Päivi Karhu

COGNITIVE AMBIDEXTERITY:
EXAMINATION OF THE COGNITIVE DIMENSION IN
DECISION-MAKING DUALITIES

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This doctoral thesis addresses the cognitive dimension of the various dualities that especially managers confront when making decisions. The study demonstrates how similar decision-making situations can be perceived differently: where one decision-maker may identify a challenge, another may find a way to channel tensions toward creative purposes. The two distinct yet interrelated literature streams of dualities and organizational ambidexterity have recognized the need for managers to respond to conflicting internal and external demands, which exposes them to a myriad of cognitive challenges. This thesis contributes to the discussion by building a framework of cognitive ambidexterity, which is defined as the ability to engage in parallel mental processes that are paradoxical or contradictory. Whereas duality scholars have been interested in the relationship of the poles of the dualities calling those for instance paradoxes and dilemmas, ambidexterity scholars have discussed the organizations’ ability to manage the opposing demands of exploration and exploitation – which is one type of duality discussed in this thesis – through spatial, temporal or contextual and behavioral solutions.

Thus far, little exploration has been done about micro-foundations of ambidexterity and the cognitive processes related to dualities in decision-making. The aim of this thesis is to understand the micro-foundations of dualities, and the strategies that enable managers to handle the opposite demands of such decision-making pairs. To do this, the study draws from managerial cognition literature, which helps to explain how decision-makers identify, assess and cope with dualities and the tensions that arise from the incompatibilities within them. Altogether this study suggests that cognitive ambidexterity can fill a gap that is acknowledged across different research fields—namely, the lack of understanding about the micro-foundations of dualities like paradoxes and dilemmas, which is a limitation that may preclude the achievement of organizational ambidexterity.

In addition to providing a conceptual illustration of cognitive ambidexterity, this thesis explores the identified research gaps empirically with qualitative and experimental methods. The qualitative studies operationalize and extend a widely cited tension framework, and test analogical reasoning in the context new product development, providing insights on different types of dualities and creative ways of coping with them. The laboratory experiment appears to be the first to explore decision-makers’ performance in facing dualities that have varying levels of cognitive complexity and their preference regarding dilemma or paradox solutions; it also sheds light on the opportunities and challenges related to different types of dualities. Extant literature on
dualities and individual ambidexterity often highlights the superiority of simultaneous paradoxical solutions as opposed to dilemma solutions; this study showcases the usefulness of separate and sequential coping mechanisms in the light of cognitive demands.

Altogether this study illuminates the cognitive dimension of decision-making by merging knowledge from distinct literature on dualities, organizational ambidexterity and managerial cognition; it addresses that business environments are, and will continue to be, characterized by dualistic demands. This thesis suggests that through active awareness of the unconscious cognitive processes that hinder or aid decision-making, managers can break from path-dependent patterns, reframe perceived threats to potential business opportunities and build ambidexterity into organizations in a way that prepares them to respond optimally to the dualities that they become inevitably confronted with.

**Keywords:** organizational ambidexterity, individual ambidexterity, cognitive ambidexterity, dualities, paradox, analogical thinking
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“You've spent the same amount of time on your dissertation as you did on your elementary school education”: my dear dad dared to make this observation when the thesis began to show signs of near-completion. It has indeed been a colorful—and indisputably long—way, with fluctuations in concentration and dedication to reaching the finish line. It feels fantastic to realize how much this journey has taught me about academic research, but also about more than that. I would not have finished this project without such amazing support from many people. I owe my greatest gratitude to those who have been involved in one way or another.

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Päivi Karhu
August 2017
Helsinki, Finland
How wonderful that we have met with a paradox. Now we have some hope of making progress.

— Niels Bohr
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Abstract

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This thesis is based on the following papers. The rights have been granted by publishers to include the papers in dissertation.


Author's contribution

I. I am the leading author. I had the main responsibility of building the conceptual framework.

II. I am the leading author. I had the main responsibility of suggesting the propositions.

III. I am the leading author. I supervised the data collection process, interpreted and analyzed the data and made most of the conclusions.

IV. I am the leading author. I supervised the data collection process, interpreted and analyzed the data and made most of the conclusions.

V. I am the leading author. I made the research plan together with the co-authors, interpreted and analyzed the data, and made most of the conclusions.

VI. I am the leading author. I supervised the data collection process together with the co-author, interpreted and analyzed the data and made most of the conclusions.
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LIST OF ABBREVIATIONS

CEO Chief Executive Officer
NPC New product creation
NPD New product development
PBV Problem-based view of the firm
SBU Strategic business unit
TMT Top management team
PART I: OVERVIEW OF THE THESIS
1 Introduction

Managers are given the task of making decisions that have a great impact on the performance of a firm. Thus, managers bear the burden of making optimal decisions that are in line with their vision of the company but which also meet the needs of the stakeholders. While the managers indeed attempt to make the best possible decisions, there are numerous impediments challenging them in their endeavor (Rode, 1997). When making decisions, managers notice that while creativity requires flexibility, without sufficient control it cannot be transformed into marketable products. Maintaining the viability of current activities is important, but the firm may be overwhelmed by the competition if resources are not invested in new innovations. This means that while making decisions, managers are surrounded by “perpetual counterforces” that defy their cognitive capabilities, and managers must decide how best to allocate the organization’s mental, financial and human resources between valid but competing alternatives, often with conflicting goals.

As managers make their way up in the corporate ladder, not only the scope but also complexity of their decision-making responsibilities rise (McKenzie et al., 2009). The challenge stems from the managers’ successful or unsuccessful interpretation of the problem and the subsequent means to solve it. It is well known that organizations are subject to different tensions, which vary in their magnitude as well as importance. However, it is less known how managers become aware of those tensions (Knight & Paroutis, 2016), what kind of tensions they encounter in different contexts and how they respond to those.

These counterforces refer to decisions that resemble a form of duality—alternative decision-making pairs that are both significant but are to some degree in conflict with one another (Birkinshaw et al., 2016a). Hence, dualities surface as pair-like, operational, and strategic decisions. Making the right choices sometimes involves abandoning feasible alternatives and making sacrifices, thus raising difficult questions. As the available resources are more often than not scarce, managers must rely on their best judgment in framing the problem, making compromises and finding creative solutions in their pursuit of the company’s strategic goals. In the worst case, managers are torn between alternatives, becoming stuck and unable to decide on the best option for the company in the long run and thus over-emphasize the easy and familiar option: to continue doing what they have always done in the past. At their best, dualities generate an impulse for important discussions or open up avenues for seeking synergies to cut costs or boost creativity, which would not happen without the tensions that those decision-making dualities set forth.

These tensions stem from an organization’s internal objectives; from seeking ways to generate both incremental and radical innovations (Dewar & Dutton, 1986); reaching for social and financial goals (Margolis & Walsh, 2003; Beech, et al., 2004); or from external demands such as the difficulties in managing changes in the environment, be they market
crises (Haveman, 1992), changes in regulations (Smith & Grimm, 1987) or some technical innovations (Henderson & Clark, 1990). While some organizations are adept at responding to the turmoil caused by these, many are in danger of inertial forces (c.f. Kaplan, 2008).

Knight (1965[1921]) proposed that these difficulties and challenges do not stem from the environmental dynamics per se but rather managers’ insufficient ability to evaluate what such contradictions mean (Kaplan, 2008). Managers base their decisions on their interpretations of their internal and external business environments, which affect the way that organizational activities are arranged and eventually shape the business environment (Uotila, 2015). Those managers who master such situations have been termed ambidextrous, demonstrating the behavioral and mental capacity to simultaneously engage in alignment and adaptability (Gibson & Birkinshaw, 2004, p. 209) and developing the ability to think paradoxically so as to hold the opposites together (Smith & Tushman, 2005). Furthermore, the managerial cognition literature discusses a myriad of mental and behavioral processes in which organizations come to identify, value and cope with different dualities in pursuing organizational ambidexterity (e.g., Smith & Tushman, 2005).

This doctoral thesis addresses the rationale and importance of bringing the distinct management literature streams of dualities, organizational ambidexterity and managerial cognition together and makes its contribution at this intersection. Thus, this article-based doctoral thesis integrates the findings of the aforementioned distinct streams and builds upon the discussion to deepen our knowledge about managerial decision-making-related complexities. Ambidexterity scholars have debated over the contradictory and complementary natures of exploration and exploitation, and the discussion on dualities has evolved around the different types or structures of dualities, which in turn gives answers to the gaps found in the ambidexterity literature. Both dualities and ambidexterity literature benefit from understanding the cognitive microprocesses, and the lack of knowledge that in this area has indeed been addressed by many scholars.

Understanding the hidden or implicit mental models that guide decision-making regarding such dualities is important so that 1) managers can become aware of their cognitive structures that steer them in their decision-making when confronted with dualities, 2) change the mental structures if necessary, and 3) understand the mental models of the others in the organization, and even the reasons for their abilities and inabilities to cope with different kinds of demands related to decision-making. Therefore, understanding the micro-foundations of decision making—the fundamentals that enable managers to obtain and maintain competitive advantage via their decisions and actions—helps the manager to make better decisions regarding resource allocations. Thus, this doctoral thesis is attentive to the cognitive dimension of managerial decision-making in organizations, with a particular focus on decisions that entail a duality, where the alternatives compete for the managerial attention and resources. To show how these different literature streams can feed off each other and conceptualize what can be seen as
a result of this merger, this doctoral thesis discusses cognitive ambidexterity, a concept put forward to fill the gap between the aforementioned fields, demonstrating the importance of the topic.

In doing so, this dissertation contributes to the wider discussion of organizational ambidexterity and its micro-foundations, organizational dualities and managerial cognition. It addresses the identified research gaps with three mutually supportive and constructive strategies. First, two research papers discuss the interrelated terminology of dualities, ambidexterity and cognition and how these together can be conceptualized as cognitive ambidexterity, which is defined as “the ability to engage in parallel mental processes that are paradoxical or in contradiction” (Karhu et al., 2016; see also Chandrasekaran, 2009; Greenberg et al., 2013; Neck, 2011). Second, two separate qualitative studies were conducted to empirically test how the interrelated concepts unfold in practice. Third, an experimental study was carried out to test a particularly interesting phenomenon revealed in the qualitative studies, namely and decision-makers’ performance and preference towards different duality types, complementarity or conflicting dualities.

