Tao, Y. (2015) 'Innovation performance in new product development teams in China's technology ventures: The role of behavioral integration dimensions and collective efficacy.', *Journal of Product Innovation Management*, 32(1), pp. 29–44.

Lubatkin, M.H., Simsek, Z., Ling, Y. and Veiga, J.F. (2006) 'Ambidexterity and performance in small- to medium-sized firms: The pivotal role of top management team behavioral integration.', *Journal of Management*, 32(5), pp. 646–672.

Luger, J., Raisch, S. and Schimmer, M. (2018) 'Dynamic balancing of exploration and exploitation: The contingent benefits of ambidexterity.', *Organization Science*, 29(3), pp. 449–470.

Lüscher, L.S. and Lewis, M.W. (2008) 'Organizational change and managerial sensemaking: Working through paradox.', *Academy of Management Journal*, 51(2), pp. 221–240.

March, J.G. (1991) 'Exploration and exploitation in organizational learning.', *Organization Science*, 2(1), pp. 71–87.

McCarthy, I.P., Tsinopoulos, C., Allen, P. and Rose-Anderssen, C. (2006) 'New product development as a complex adaptive system of decisions.', *Journal of Product Innovation Management*, 23(5), pp. 437–456.

McGrath, R.G. (2001) 'Exploratory learning, innovative capacity, and managerial oversight.', *Academy of Management Journal*, 44(1), pp. 118–131.

Miron-Spektor, E., Erez, M. and Naveh, E. (2011) 'The effect of conformist and attentive-to-detail members on team innovation: Reconciling the innovation paradox.', *Academy of Management Journal*, 54(4), pp. 740–760.

Miron-Spektor, E., Ingram, A., Keller, J., Smith, W.K. and Lewis, M.W. (2018) 'Microfoundations of organizational paradox: The problem is how we think about the problem.', *Academy of Management Journal*, 61(1), pp. 26–45.

Murnighan, J.K. and Conlon, D.E. (1991) 'The dynamics of intense work groups: A study of British string quartets.', *Administrative Science Quarterly*, 36, pp. 165–186.

Nakata, C. and Im, S. (2010) 'Spurring cross-functional integration for higher new product performance: A group effectiveness perspective.', *Journal of Product Innovation Management*, 27(4), pp. 554–571.

O'Mahony, S. and Bechky, B.A. (2006) 'Stretchwork: Managing the career progression paradox in external labor markets.', *Academy of Management Journal*, 49, pp. 918–941.

O'Reilly, C.A. and Tushman, M.L. (2008) 'Ambidexterity as a dynamic capability: Resolving the innovator's dilemma.', *Research in Organizational Behavior*, 28, pp. 185–206.

Olson, E.M., Walker, O.C., Ruekert, R.W. and Bonner, J.M. (2001) 'Patterns of cooperation during new product development among marketing, operations and R&D: Implications for project performance.', *Journal of Product Innovation Management*, 18(4), pp. 258–271.

Post, C. (2012) 'Deep-level team composition and innovation: The mediating roles of psychological safety and cooperative learning.', *Group & Organization Management*, 37(5), pp. 555–588.

Prahalad, C.K. and Hamel, G. (1990) 'The core competencies of the corporation.', *Harvard Business Review*, 68(3), pp. 79–91.

Raisch, S. and Birkinshaw, J. (2008) 'Organizational ambidexterity: Antecedents, outcomes, and moderators.', *Journal of Management*, 34(3), pp. 375–409.

Raisch, S., Birkinshaw, J., Probst, G. and Tushman, M.L. (2009) 'Organizational ambidexterity: Balancing exploitation and exploration for sustained performance.', *Organization Science*, 20(4), pp. 685–695.

Raisch, S. and Zimmermann, A. (2017) 'Pathways to ambidexterity: A process perspective on the exploration-exploitation paradox.', in Smith, W. K., Lewis, M. W., Jarzabkowski, P. A. and Langle, A. (eds.) *The Oxford Handbook of Organizational Paradox*. Oxford Uni. Oxford.

Rothaermel, F.T. and Deeds, D.L. (2004) 'Exploration and exploitation alliances in biotechnology: A system of new product development.', *Strategic Management Journal*, 25(3), pp. 201–221.

Rothenberg, A. (1979) *The emerging goddess*. Chicago: University of Chicago Press.