This chapter introduces the research background and the gaps addressed by this doctoral thesis. Thereafter, the research questions are presented, and the structure of the rest of the thesis is outlined. The first chapter finishes with definitions of the key concepts.

1.1 Research background

This section pinpoints three dimensions that play a role in constituting the theoretical background of this doctoral thesis—organizational ambidexterity, dualities with a strongest focus on paradoxes and the cognitive dimension of handling multiple demands in parallel. The research background consists of a discussion on organizational ambidexterity and its theoretical underpinnings. The section moves forward giving examples of practical dualities, of which one, exploration and exploitation, has been generally discussed and considered as a central duality in the organizational ambidexterity literature. The section also highlights the psychological dimension related to dualities. Mirroring the thought worlds of ancient philosophers, a historical overview is provided of the role of paradox in life and the universe and how it characterizes the operations of organizations. Given that this thesis focuses on the micro-foundations of dualities and organizational ambidexterity in the context of decision-making, the term micro-foundations is first clarified.

Micro-foundations

Management and the organizational sciences have discussed macro and micro levels. Macro refers to research areas such as strategic management and organization theory and
seeks to analyze firm or organizational, even interorganizational relationships. For instance, the knowledge management literature has largely discussed the macro elements such as absorptive capacity, where the organizational ability to create, integrate and disseminate knowledge depends to large extent on the organizational actors, the individuals’ abilities to respond to the changes and dynamics (Foss, 2010). The reason for the general emphasis on the macro level in management science may be due to the supposition that management scholars are “better off” leaving the individual discussions to the base sciences like psychology (Molina-Azorín, 2014).

Increasingly, several fields have become interested in the micro analyses that encompass areas such as organizational behavior mainly taking the individuals and groups as a unit of analysis. Foss (2010) described micro-foundations as “foundations of something, namely aggregate concepts and/or relations between aggregate variables” (p. 12); micro examination looks at the elements such as individuals’ actions and interactions leading to heterogeneity in firm performance (Molina-Azorín, 2014). Hence, micro-foundations refers to the microelements of individuals’ thinking and behavior that are the underlying mechanisms to produce anything that the company does (Foss, 2010).

Molina-Azorín (2014) elaborated on the reasons why micro-foundations are critical for strategy research, but also addresses well those criticality in organizational decision-making activities, as follows: 1) it is only individuals, and not collectives, that come to make decisions and engage in human actions that drive the strategy; 2) firm heterogeneity can be located at the individual level due to individuals’ heterogeneous capabilities and routines; 3) individuals constitute the learning, capabilities and knowledge of the organization, and thus to understand the organization one should understand the individuals within the organization and their “nature, choices, abilities, propensities, heterogeneity, purposes, expectations and motivations” (p. 105). Thus, micro-foundations have been discussed as a central factor to explain not only firm heterogeneity (Powell et al., 2011) but also as the origins and development of different capabilities and processes (Felin et al., 2012). Hence, micro-level phenomena are the individuals, structures and processes of the organization. Dijksterhuis et al. (2003) noted that when studying micro-organizational behavior, managerial cognition perspective (Walsh, 1995) has been adopted to explain changes in the strategies and structures of organizations.

Theorists looking at the role of cognition in strategy-related processes build on the premise that strategy as well as the organizational actors’ behavior are a result of the underlying belief systems. When the beliefs and assumptions represent a correct interpretation of the situation, those guide the decision-makers towards the right course of action. However, if the decision-makers hold “impoverished views of the world” (Goia, 1986, p. 3, c.f. Dijksterhuis et al., 2003)) it is very difficult to act on the changes and external demands in an optimal way. The belief systems concern all organizational members, however, managers have a special role as their beliefs are transformed as decisions, which concern the organization and its actions (Dijksterhuis et al., 2003). Micro-foundations as a research topic is continuously gaining more foothold in the
management research with devoted special issues in journals and conference tracks (Foss, 2010; Molina-Azorín, 2014).

This doctoral thesis looks at the micro-foundations of dualities with regard to decision-making and how those elements assist or hinder in building ambidexterity in the organization. Examination of the micro-processes helps in gaining a better understanding of the role of the cognitive dimension related to dualities and organizational ambidexterity. A multidisciplinary approach was chosen to address dualities and ambidexterity through a managerial cognition lens.

Dualities relate to alternative decision-making pairs that are both significant but are to some degree in conflict with one another (Birkinshaw et al., 2016a). The phenomenon that organizations have to deal with contradictory objectives has been addressed already in the context of complex organizations; the mechanistic versus organic systems by Burns and Stalker (1961) (Sánchez-Runde & Pettigrew, 2003). Dualities is used as an umbrella term for organizational contradictions and includes discussion on different kind of dualities such as paradoxes and dilemmas. These are also gaining a foothold in the organizational ambidexterity discussion (Birkinshaw et al., 2016a). The terminology around different types of contradictions or tensions is not yet well-established, and often the extant literature refers to paradox theory (Smith & Lewis, 2011) to signify all contradictions in the organization. The increasing fascination around organizational ambidexterity has, however, spurred academic attention and attempts to clarify the fuzzy terminology; recent special issues of The Journal of Applied Behavioral Science (Lewis & Smith, 2014; Johnson, 2014), The Academy of Management Annals (Schad, et al., 2016; Putnam, et al., 2016) and Organization Studies (e.g., Knight & Paroutis, 2016; Hargrave & Va de Ven, 2016; Jarzabkowski & Lê, 2016) were devoted to reviews of the duality literature, which contributed greatly to the amplification of the dispersed terminology and greatly increased our understanding of the concept’s applicability. Further research and special issues on the topic will follow.

Organizational ambidexterity’s roots are often traced back to J.G. March’s (1991) seminal paper Exploration and Exploitation in Organizational Learning. However, in addition to learning activities, exploring and exploiting were later linked with various inconsistent organizational behavioral and structural processes and architectures (Smith & Tushman, 2005). Organizational ambidexterity in a broad sense refers to the ability of an organization to both explore and exploit (O’Reilly & Tushman, 2013). Whereas exploration is rooted in learning through trial and error experimentation, exploitation refers to stability and maintenance activities and meticulous problem-solving. Where exploration creates a future that may require processes created in the past to be abandoned, exploitation builds on an organization’s existing competences (Smith & Tushman, 2005). Moreover, products that have been created as a result of exploration activities are often competing with existing products that exploitation activities maintain and refine (for a review of the ambidexterity literature see, e.g., Lavie et al., 2010;
Notwithstanding their fundamental differences, these apparent opposites are regarded as interdependent and non-substitutable activities of the firm (e.g., Gibson & Birkinshaw, 2004), which complement each other but also entail inconsistencies and contradictory logics, ultimately creating organizational and managerial challenges (Smith & Tushman, 2005). These contradictions often cause tensions that are related to resource allocation, but also different skills and mindsets are needed to carry out the intended activities. The widespread enthusiasm around ambidexterity can be seen as a result of its perceived newness and progressivity but also because the concept is seen as versatile (Birkinshaw & Gupta, 2013). This has led to its wide adoption in multiple contexts, which has eventually shaken the term’s explanatory power and credibility (O’Reilly & Tushman, 2013; Birkinshaw & Gupta, 2013). O’Reilly and Tushman (2008) elaborate how the capabilities and practices of senior managers play an important role. The ability to optimally allocate scarce resources in both mature and nascent businesses—an ambidextrous aptitude—is a key element in becoming successful and achieving long-term competitive advantage. Because the skillset and mindset required by exploitation activities and exploration activities are fundamentally different, ambidexterity calls for what has been termed paradoxical capabilities (O’reilly & Tushman, 2008).

Indeed, in their operations, organizations are subject to dealing with a variety of dualities (Gulati & Puranam, 2009) that resemble a juxtaposition similar to exploration and exploitation, where the perceived relationship is seen either as somehow orthogonal, synergistic and complementary or conflicting and opposite (see Cao et al., 2009; Gupta et al., 2006; Katila & Ahuja, 2002). The pressure to satisfy various inconsistent contextual demands only appears to have increased with time (Benner & Tushman, 2003; Graetz & Smith, 2008). Smith et al. (2017) describe the counterforces with abstract terms such as the tensions between “simplicity and complexity, rationality and irrationality, circularity and linearity” (p. 311). More tangible examples of strategic and operational organizational dualities have been discussed in relation to the following opposing pairs:

- Adaptability and alignment (Gibson & Birkinshaw, 2004).
- Flexibility and efficiency (Ghemawat & Ricart Costa, 1993; Adler et al., 1999).
- Formal and informal (Vlaar, et al., 2007; Gulati and Puranam, 2009).
- Continuity and change (Evans, 1992); revolutionary and evolutionary change (Tushman & O’reilly, 1996).
- Global integration and local responsiveness (Prahalad & Doz, 1987; Marquis & Battilana, 2009).
- Structure and agency (Battilana & D’Aunno, 2009; Garud, et al., 2007).
- Designed versus emergent structures (De Rond & Bouchikhi, 2004).
- Artistic and commercial orientations (Achtenhagen & Raviola, 2009).
- Incremental versus radical innovations (Andriopoulos & Lewis, 2010).
- Functions with opposite purposes such as service and sales (Jasmand et al., 2012; Yu et al., 2013).
- Commercial logic and social logic goals (Margolis & Walsh, 2003; Beech et al., 2004) or societal benefits and corporate profits (Zimmermann et al., 2014).
- Organizations’ private and social missions (Besharov & Smith, 2014; Smith et al., 2013).

In all these cases, it is possible to use the concept of ambidexterity to frame the respective research questions that are being asked (Birkinshaw & Gupta, 2013). Also Gulati and Puranam (2009) noted that organizations seek to manage several dualities, including exploration and exploitation, integration and responsiveness, efficiency and flexibility and low cost and differentiation, which can be framed as an ambidexterity issue (Markides, 2013). The underlying challenge of dualities is that they often involve tensions (Tushman & O’Reilly, 1996). Nevertheless, despite the negative connotation of the term, the tensions are not always malevolent.

The type of the dualities is defined by the relationship of what is called the poles of the duality—the extremes between which the decision-maker oscillates. The relationship of the poles can be described in the case of a dilemma as “either–or”; as interrelated in the case of a paradox, “both–and”; or as a dynamic process as in the case of a dialectic (thesis–antithesis–synthesis). The dualities literature, however, has traditionally emphasized the superiority of paradoxes over dilemmas as a synergistic approach that avoids having to choose one alternative and demonstrating the option of “having it all.”

For the sake of clarity, this dissertation discusses organizational ambidexterity as one type of capability that appears in the form of a duality. March’s (1991) paper extended his earlier notions of bounded rationality and problematic search and argued that there are fundamental incompatibilities between exploration and exploitation as modes of organizational learning. March’s framing of this tension in such an “all-purpose way” was found by many scholars to be a useful anchor to attach their research to (Birkinshaw & Gupta, 2013). Other dualities (Smith & Graetz, 2006; Janssens & Steyaert, 1999), which have been perceived as central, such as continuity and change (e.g., Graetz & Smith, 2008; Smith & Graetz, 2011), in a similar vein represent a broad juxtaposition, which could also be incorporated as one activity that the exploration and exploitation duality encompasses; exploration refers to change, whereas exploitation adheres to continuity. The duality, be it between exploration and exploitation or some other decision-pair, can be framed differently depending on whether the poles of the duality—or the extremes of the pair—appear complementary or contradictory. This relationship is described as a paradox or a dilemma depending on whether the solutions—often referred to as coping mechanisms in this thesis—handle the two opposites of the duality as if they
are conflicting or complementary, and thus engaging in both activities simultaneously or splitting those activities in time or space, for example (e.g., Poole & Van de Ven, 1989).

The history of paradoxes goes back a long way. Philosophers from the ancient Greeks to the Existentialists, as well as Eastern culture, perceived human existence *per se* as paradoxical: an attempt to balance between perpetual tensions of good and evil, life and death, others and the self (Hampden-Turner, 1990; Schneider, 1990; Chen, 2002). Chinese culture has its roots in yin–yang philosophy, which observes the being in the world as holistic, dynamic and dialectical, through which “all universal phenomena are shaped by the integration of two opposite cosmic energies, namely Yin and Yang” (Fang, 2012, p. 31; see also Peng & Nisbett, 1999; Li, 1998; Zhang et al., 2015; Lewis, 2000; Janssens & Steyaert, 1994). Yin stands for the female energy, yang for the male energy. Yin and yang together function universally and mutually. These together constitute a state of constant change, which dynamically shapes everything that happens around us (Fang, 2010). Essential to yin–yang philosophy is that, even though these opposites seem to be separate and negate each other, they still constitute an interdependent and complementary whole (Chen, 2002; Zhang, et al., 2015). In the management literature, Quinn and Cameron (1988) introduced the paradox as a framework to cope with the inherent convolution of business organizations, and it has also attracted interest in the organizational theory literature; one could say that increasingly over the past decades organizations have become more diverse, dynamic and complex, entailing increasingly more controversies or opposites (Clegg, et al., 2002; Poole & Van de Ven, 1989; Smith & Lewis, 2011).

Psychologists have, for a long time, emphasized the cognitive dimension inherent in dualities, especially in paradoxes. They have, for example, studied the impact of such tensions on mental health (Bateson, 1972; Rothenberg, 1979). They have also used paradoxical therapy to assist and accommodate the search for the individual’s inner conflicts (Harris, 1996; Watzlawick et al., 1974; c.f. Lewis, 2000). Gary and Wood (2011) and Gary et al. (2012) noted that a considerable amount of research indicates that individual mental models guide action when decision-makers attempt to adjust their strategic choices according to their individual understanding of what happens in the business environment (see also Kaplan, 2008; Tripsas & Gavetti, 2000). The managerial cognition literature (Walsh, 1995) discusses *cognitive frames*, which have been described as constructs that provide a lens or a structure for understanding a situation, be it a decision or other occurrence (Walsh, 1995), and serve as a means for explaining differences in how the decisions are perceived in the first place. The cognitive frames serve as the facilitation mechanism for a set of complex cognitive processes (Walsh, 1995) as well as behavioral acts (Denison et al., 1995; Gavetti, 2012). *Cognitive processes* are behavioral routines (Gavetti, 2012) and the means through which individuals make sense of and respond to information (Weick, 1995). Empirical applications of the cognitive dimension to ambidexterity literature are still rather rare.
Past studies show that managers frequently utilize past knowledge and prior learning experiences to make strategic choices in novel situations (Gavetti & Rivkin, 2005; Gavetti, et al., 2005). Analogical thinking has been suggested as an auspicious avenue for creating novel, inventive combinations and making sense of complex decision-making situations (e.g., Dahl & Moreau, 2002; Kalogerakis et al., 2010; Gary et al., 2012). The utilization of analogy in problem-solving (Keane, 1988) requires an analogical transfer of knowledge (past experiences and knowledge) from a base domain to a target domain (Gick & Holyoak, 1983). As managers aim to decide how to cope with contradictions related to dualities or create completely new solutions, they withdraw information from past experiences, searching for reference points. Very limited knowledge is available regarding managers’ utilization of analogies in new or dynamic decision-making contexts (Gary, et al., 2012; Kalogerakis, et al., 2010) that dualities also cultivate. Given the potential it has as a tool to facilitate different and opposite mental activities, this thesis looks at its value in generation of new product ideas that foster either exploration or exploitation.

Building the theoretical background

The theoretical background of this doctoral thesis was built through an iterative process. The point of departure was to understand the micro-foundations of ambidexterity and how such processes unfold in the context of decision-making. The organizational ambidexterity literature discusses managing the opposing demands that organizations are subject to; however, the literature addressing those micro-foundations is still relatively scarce, and therefore the ambidexterity literature alone could not provide sufficient knowledge to answer the research questions of this study. This is why the dualities literature came into consideration.

Whereas the decisions managers face may look fuzzy from a distance, when scrutinized closely they often entail a duality—polarized alternative directions that could be taken. Dualities emerge in different contexts and different forms and are good descriptions of the contradictions that characterize managerial decision-making. The ambidexterity literature addresses the antecedents, achieving the fit or balance between exploration and exploitation, or the outcomes of ambidexterity at different levels: network, organization, strategic business units (SBUs), and increasingly the top management team (TMT), lower level managers and other individuals. Ambidexterity scholars have also been interested in the spatial, temporal or behavioral means to organize the activities mainly concentrates on the poles of exploration and exploitation. Dualities have been discussed with a wider scope and provide a useful lens with which to study opposites from a decision-making context; whereas the ambidexterity literature concentrates on the complementary and conflicting aspects of exploration and exploitation, dualities offer a richer lexicon to describe the relationships between extremes (i.e. the poles of the duality).

When reviewing the literature on organizational ambidexterity and dualities, with the aim to understand the micro-foundations that enable such activities, it became evident that a range of cognitive processes are involved that facilitate the capability to tackle the
opposite demands of dualities. Ambidexterity can be seen as a behavioral act; however, to explore the roots of the behavior, we must understand the manager’s thinking that led to the act. Thus, to achieve ambidextrous capabilities, one has to master the cognitive dimensions that enable those capabilities. Moreover, to understand the origins of a manager’s thought world, we have to examine their beliefs, values, attitudes and experiences based on how they perceive, assess and eventually cope with decision-making situations. The basis of organizational ambidexterity indeed lies in the concept of learning, which was originally established in individual psychology to illustrate the different mental processes that accommodate the interpretations of different situations, to remember things and obtain knowledge via experience (Bower and Hilgard, 1981, c.f. Achtenhagen et al., 2003). Achtenhagen et al. (2003) noted there are two schools of organizational learning: the cognitive and behavioral school. Whereas the behavioral school as a “manifest change in behavior of individual, based primarily on classical or contiguous conditioning” (Achtenhagen et al., 2003, p. 76). The behavioral theory of the firm set forth by March and Simon (1958) and extended by Cyert and March (1963) views organizations as social entities that function as information processing systems, wherein decision-makers operate with a limited capacity—called bounded rationality—to contend with information flows. The cognitive school looks at the mental processes that relate to learning: how individuals make sense of situations and create meanings to those, and learning causes changes in the cognitive structures (Achtenhagen et al., 2003). As the decision-makers try to make sense of this information, they draw from their past experiences and use their individual cognitive frames and their individual knowledge structures to simplify and organize the otherwise excessively complex information.

Thus, this thesis adopts elements of both schools and establishes a framework incorporating both: mental processes that take place and can be connected to certain behavior. This follows the crystallization of cognition concept by Gavetti (2012) where “behavioral refers to the psychological underpinnings of a given phenomenon, where psychologically broadly denotes “being about mental processes”” (p. 267) perceiving cognitive and behavioral processes intertwined. This finding links the challenges of decision-making addressed in the organizational ambidexterity and duality literature to managerial cognition literature and managerial cognitive processes such as cognitive frames (Tversky & Kahneman, 1981; Walsh, 1995) and sensemaking (Weick, 1995), which give support to and an explanation as to why decisions are perceived and handled as they are.