- Schad, J., Lewis, M.W., Raisch, S. and Smith, W.K. (2016) 'Paradox research in management science.', *The Academy of Management Annals*, 6520(May), pp. 1–60.
- Schmitt, A. and Raisch, S. (2013) 'Corporate turnarounds: The duality of retrenchment and recovery.', *Journal of Management Studies*, 50(7), pp. 1216–1244.
- Shane, S.A. (2000) 'Prior knowledge and the discovery of entrepreneurial opportunities.', *Organization Science*, 11(4), pp. 448–469.
- Siggelkow, N. and Levinthal, D.A. (2003) 'Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation.', *Organization Science*, 14(6), pp. 650–669.
- Sivasubramaniam, N., Liebowitz, S.J. and Lackman, C.L. (2012) 'Determinants of new product development team performance: A meta-analytic review.', *Journal of Product Innovation Management*, 29(5), pp. 803–820.
- Smith, K.K. and Berg, D.N. (1987) *Paradoxes of group life : understanding conflict, paralysis, and movement in group dynamics*. San Francisco: Jossey-Bass.
- Smith, W.K. (2014) 'Dynamic decision making: A model of senior leaders managing strategic paradoxes.', *Academy of Management Journal*, 57(6), pp. 1592–1623.
- Smith, W.K. and Lewis, M.W. (2011) 'Toward a theory of paradox: A dynamic equilibrium model of organizing.', *Academy of Management Review*, 36(2), pp. 381–403.
- Smith, W.K. and Tushman, M.L. (2005) 'Managing strategic contradictions: A top management model for managing innovation streams.', *Organization Science*, 16(5), pp. 522–536.

Söderlund, J. (2011) 'Pluralism in project management: Navigating the crossroads of specialization and fragmentation.', *International Journal of Management Reviews*, 13(2), pp. 153–176.

Stadler, C., Rajwani, T. and Karaba, F. (2014) 'Solutions to the exploration/exploitation dilemma: Networks as a new level of analysis.', *International Journal of Management Reviews*, 16(2) Blackwell Publishing Ltd, pp. 172–193.

Thongpapanl, N.T., de Clercq, D. and Dimov, D. (2012) 'An investigation of the performance consequences of alignment and adaptability: Contingency effects of decision autonomy and shared responsibility.', *R and D Management*, 42(1), pp. 14–30.

Tranfield, D., Denyer, D. and Smart, P. (2003) 'Towards a methodology for developing evidence-informed management knowledge.', *British Journal of Management*, 14(3), pp. 207–222.

Tsai, W. and Ghoshal, S. (1998) 'Social capital and value creation: The role of intrafirm networks.', *Academy of Management Journal*, 41(4), pp. 464–476.

Turner, N., Swart, J. and Maylor, H. (2013) 'Mechanisms for managing ambidexterity: A review and research agenda.', *International Journal of Management Reviews*, 15(3) Wiley-Blackwell, pp. 317–332.

Turner, N., Swart, J., Maylor, H. and Antonacopoulou, E. (2016) 'Making it happen: How managerial actions enable project-based ambidexterity.', *Management Learning*, 47(2), p. 1350507615610028-.

Tushman, M., Smith, W.K., Wood, R.C., Westerman, G. and O'Reilly, C. (2010) 'Organizational designs and innovation streams.', *Industrial and Corporate Change*, 19(5), pp. 1331–1366.

Tushman, M.L. and O'Reilly, C.A. (1996) 'Ambidextrous organizations: Managing evolutionary and revolutionary change.', *California Management Review*, 38(4), pp. 8–30.

Tushman, M.L. and Romanelli, E. (1985) 'Organizational evolution: A metamorphosis model of convergence and reorientation.', *Research in organizational behavior*, 7, pp. 171–222.

Ulrich, K. and Eppinger, S. (1995) *Product design and development*. McGraw Hil. New York: McGraw-Hill Inc.

UNESCO Institute of Statistics (2017) *Summary Report of the 2015 UIS Innovation Data Collection*. Montreal, Quebec.

Van de Ven, A.H. (1986) 'Central problems in the management of innovation.', *Management Science*, 32(5), pp. 590–607.

Van de Ven, A.H., Polley, D., Garud, R. and Venkataraman, S. (1999) *The innovation journey*. New York: Oxford University Press.

Vince, R. and Broussine, M. (1996) 'Paradox, defense and attachment: Accessing and working with emotions and relations underlying organizational change.', *Organization Studies*, 17(1), pp. 1–21.

West, M.A. and Anderson, N.R. (1996) 'Innovation in top management teams.', *Journal of Applied Psychology*, 81(6), pp. 680–693.

Wheelwright, S. and Clark, K. (1995) *Leading product development*. Free Press. New York: Free Press.

Zahra, S.A. and George, G. (2002) 'Absorptive capacity: A review, reconceptualization, and extension.', *Academy of Management Review*, 27(2), pp. 185–203.

Zahra, S.A., Ireland, R.D. and Hitt, M.A. (2000) 'International expansion by new venture firms: International diversity, mode of market entry, technological learning, and performance.', *Academy of Management Journal*, 43(5), pp. 925–950.