The “onion” (Figure 1) describes the layers—from the point of departure to the supporting theoretical concepts—that have been used to understand and explain the micro-foundations of organizational ambidexterity. The figure illustrates the relationship of the constructs: dualities serve as the overarching concept of opposite activities, ambidexterity refers to the capability to deal with dualities. Furthermore, certain managerial cognitive capabilities function as important enablers of ambidextrous capabilities.
Figure 1 Conceptual point of departure

Whether dualities or organizational ambidexterity should be labelled as the core (or overarching) term is debatable. Schad et al. (2016) and Putnam et al. (2016) note that paradoxes are often framed around ambidexterity and defined as the organizational or managerial ability to simultaneously explore and exploit and so achieve a superior, sustainable performance (O’Reilly & Tushman, 2008; Raisch & Birkinshaw, 2008). Birkinshaw and Gupta found that “ambidexterity research seems to have converged around the duality of exploration/exploitation” (2013, p. 292). The terminology of dualities and ambidexterity is interwoven and overlaps a great deal; exploration and exploitation is an example of a strategic duality, yet the pair plays a central role in the ambidexterity literature. In this thesis, the focus is to understand the micro-foundations of ambidexterity, and thus it is used as the central term. Organizational ambidexterity refers to the capability of an organization to engage in exploration and exploitation activities and thereby maintain competitiveness in a long-run. Ambidextrous manager or individual is able to handle the demands of exploration and exploitation on the individual level. Thus, ambidexterity has been discussed as the capability to deal with different kind of dualities related to decision-making situations. In this doctoral thesis, the focus is to understand the micro-foundations of dualities and ambidexterity, the capability to deal with different types of dualities.
1.2 Research gaps and aims

As the complexity of competitive environments increases, managers need to respond quickly, sometimes with limited information. Therefore, managers face increasing difficulties in knowing what kind of decisions they should make to ensure a company’s success now but also its viability in the future. Organizational boundaries become blurred, and demands from different stakeholders make it more difficult to respond to simultaneous, often conflicting, demands. Even though organizational ambidexterity has steadily gained impetus over the past two decades, and researchers have managed to increase our understanding of the importance of achieving ambidexterity at different organizational levels, there are still various theoretical and empirical gaps that should be addressed. These are outlined in the following paragraphs in descending order, starting from the most general and proceeding to the more specific, profound niches. The overall motivation for addressing the identified gaps in the literature is to draw together the findings from the disparate research tenets of organizational ambidexterity, dualities (including the discussion around paradox, dilemmas, tensions and so on) and the cognitive processes related to decision-making and problem-solving; it is motivated by a desire to provide a stronger foundation for future empirical research to better understand what hinders or aids successful decision-making in a turbulent business environment and why some decisions are perceived as more complex than others.

The first gap results from the paramount interest in and the resulting diffusion and adoption of the ambidexterity concept throughout different streams of literature. This doctoral thesis aims to clarify the typology from a decision-making perspective and provide a framework of ambidexterity types in relation to the related but distinct streams of dualities and managerial cognition. The growing recognition of the significance of the ambidexterity concept and its usefulness has led to the proliferation of different and even conflicting perspectives and definitions of ambidexterity. Ambidexterity has been criticized for becoming a vague concept (Birkinshaw & Gupta, 2013; O'Reilly & Tushman, 2013), and the popularity of the term has diminished its credibility and explanatory power. It has been criticized for lacking consensus due to its wide adoption and application in versatile contexts. As Birkinshaw and Gupta put it: “[i]f ambidexterity is everything, then perhaps it is also nothing” (2013, p. 291).

The second research gap relates to dualities. To describe the dynamics of opposites, ambidexterity scholars have borrowed terminology from the duality literature such as paradoxical thinking (Mom et al., 2009; O'Reilly & Tushman, 2004; Raisch et al., 2009; Smith & Tushman, 2005; Smith, 2014) and paradoxical leader (Zhang, et al., 2015; Lewis, et al., 2014), which have increasingly gained cachet in recent years. For instance, O'Reilly and Tushman (2008) define ambidexterity as the paradoxical competences of senior managers, which are manifested as a range of decisions concerning the structure, culture and behavioral processes (see also Hodgkinson & Healey, 2011; Smith et al., 2010; Lewis et al., 2014). In addition to pointing out the connection between the literature streams of ambidexterity and dualities, this gap also addresses the fuzziness within the
terminology in the duality literature itself. The use of terms is not entirely established, and the scholars use a wide range of terms such as paradox, tensions and dilemmas for mixed purposes and interchangeably to describe the relationship of opposite activities, processes or mindsets. For example, Smith and Lewis claim that the “lack of conceptual clarity in this field is evident in the varying language adopted to describe tensions” (2011, p. 385). In turn, Putnam et al. detect a “conceptual malaise” in the organizational literature on tensions and urge researchers to “sharpen their definitions” (2016, p. 68). Also, the relationship of different constructs in the area of dualities remains relatively opaque. By addressing these gaps in the duality literature, this thesis contributes to the discussion around the typology.

The third research gap addresses the insufficient understanding of the cognitive standpoint related to building ambidexterity into an organization (Eisenhardt et al., 2010; Good & Michel, 2013). Ashforth et al., in their review of ambivalence and related concepts including ambidexterity, ask, “how do actors accomplish this difficult feat?” and “how do they respond to the vexing mixed feelings and thoughts?” (2014, p. 1453). Despite the vast number of articles on ambidexterity in the context of management, innovation and organizational behavior, research into the underlying cognitive processes required to cope with the tensions stemming from exploration and exploitation demands, or other dualities, is still at an emergent stage. The extant literature has highlighted the multiple roles that managerial cognition has in corporate strategizing activities generally (e.g., Walsh, 1995) and other organizational processes (Kaplan, 2011); however, relatively few of these studies have scrutinize the mental aspect of cognition (for these studies see Eggers & Kaplan, 2013; Gavetti, 2012; Helfat & Peteraf, 2015), particularly in the context of organizational ambidexterity (see also Tuncdogan et al., 2015; Kauppila & Tempelaar, 2015; Good & Michel, 2013; Parker, 2014). There is also a lack of understanding how cognition allows managers to achieve such balance between opposite demands (Eisenhardt et al., 2010). Similarly, as Cantarello et al. (2012) observe, regardless of how the “state of ambidexterity” is conceived, the central question how remains unclear.

In a similar vein, Knight and Paroutis (2016) note that recent studies have begun to unpack how actors respond to paradoxical tensions once they come to know them (see also Jarzabkowski et al., 2013; Vince & Broussine, 1996) and also address the gap that thus far we know very little about how paradoxical tensions become salient in the first place. Birkinshaw and Gupta (2013) note that if we wish to make progress on how ambidexterity is attained, much profounder comprehension on the nature of managerial capability is needed. Past research notes that some organizations are better at handling ambidextrous solutions than others, but for this insight to be valuable we must take a more better glance at the means how they make their decisions, who are involved in those decisions and how those decisions are executed (Birkinshaw & Gupta, 2013). Therefore, in order to understand the micro-processes related to ambidextrous capabilities, this thesis draws also from managerial cognition literature.
The fourth research gap, which relates to all three abovementioned gaps, is that this thesis takes the individual as the focal point. Research has predominantly focused on macro-level tensions; such challenges at micro-levels have received less attention (Zhang et al., 2015). There are exceptions in the paradox literature (Smith, 2014; Jarzabkowski & Lê, 2016) and ambidexterity literature (Good & Michel, 2013; Laureiro-Martínez et al., 2015; Laureiro-Martínez et al., 2010; Parker, 2014; Tuncdogan et al., 2015; Kauppila & Tempelaar, 2016). Nevertheless, senior managers in particular (Mom et al., 2009) are subject to such challenges. Ambidexterity scholars have also become increasingly interested in the multiple demands experienced by lower-level managers (Mom et al., 2007; Knight & Paroutis, 2017) or frontline managers (Zimmermann et al., 2015) and also those faced by the frontline employees (Jasmand et al., 2012; Yu et al., 2013), gearing the discussion from the structural and mechanistic factors toward the behavioral dynamics that enable or hinder ambidexterity or its movement within the organization (Knight & Paroutis, 2017). When an individual is required to “wear two hats simultaneously” (Gibson & Birkinshaw, 2004; see also behavioral integration, e.g., Mom et al., 2007; Birkinshaw et al., 2016b), he or she is consequently posed psychological and cognitive constraints as well as positive effects such as increasing motivation or pleasure (see also Duhaime & Schwenk, 1985). This doctoral thesis contributes to this discussion and aims to answer what organizational ambidexterity is in the decision-making context in the organization but with the biggest emphasis on individual ambidexterity (for a review on individual ambidexterity, see Papachroni et al., 2015). While few in number, empirical studies suggest that individuals play a remarkable role in obtaining organizational ambidexterity (Lubatkin et al., 2006; Gibson & Birkinshaw, 2004; Mom et al., 2007; Mom et al., 2009) and accentuate the managers’ behavioral actions to explore new information and to exploit existing knowledge. While the urge for balance between exploitation and exploration has been acknowledged and that the pursuit of both may cause tensions, there is little evidence to suggest what supports being able to do it well (Eisenhardt et al., 2010).

Thus, the fifth research gap of this thesis therefore addresses the mechanisms by which such multitasking and multi-thinking can be practiced, and the reasons why different dualities require different kinds of coping mechanisms. To date, the cognitive underpinnings of exploration and exploitation and other dualities remain largely unexplored (Helfat & Peteraf, 2015). Also, the review by leading paradox experts Smith and Lewis (2011) suggested that there is a gap in the understanding of the cognitive underpinnings of how managers, in fact all individuals, actually deal with contradictions. Although the individual has been considered as the unit of analysis in recent ambidexterity and duality studies, it has dealt contradictions without really demonstrating what the duality is they perceive in terms of the poles of the dualities and how do they practically manage those cognitively and behaviorally. This thesis taps onto these areas shedding light on how different types of dualities should be handled more on a micro level taking the cognitive dimension into account.
This gap relates to the practical solutions that managers implement to facilitate the co-existence of multiple roles and respond to varying demands and also lacks empirical investigation into the matter. The aspects related to subjective perception and unconscious cognitive biases in decision-making have been studied in the field of management (Ritala et al., 2016; McKenzie et al., 2009) and also, unsurprisingly, in the fields of psychology, cognitive science, information science and behavioral economics (c.f. Kaplan, 2011). Hence, despite the fact that the literature streams of dualities and ambidexterity notify of and agree on the existence of tensions, which stem from contradictory and also complementary demands, and that there is a vast amount of terminology around ambidexterity and dualities, very little of it actually empirically explores what type of solution or mechanism is the best suited for what kind of duality.

The extant literature on ambidexterity discusses the modes for organizing ambidexterity or building ambidexterity into organization—for example, one should structurally separate the incompatible exploration and exploitation activities (e.g., Tushman & O’Reilly, 1996), sequence or oscillate between those (e.g., Simsek et al., 2009) or create a context where individuals can independently divide their resources between exploration and exploitation in the most suitable way (Gibson & Birkinshaw, 2004) and carry out those activities (almost) simultaneously (for a discussion, see Good & Michel, 2013). The duality literature discusses the coping mechanisms of splitting or temporally separating the extremes of the duality (e.g., Poole & Van de Ven, 1989) or accepting the inherent paradox and trying to invent solutions to accommodate both opposites simultaneously. While these mechanisms appear useful, they generally fail to show why the particular mode was selected or what the structure of the duality is (paradox or dilemma), which ultimately impacts on the way in which it should be handled. Thus far, the extant literature provides very little explanation as to why certain dualities should be organized differently.

This gap also relates to the utilization of cognitive processes in decision-making with the purpose of finding creative solutions, not only creating structures or mechanisms to cope with or manage the tensions. In addition to managing and resolving harmful tensions, decision-makers have also been said to be able to make effective use of those (e.g., Smith & Lewis, 2011). There is growing evidence that senior managers make decisions, unconsciously and consciously, by applying analogies. Nevertheless, prior studies show that decision-makers find it difficult to identify situations that they can use those for knowledge transfer (Gary et al., 2012). Even when underscoring the potential of using analogical thinking, scholars have also noted the possible downsides related to this: attempts to use analogies for knowledge transfer can also paint an overly simplistic, even false, picture of the strategic problems they deal with (Schwenk, 1986; Gary et al., 2012). It is often seen as a goal, but managers lack the tools to implement it in the organization. Therefore, this calls for an exploration of what allows decision-makers to use analogies well for their purposes and how they are generated to thereby raise managerial awareness of this high-potential tool for problem-solving and innovative activities.
Past research has found that mental models play an essential role in the way that decision-makers make sense of the business environment and what kind of strategic choices they make based on their individual understanding of the events, opportunities or threats concerning operations (Gary & Wood, 2011; Hodgkinson et al., 1999; Kaplan, 2008; Porac et al., 1995; Tripsas & Gavetti, 2000). Important questions here are when and in particular how can managers utilize analogies from their existing structures in new or changing decision-making contexts (Gary et al., 2012). Past studies show that the utilization of analogies by transferring knowledge from familiar problems to novel situations can reformulate how the strategic problems are defined, reduce uncertainty and cut complexity as well as generate new, innovative ideas (Duhaime & Schwenk, 1985; Gavetti, et al., 2005). Hence, it can be considered an excellent method for overcoming the inertial tensions related to an inability to generate new ideas and the comfort of adhering to old routines, the latter of which is generally described as a challenge in the organizational ambidexterity literature (Volberda & Lewin, 2003; Levitt & March, 1988; Leonard-Barton, 1992; Levinthal & March, 1993).

The ambidexterity, duality and managerial cognition streams of literature highlight the role of creativity, but there are certain limitations to current theorizing that address the utilization of analogies as a cognitive process to make effective use of tensions; there is also a lack of empirical research on how this can be done. Despite the interest in analogies as an omnipresent mechanism of human thinking, scholars have discussed the lack of empirical research around this phenomenon as a limitation in the new product development context (Bonnardel, 2000; Dahl & Moreau, 2002; Hargadon, 2002; Kalogerakis et al., 2010). Therefore, this thesis addresses this gap as a part of creative coping mechanisms of dualities.

Last, the sixth research gap binds the aforementioned research gaps together and relates to the conceptualization of cognitive ambidexterity and the processes that relate to achieving it and the mechanisms regarding how it can be coped with. By bringing the aforementioned disparate research fields together, this doctoral thesis highlights the notion of cognitive ambidexterity. This thesis makes clear the importance of the notion by explaining how managers first recognize and perceive the tensions and how this influences their reactions and ways of arranging the dualities with different ambidexterity modes. Hence, the theoretical contributions concern the fact that the concept of cognitive ambidexterity in general has been tapped upon in the current ambidexterity literature only lightly (for exceptions see Chandrasekaran, 2009; Greenberg et al., 2013; Karhu et al., 2016; Neck, 2011) and warrants further conceptualization as well as empirical research. A notable example is Smith and Tushman (2005), who suggest in their conceptual paper that paradoxes originate from situational aspects (i.e., oppositional tendencies) as well as factors related to actors’ cognition (i.e., reflection or interaction). They propose that a paradox refers to the tensions in a situation, which are juxtaposed through an actor’s cognition that requires both exploration and exploitation (Smith & Tushman, 2005). The paper is a very valuable discussion opener but does not provide concrete or empirically validated solutions for how managers (and indeed all individuals) manage such processes.
Generally, the duality and ambidexterity literature share commonalities; however, their cross-pollination has remained nascent and the empirical investigation even more so.

Thus, in addition to typology clarification and conceptualizations, the described gaps require empirical examination. The conducted qualitative interviews give guidelines for the coping mechanisms for each type of duality. To do this, the thesis also operationalizes the paradox framework addressing the nature of dualities and advances our understanding of the nature of dualities. The research gaps have also been addressed by utilizing experimental methods, addressing the decision-makers’ performance and preferences regarding different types of dualities.

Figure 2 shows the research gaps and related publications. The doctoral thesis looks at the decision-making activities and draws from the extant knowledge reported by the organizational ambidexterity and duality scholars. The opposite and complementary activities, processes or mindsets are mirrored against the managerial cognition literature to tap into the micro-foundations of the opposites, the underlying mechanisms and root causes of heterogeneity in actors’ thinking and behavior. Figure 2 shows which areas—ambidexterity, dualities and managerial cognition—the individual publications contribute to the most strongly. Notable is that all publications move within all research areas, however each has a primary focus on a specific tenet. Publications 1 and 2 conceptually clarify the relationship of the three research streams, providing propositions and building a framework for cognitive ambidexterity, which has benefitted from the findings from all of these distinct research fields. Publications 3 and 4 are empirical studies exploring the nature and type of dualities and their coping mechanisms, further showcasing the role of cognitive ambidexterity in decision-making, deepening the understanding of the concept. Publications 5 and 6 have a special focus on the opposite mental activities of individuals, problem-solving and creative tasks. Publication 5 also looks at the performance and preferences of decision-makers with regards to paradoxes vs. dilemmas. The aforementioned six research gaps are addressed with the six publications, which altogether enlighten the cognitive underpinnings of organizational ambidexterity and dualities.
1 Introduction

This section highlighted the theoretical background and the point of departure of this doctoral thesis. The next section explains the research objectives and research questions in relation to the identified research gaps.

1.3 Research questions

To address the aforementioned research gaps, the overall purpose of this doctoral thesis is to build a framework for cognitive ambidexterity that combines the distinct but interrelated discussions of dualities, ambidexterity and managerial cognition. Overall, this doctoral thesis consists of two conceptual papers and three separate empirical studies, the results of which are reported in four papers. The main question is divided into three sub-questions, which each adopt a different viewpoint on the topic, addressing a different phase of the overall process and also a different levels of analysis. Altogether the six publications address the sub-research questions; nevertheless, all the publications also address the main research question from different perspectives.
The main research question of this doctoral thesis is the following:

*How do organizations identify, value and cope with contradictory and complementary dualities in pursuing organizational ambidexterity?*

The main research question first required a thorough review of the different literature streams. To answer the main research question, the extant literature on organizational ambidexterity was first reviewed to identify the factors related to the key limitations, namely the insufficient understanding of the micro-foundations of organizational ambidexterity. To meet this objective, two conceptual research papers were written, which aimed to answer the first sub-research question. These sub-research questions are addressed in *publications 1* and *2*, which analytically review the distinct concepts of organizational ambidexterity, dualities and managerial cognition and begin to conceptualize cognitive ambidexterity by building a conceptual framework and providing propositions that pave the way toward addressing the importance of cognitive ambidexterity in decision-making. The first sub-research question can be now given as follows:

**SRQ 1: What are the conceptual underpinnings of managerial decision-making in organizational ambidexterity?**

After gaining a conceptual understanding of the phenomenon, the thesis proceeds to the empirical section, which consists of four papers. The first two empirical papers, *publications 3* and *4*, explore the dualities that managers encounter in decision-making activities as well as the type and nature of those dualities. Whereas the extant literature describes the dualities on an abstract level, this study aims to bring out the dualities in decision-making, the poles of those dualities and also the nature of those dualities and thereby extend the current understanding by demonstrating the usefulness of dilemma and paradox approaches and further clarifying the coping mechanisms related to them. For that reason, the second sub-research question has been formulated as follows:

**SRQ 2: How do decision-makers perceive and cope with tensions related to organizational dualities?**

To further examine the perceived structure of dualities, *publications 5* and *6* employ different empirical research methods. Publication 5 takes an experimental approach and examines the decision-making and problem-solving processes regarding dilemma or paradox type of dualities. Publication 6 looks at the managerial decision-making and problem-solving processes in the context of new product creation and demonstrates the importance of cognitive ambidexterity and the power of analogical thinking in assisting in exploration activities, which are generally perceived as more difficult as opposed to exploitation activities. Hence, the third, and the last, sub-research question is as follows:
SRQ 3: How do organizations make use of cognitive ambidexterity in facilitating creativity?

Together, these research questions guide the thesis toward the understanding, illumination and demonstration of the micro-foundations of dualistic decision-making processes.

This doctoral thesis is comprised of two parts: Part I gives an overview of the doctoral thesis and Part II contains the individual publications that address the outlined research questions. Part I introduces the topic of the doctoral thesis in Chapter 1, outlining the key aspects of the research background and addressing the research gaps and objectives as well as the research questions of the study. Chapter 2 summarizes and briefly discusses the extant knowledge of the theoretical literature streams that constitute the background for the doctoral thesis: ambidexterity, dualities and managerial cognition reviewed in the context of decision-making. Chapter 3 specifies the methodological choices, research methods and outlines the key details of data collection and analysis related to the empirical studies of this doctoral thesis. Chapter 4 summarizes the objectives, the key findings and the main contributions of each individual publication. Chapter 5 concludes Part I with the answers to the research questions, the main contributions of the thesis and the managerial implications as well as discusses the limitations of the study and gives some direction for future research.

The doctoral thesis seeks to introduce the cognitive ambidexterity concept, which has been only lightly addressed in the current ambidexterity literature (empirical exceptions include Chandrasekaran, 2009; Karhu et al., 2016; conceptual exceptions include Greenberg et al., 2013; Neck, 2011). The thesis highlights the variety of cognitive processes that dualities involve in the decision-making context. Last, it demonstrates the role of cognitive ambidexterity in problem-solving and generating creative solutions. In addition to the conceptual and theoretical contributions in clarifying the dualities, ambidexterity and managerial cognition literature, the thesis aims at some empirical theoretical implications. Empirically, this doctoral thesis contributes to showcasing how individuals cognitively process the different duality types and how they cope with the opposite demands inherent to the dualities. Table 1 highlights the research questions, the most corresponding research gaps and the overall objectives of the study.
Table 1 Research questions and objectives of the study

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<th>Part I: Overview of the doctoral thesis</th>
<th>Part II: Publications</th>
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<tbody>
<tr>
<td><strong>Main research question:</strong></td>
<td>How do organizations identify, value and cope with contradictory and complementary dualities in pursuing organizational ambidexterity?</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>THEORETICAL/CONCEPTUAL</th>
<th>Research sub-topic</th>
<th>Research gaps</th>
<th>Sub-research questions</th>
<th>Publications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction to cognitive ambidexterity</td>
<td>Conceptualizing and identifying the role of cognitive ambidexterity in decision-making processes</td>
<td>1, 2, 3, 4, 5, 6</td>
<td>SRQ 1: What are the conceptual underpinnings of managerial decision-making in organizational ambidexterity?</td>
<td>1, 2</td>
</tr>
</tbody>
</table>

| EMPirical                           | Identification of dualistic decision-making activities, assessment of their nature and recognition of established coping mechanisms | 2, 5, 6 | SRQ 2: How do decision-makers perceive and cope with tensions related to organizational dualities? | 3, 4         |

| | Scrutinizing decision-making processes that aim at generating creativity | 5, 6 | SRQ 3: How do decision-makers make use of cognitive ambidexterity in facilitating creativity? | 5, 6         |

The next section briefly outlines a glossary of the key concepts discussed in this doctoral thesis.
1.4 **Definitions of the key concepts**

Before discussing the theoretical background and the framework of this doctoral thesis, it is essential to briefly introduce the key concepts and how they are used and defined in the present thesis. This sub-section presents the working definitions used in this thesis in alphabetical order. The terms presented in this glossary are the key definitions used throughout this doctoral thesis and serve as a reminder for the reader. The glossary is not a univocal list of the terms used in this thesis but aims to serve as a quick aid for the reader. Thus, the purpose of this section is not to explain the concepts thoroughly but rather list the key concepts that will be discussed throughout this thesis. The terms are summarized in Table 2, which only briefly introduces the key concepts (and not their "sub-concepts").

Table 2 Summary of working definitions

<table>
<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analogy</td>
<td>A cognitive process of transferring information or meaning from a familiar subject or domain (the source) to another context (the target).</td>
<td>Gick and Holyoak (1983)</td>
</tr>
<tr>
<td>Cognition</td>
<td>The mental activities involved in acquiring knowledge and carrying out processes of attending, remembering, and reasoning; also the content of the processes, such as concepts and memories.</td>
<td>The American Psychological Association Glossary of Psychological Terms (2002); Kaplan (2008)</td>
</tr>
<tr>
<td>Cognitive ambidexterity</td>
<td>&quot;The ability to engage in parallel mental processes that are paradoxical or in contradiction (which may then result in a particular behavior).&quot;</td>
<td>Karhu et al. (2016, p. 5)</td>
</tr>
<tr>
<td>Cognitive frames</td>
<td>Cognitive filters or lenses, which structure the reality and attach meanings to events. Frames lead individuals to consider responses that they find suitable.</td>
<td>Porac and Thomas (2002); Weick (1995)</td>
</tr>
<tr>
<td>Contradiction</td>
<td>Bipolar opposites that are mutually exclusive and interdependent such that the opposites define and potentially negate each other.</td>
<td>Putnam et al. (2016, p. 70)</td>
</tr>
<tr>
<td>Dialectic</td>
<td>A pattern that starts with a thesis, is followed by an antithesis and is then resolved by synthesis (integration). Publication 3 uses the term dialectic to illustrate that the opposites of the same duality are activated and oscillated between to find a resolution (synthesis).</td>
<td>Smith and Lewis (2011); Westenholz (1993)</td>
</tr>
<tr>
<td>Dilemma</td>
<td>Occurs when it is hard to choose between two equally beneficial elements. Dilemmas are either–or situations.</td>
<td>Janssens and Steyaert (1999); Westenholz (1993); Gaim and Wåhlin (2016)</td>
</tr>
<tr>
<td>Duality</td>
<td>Relates to alternative decision-making pairs that are both significant but are to some degree in conflict with one another.</td>
<td>Birkinshaw et al. (2016a); Graetz and Smith (2008)</td>
</tr>
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(Continued)
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<thead>
<tr>
<th>Concept</th>
<th>Definition</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managerial</td>
<td>The knowledge structures that represent the individual information worlds.</td>
<td>Walsh (1995)</td>
</tr>
<tr>
<td>cognition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micro-founding</td>
<td>Looks at the microelements such as individuals’ actions and interactions leading to heterogeneity in firm performance.</td>
<td>Molina-Azorín (2014)</td>
</tr>
<tr>
<td>Paradox</td>
<td>Contradictory yet interrelated elements that exist simultaneously and where the tension persists over time and there is no attempt to resolve it.</td>
<td>Smith and Lewis (2011); Gaim and Wåhlin (2016)</td>
</tr>
<tr>
<td>Tension</td>
<td>Often emotional states, which stem from feelings such as frustration, blockage and uncertainty that individuals experience when they are faced with contradictions in their decision-making activities.</td>
<td>Lewis (2000); Smith and Berg (1987); Smith and Lewis (2011); Vince and Broussine (1996); Putnam et al. (2016)</td>
</tr>
</tbody>
</table>
2 Theoretical background

In the following, the core concepts and the underlying characteristics of the main concepts—organizational ambidexterity and dualities—will be reviewed and discussed. The focus will be on the aspects that are relevant for this particular study, and the concepts are examined in the light of decision-making in operational and strategic activities instead of the traditional approach of looking solely at strategy-making decisions. The last section will present the conceptualization of cognitive ambidexterity and the outcome of drawing together those that are currently considered as distinct literature streams. It is crucial to critically review the current body of literature regarding the related areas to arrive at new conclusions and contributions to extend our current understanding of the contradictions related to decision-making. The decision-making in this thesis concentrates to large extent on the “pre-phase of decisions,” the moments before the actual decision is made. The thesis looks at framing the decision, making sense of the decision, and making an assessment of the nature of the decision and its structure. These pre-phases eventually lead to a certain outcome, how the decisions are coped with, which this thesis also taps into. The theoretical background thus helps this thesis toward making its intended contribution: to provide understanding on the context and contingencies of how the tensions become salient to the individuals, especially managers in organizations, and showcase how those tensions are perceived and eventually coped with. Handy (1994) suggested moving from managing paradoxes to coping with paradoxes. This term has been adopted in this thesis, and coping has been used to refer to finding solution to the decision making situation, or managing the tensions related to the opposites, eventually coming to a workable solution.

2.1 Theoretical point of departure

The theoretical points of departure are dualities, organizational ambidexterity and management decision-making. Figure 3 illustrates the basic framework of the study that will be used and which will be discussed shortly. The main idea of the theoretical framework presented is to underscore the interrelatedness of the three elements—strategic and operational dualities and managerial cognition in building ambidexterity into organization in the context of decision-making.
As the framework shows, the concepts share a plenty of common ground, which the extant literature has not yet made explicit or used these connections to their full potential. The literature on dualities assists in explaining the demands that ambidexterity poses on individuals. Managerial cognition helps to understand the tensions that arise from the dualities in decision-making as well as the cognitive demands that stem from the pursuit of ambidexterity. Finally, cognitive ambidexterity utilizes the knowledge from the three distinct literature streams and the new information that arises in their intersections. The next section discusses managerial decision-making as a context of this doctoral thesis.

2.2 Managerial decision-making as a context

As a result of digitalization, globalization and many other changes, complexity has increased, and managers face the pressure to address myriad competing strategic and operational demands simultaneously (Smith et al., 2010), which consequently complicates the decision-making processes. Early organizational scholars had already acknowledged these competing strategic demands—such as the pressures of exploring and exploiting (March, 1991), the simultaneous demands of maximizing profits and increasing social welfare (Margolis & Walsh, 2003), or global integration for economies of scale and local adaptations (Marquis & Battilana, 2009; Prahalad & Doz, 1987)—but
argued that success depended on managers’ ability to make decisions and maintain a consistent commitment to those decisions (Barnard, 1938; Thompson, 1967; c.f. Smith, 2014).

Decision-making is often paralleled to problem-solving, which can be seen as a semantic matter (Cooke & Slack, 1984). Decision-making can be seen as the choice of alternative courses of action (Cooke & Slack, 1984). Lang et al. (1978) in their review paper assessed the difference between problem-solving and decision-making: “[s]ome writers envision problem-solving as a broad process that includes decision-making […] Other authors depict the opposite—problem-solving as an element in the decision-making process. A third set of authors treat decision-making and problem-solving as synonymous and use both terms to describe a general process of information gathering, analysis and choice behavior” (pp. 855-856). This doctoral thesis adopts also the problem-based view of the firm (Nickerson & Zenger 2004), where the problem has been taken as the unit of analysis (see Publication 2). Overall, this thesis discusses decision-making as a part of a bigger process of problem-solving, which incorporates the phases of recognizing that the problem exists, its interpretation and diagnosis as well the implementation of a suitable solution mechanism adopting a similar view to that of Cooke and Slack (1984).

Taking decision into the central point for understanding managerial activities date back at least to Barnard (1938) (c.f. Kaplan, 2008). The theory of rational choice, which is based on the assumption that individuals scan the available options and choose the preferred one following a consistent, rational criterion, has been widely appreciated; nevertheless, its limitations have been said to be its inability to fully explain why or how managers make economic decisions in an uncertain world using their subjective cognitive systems (Stubbart, 1989). In economics, little comfort was given to managers who were unsure what the best or preferred strategic decision should be or what the economic alternatives actually are and were puzzled as to which strategy is the best for the marginal utility-maximization. In the strategic management domain, Schendel and Hofer (1979) elaborated on and expanded the ideas that Chandler (1962) had set forth in his work Strategy and Structure. They described strategic management as an analytical process consisting of elements that highlight the principles of microeconomic theory: rational decision-making, economic motivations, efficiency, environmental analysis, goal and strategy formulation and their evaluation, which were considered to be a result of rational thinking activities. However, later it was noted that all the aforementioned activities embody a cognitive component, and in order to perform those activities, managers indeed need to envisage, anticipate, prioritize, assess and make judgments—even when they address behavioral routines, such as implementation, which must also be considered (mentally) before putting the plan into practice (Stubbart, 1989). Decision theory can be divided into normative theory, which suggests how to make the best possible decisions, and descriptive decision theory analyzes individuals, who may behave irrationally, when they made decisions (Rode, 1997). This thesis adopts the latter approach.
Cognitive psychology and behavioral decision theory research report abundant deviations from flawlessly rational behavior related to all aspects of economic activity (Rode, 1997; Kahneman & Tversky, 1979). The roots of the cognitive perspective of the organizations can be found in the very large body of work produced by the Carnegie School researchers in the 1950s and 1960s, headed by J. G. March, H. A. Simon and R. Cyert (Uotila, 2015). The research largely concentrated on organizational behavior, management science and psychology as well as decision analysis, including the widely applied theory of bounded rationality, addressing the cognitive limitations of organizational actors when making decisions. This perspective adopted decisions and the information processing activities as the unit of analysis for organizations (Gavetti et al., 2005; Uotila, 2015). Hence, decision-makers, and indeed managers, are constrained by the computational capacities of the human mind when facing complex, multidimensional decisions. This is to say they are limited in their perceptions, their knowledge is imperfect and incomplete, and they have to respond with limited attention, memories and information-processing abilities. Thus, rather than optimizing, individuals deploy simplifying rules and heuristics to streamline decision-making processes (Mellers, et al., 1991). Stubbart (1989) noted that most strategic management scholars would now agree with the notion that managers operate with limited rationality—nevertheless, it must be admitted that at the same time, many managers master exceptional strategy-making, are proficient organizational experts and are also creative innovators.

From a managerial decision-making point of view, the aforementioned strategic and operational demands involve contradictory tensions (Tushman & O’Reilly, 1996), which managers perceive differently as a result of different demographics, cultures, processes and knowledge-management practices (Smith, 2014). Multiple studies have pointed to leaders who can anticipate trends and based on those foresee and develop strategies to suit the novel conditions that are likely to be successful (Laureiro-Martínez, et al., 2015); nevertheless, generally speaking, decision-making is an important act in which many managers have failed. Rode (1997) suggested two reasons for this: either managers feel indifferent about making suboptimal decisions—which appears as the less likely option—or they are not aware of making suboptimal decisions. The latter points toward the gap addressed in this doctoral thesis.

Given the rising complexity of managerial decision-making activities, it has also been discussed in the organizational ambidexterity literature. Jansen et al. linked research on ambidexterity to the framework of dynamic capabilities and suggested that organizational ambidexterity refers to “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” (2009, p. 799). Altogether, the complexity, ambiguity and different abilities required make decision-making a fruitful context for exploring tensions of all kinds, and therefore decision-making including strategic and operational decision with regards to dualities was selected as a research context for this doctoral thesis. More particularly, this thesis looks at decision-making in the context of marketing management and innovation management.
Such decisions incorporate multiple stakeholders and represent a duality setting as such: ensuring the continuity of business operations and change management activities to find novel business opportunities, new customers and more efficient or innovative processes.

The next sections highlight the concept of organizational ambidexterity, which is a management stream discussing the opposite – or seemingly opposite – or complementary demands faced by organizations.

### 2.3 Organizational ambidexterity

Organizational ambidexterity has become a popular theoretical anchor (Birkinshaw & Gupta, 2013) for a variety of research questions. Several scholars (e.g., O’Reilly & Tushman, 2013; Birkinshaw & Gupta, 2013) have noted the risk that the organizational ambidexterity concept bears: the concept has been applied to increasingly more disparate phenomena. While this popularity has a positive impact on the gained research on the topic, eventually this decreases the concept’s explanatory power, and it is in danger of losing its meaning, eventually becoming a buzz word that means everything and at the same time nothing. The next sections highlight the evolution of the term from a biological or medical term to the concept it is today, the complementary and conflicting relationship of exploration and exploitation as well as the different modes to organize those to build ambidexterity into organization.

#### 2.3.1 Background and definitions

The term ambidexterity has its roots in the Latin word ‘ambidexter’. The prefix ambis means “on both sides” and dexter is an indication of “right or favorable” (Szaflarski, et al., 2008). Therefore, an ambidextrous person is capable of using both hands equally well in playing instruments or sports, for example. Originally, ambidexterity referred to “the power of using both hands alike” or figuratively to a “superior dexterity or cleverness; shiftiness or general readiness or even ‘double-dealing’” (Oxford English Dictionary). Thereby, ambidexterity can be considered as a source of competitive advantage: ambidextrous persons are more successful in manual as well as mental tasks. In sports, for example, mastering ambidexterity is equal to outstanding physical performance: ambidextrous footballers, tennis players or boxers have a net advantage in contests against players who can skillfully use only their right or left appendages (Hess & Rothaermel, 2008).

Tushman and O’Reilly (1996) defined organizational ambidexterity as “[t]he ability to simultaneously pursue both incremental and discontinuous innovation…from hosting multiple contradictory structures, processes, and cultures within the same firm” (p. 24). Departing from this definition, in the context of business operations, ambidexterity refers
to organizations’ ability to perform opposite—or at least very different but somehow interdependent—activities that are to some degree in conflict (Gibson & Birkinshaw, 2004). Yet, ambidexterity differs from mere multitasking, such as for instance walking and having a phone meeting stress different cognitive dimensions, and therefore there is no tension or conflict that results from these actions, and those activities are not opposite in the sense of being non-substitutable and interdependent.

Researchers have also increasingly addressed the complementary nature of opposites, which better follows the original definition drawn from biology, where the ability to use both appendages equally results in better performance. It was Duncan (1976) who first introduced the term organizational ambidexterity to the management literature and argued that firms should put up dual structures to both initiate and execute innovation. Fifteen years later, March (1991), building on his previous works, developed the widely adopted notion of exploration and exploitation, which has subsequently often been cited as the basis for ambidexterity—despite the fact that this seminal paper does not mention the term. The central problem that ambidexterity postulates is the tradeoff or mutuality between the previously mentioned exploration and exploitation (March, 1991) in addition to efficiency and flexibility (Adler et al., 1999) or adaptability and alignment (Gibson & Birkinshaw, 2004) among other opposites. Thompson described the phenomenon as central to the “paradox of administration” (1967, p. 15); managers have to choose between organizational designs that fit to repetitive, routine tasks and those that are suitable for innovative, non-routine tasks. Ambidexterity research has traditionally scrutinized the actual meaning of ambidexterity and the antecedents or outcomes of engaging in both exploration and exploitation activities, developed measurements for ambidexterity and discussed the complementarity and conflicting aspects of exploration and exploitation as well as the ambidexterity types (see, e.g., Raisch & Birkinshaw, 2008; Gupta et al., 2006). Central to the ambidexterity studies is that organizations—even individuals—should aim at finding the fit or balance between the opposite activities, as an over-reliance on one can have detrimental impacts on the organization’s long-term success and is thus considered to be an untenable strategy. The next section discusses the activities of exploration and exploitation, which are generally discussed as the opposite activities, which have to be handled together in order to become ambidextrous or maintain ambidexterity.

### 2.3.2 Exploration and exploitation

Despite an awareness of the importance of achieving the right balance or fit between exploration and exploitation (or other opposite activities), it is a challenge, as the concepts represent two fundamentally different notions (He & Wong, 2004), which require different modes of learning and mindsets (March, 1991) and different processes and routines (Burgelman, 2002). March (1991) and later Levinth and March (1993) made it clear that organizations need to conserve the balance between exploiting the existing competencies and investing sufficient resources for exploring new business opportunities.
that ensure future success or survival at least. March discussed firms’ exploitation actions describing those as “refinement, choice, production, efficiency, selection, implementation, and execution” and stated that its opposite, exploration tasks, are characterized by “search, variation, risk taking, experimentation, play, flexibility, discovery, and innovation” (1991, p. 71). Finding, achieving or maintaining this balance between exploration and exploitation ambidexterity literature refers to “being ambidextrous”, “acting ambidextrously” or “building ambidexterity”.

While the strong focus on exploitation might deliver positive short-term results, and performance is likely to be more steady for a certain time (He & Wong, 2004), paths to new opportunities in volatile markets can be blocked (Barkinshaw & Gibson, 2004); what initially were seen as the core competencies of the firm may eventually develop into its core rigidities (Leonard-Barton, 1992). Similarly, mere focus on exploration might significantly reduce efficiency within the company due to the inability to improve existing processes (March, 1991) and that the performance of explorative organizations is characterized by greater fluctuations, which can become great success stories but also bring a risk of a failure (He & Wong, 2004). Thus, the recommendation from the ambidexterity scholars is to find ways to invest enough managerial attention and resources to both, exploration and exploitation activities.

Managers at different levels of the corporate hierarchy make decisions from their own perspective based on where they are positioned in the company (Weick, 1995; Lubatkin et al., 2006). Lubatkin et al. (2006) noted that exploration requires an open mind from the senior management: the development of a whole new set of heterogeneous skills and processes that are targeted at experimenting with new market opportunities, which open up as a result of shifts in factor or product markets (Burgelman, 1991). Exploration requires managers to neglect familiar routines and listen to the employees in the organization and learn from them instead of giving orders (Wooldridge & Floyd, 1989). Exploitation usually signifies top-down orders as opposed to learning from subordinates, formal routines and guidelines and established procedures that support the existing course of action. The challenge that stems from the exploration and exploitation are the possible tensions, for instance resource conflicts or different skills needed, for managers is the simultaneous maintenance of flexible and formal structures and behavior and the provision of a suitable context that allows the efficient co-existence of both necessary and mutually supporting activities.

Turner et al. (2013) noted in their review that the term “ambidexterity” in the current literature is not about managerial “activity,” something that managers do, but that it is about managerial “capability,” the exploration of what managers do. However, it seems that with the excess of ambidexterity vocabulary, ambidexterity can refer to other settings as well. The main principle is that it builds on the identification of tasks or functions, which at first glance seem incompatible, into time or space by establishing organizational structures. Table 3 presents some selected examples of definitions of exploration and exploitation.
In this thesis, ambidexterity is seen as the capability to handle different dualities in parallel, sequentially or simultaneously. At first glance, one may think that to define exploration and exploitation duality as one cannot describe the other element of the duality without describing the other element. In the theory of minimizing or maximizing functions subject to constraints, a problem may lead to a certain “dual problem” (Rockafeller, 1967), where the two problems are bound together like the strategy problems of the opposing players in a game of two persons: neither can be solved without implicitly solving the other. In light of the findings in the recent literature reviews, this does not hold true, or at least only to a much lesser extent than before. Exploration and exploitation have largely departed from the idea of “literal opposites,” and nowadays scholars have applied exploration and exploitation to mean different functions (e.g., sales vs. service), ideologies (profit vs. non-profit) and strategies (e.g., low cost vs. differentiation) as well as business logics (old vs. new business model), where the exploration and exploitation are not exactly conflicting or complementary but rather different enough to be called opposites.

This thesis follows the general understanding of what ambidexterity means to the firm: the opposite activities are characterized by their interrelatedness and non-substitutability: the organization needs both and cannot dismiss either one of the activities. Therefore, organizations, business units or individuals cannot decide for either one; they have to organize both. Ambidexterity is interested in the question of how exploration and exploitation are organized. The extant research is also concerned with why exploration and exploitation (or other opposites) should be balanced, fitted or maximized. The reasoning for finding the optimum resource allocation fit for the opposites is ultimately rooted in the sustainable advantage of the firm. The next section discusses the central aspect of ambidexterity: complementarity and conflicting nature of exploration and exploitation.
2.3.3 Exploration and exploitation: complementary or contradictory

The ambidexterity literature has discussed the relationship of exploration and exploitation. March (1991) suggested that exploration and exploitation are two contradictory activities, which should be seen as two ends of a continuum. March saw these two as competing for scarce resources and as technically incompatible. Exploitation of the already known can be substituted by the exploration of the unknown. Tushman and O’Reilly (1996), in a similar vein, argued that successful firms develop through incremental change, which is predominant for long periods, and short periods of revolutionary change. In times characterized by transitions in the industry, firm executives may need to creatively destroy the present source of their success to come up with better ideas, better products and better solutions that will build the success of tomorrow. Also, Walrave et al. (2011) proposed that exploitation and exploration are conflicting elements, given that the companies’ resources are limited and that devoting resources to exploitation will thus directly decrease the resources that can be dedicated to exploration. Gupta et al. (2006) suggested that both exploration and exploitation refer to learning but to different degrees or types of learning and that, depending on whether the focus is on one domain or many, exploration and exploitation take the form of two ends of a continuum. Cao et al. (2009) noted that under resource-constrained conditions, managers may be better off concentrating on managing trade-offs between exploitation and exploration demands; however, when resources are abundant, the simultaneous pursuit of exploitation and exploration can be conceivable and desirable.

Hence, not all resources held by organizations are scarce by nature. Resources such as knowledge can be accumulated without limit and are fostered by sharing (Shapiro & Varian, 1998). Nerkar defined exploration as “the creation of new knowledge through recombination of older knowledge obtained by examining a wider time spread” and exploitation as “the creation of new knowledge through a recombinant process that emphasizes regency” (2003, p. 211). Also, a firm can acquire at least a part of its organizational knowledge by learning from past experience (Huber, 1991) and can utilize analogical thinking, for example, to generate limitless new possible combinations (Schunn & Dunbar, 1996). Thus, when a company’s resources regarding some aspect such as knowledge are not seen as limited, one can depart from the underlying idea of two ends of a continuum toward a more orthogonal (Gupta et al., 2006) or balanced view (Cao, et al., 2009) and begin to look for options for how exploration and exploitation can be organized simultaneously in a mutually reinforcing way. Therefore, an alternative view to the polarized view of exploration and exploitation is to see these seemingly opposite activities as complementary approaches. For example, Katila and Ahuja (2002), in their study of new product introduction, called the first dimension search depth, referring to the depth of knowledge reuse, and the second dimension search scope, referring to the width of new knowledge exploration. In this case, both dimensions are not only compatible but also complementary to each other—orthogonal dimensions.

This thesis takes a broad view and looks at the dualities of exploration and exploitation among others as opposites that generate a tension of some kind, be it positive, negative,
both or neutral, and where the opposites have a connection of between each other yet varying levels of interdependency and non-substitutability. Characteristic to the exploration and exploitation activities is that the need to satisfy these opposite demands cause tensions. To level out the tensions, obtain both parts of the duality or maintain the balance between the opposites, organizations have created different methods, which are called as modes for ambidexterity. Those refer to the coping mechanisms for organizing exploration and exploitation or other dualities such as flexibility and efficiency or adaptability and alignment discoursed in the ambidexterity literature. These will be discussed in the following section.

### 2.3.4 Modes for ambidexterity

Given the different skills, mindsets and capabilities that exploration and exploitation require from the organization, the attainment of both often proves to be a challenge. Whereas exploration activities require flexible, fluid organizational structures that allow creative and agile processes, exploitation activities call for stable routines and follow established processes. It is obvious that even though the resources may not be scarce, such differences do contradict in terms of the processes, timelines, skills and attitudes required, which inevitably causes tensions. Organizations are inherently steered toward adherence to routines and prone to be resistant to change. However, all sustainably competitive organizations should find a way to facilitate both exploration and exploitation—or however one wishes to call the opposing endeavors—and organizations have established different methods for facilitating this. To avoid an over-emphasis on exploitation, or more rarely an exploration trap (Volberda & Lewin, 2003), or the tensions that arise from the capabilities and resources needed, organizations can choose to separate exploration and exploitation structurally, temporally or, when possible or feasible, organize them together contextually for the same business unit; the most demanding option is to combine them on an individual level. In the following section, these options, or modes for balancing (Lavie et al., 2010), for ambidexterity are discussed in more detail.

Duncan (1976) claimed that different organization structures are required during the initiation and implementation stages of the innovation process and suggested the idea of dual structures. Structural ambidexterity (Benner & Tushman, 2003; O’Reilly & Tushman, 2004; see also partitional ambidexterity, Simsek et al., 2009) refers to such spatial separation of the opposite activities and was the first to appear in the ambidexterity literature. Structural ambidexterity is a synonym for dual-structure organizations, which means that the exploration and exploitation activities are carried out separately. The most frequently demonstrated form of structural ambidexterity are structurally separate business units, where some are specialized in explorative tasks such as breaking the familiar routines, new product development (NPD) activities and novel innovations, whereas the opposite unit carries out incremental innovation, maintenance and fine-tuning tasks related to exploitative innovation. Structural ambidexterity (O’Reilly & Tushman, 2008) thus synchronizes exploitation and exploration by allocating the conflicting aspects—skills, mentality and resources required—into different structural
units such as divisions of an organization (e.g., Tushman & O’Reilly, 1996; Simsek et al., 2009) or even locates them outside of the firm’s boundaries by outsourcing some activities.

From a decision-making viewpoint, separate structures pose the danger of communication gaps for the organization, as this mode of ambidexterity involves the separation of exploitative and explorative activities into two different units (or employees) (e.g., Simsek et al., 2009). Structural separation bears the risk that innovative ideas cannot be transferred and integrated effectively across the whole company, thus leading to the isolation of particular business units (Prange & Schlegelmilch, 2009). Essentially, each unit establishes its own management team, organizational culture, structure, incentive and control systems (Benner & Tushman, 2003). Therefore, the units dedicated to exploration or exploitation operate fairly independently; nevertheless, from the organization’s perspective they are interdependent and require coordination and a shared vision from the management team to steer both objectives simultaneously (Simsek, et al., 2009; O’Reilly & Tushman, 2008).

Cyclical (Simsek et al., 2009) or punctuated ambidexterity (Rothaermel & Deeds, 2004; Winter & Szulanski, 2001; Helfat & Raubitschek, 2000) is rooted in the observation that organizations evolve through periods of stability (exploitation), which are interpolated by episodes of change (exploration). In contrast to the spatial separation logic of the structural ambidexterity mode, the rationality of cyclical ambidexterity lies in the temporal separation of opposite activities. Cyclical ambidexterity is theoretically rooted in punctuated equilibrium, introduced by psychologist Kurt Lewin (1947), who presented a three-phase model for change at the group level, a “quasi-stationary social equilibrium,” which is equivalent to a river which flows with a certain speed in a certain direction during a certain time interval. This equilibrium is described as a threefold process consisting of unfreezing the present level, then moving to the new level and finally freezing the new level reached (Lewin, 1947). The idea was brought to the ambidexterity literature by Tushman and O’Reilly (1996), who described the successful process of punctuated equilibrium using biological evolutionary theory: “Instead of slow change, discontinuities required a different version of Darwinian theory—that of punctuated equilibria in which long periods of gradual change were interrupted periodically by massive discontinuities” (Tushman & O’Reilly, 1996, p. 12). Gersick (1988) noted that similar punctuated equilibrium patterns can be observed in project groups’ behavior in how they approach their work, alternating between inertial change and revolution; this “did not develop in uniform series of stages, nor through linear, additive building block sequences” (Gersick, 1991, p. 13).

In the context of decision-making and processes that unfold through a concentration on stable activities that are interrupted by periods of innovation, reciprocal ambidexterity (Thompson, 1967; c.f. Simsek et al., 2009) can be seen as a variant of cyclical ambidexterity and is based primarily on collaborative problem-solving, information exchange and communal decision-making. It refers to the sequential pursuit of
exploitation and exploration across units, whereby the exploration outputs of one business unit become the exploitation inputs of another business unit, or vice-versa, in a process-like, sequential manner. Social networks enhance the synergy between the alternating streams of exploitation and exploration that occur across time and units, and, therefore, unlike the other ambidexterity types, reciprocal ambidexterity requires relationships among the managers—and perhaps also other employees—of different units in addition to the coordination activities of the top management team (Simsek et al., 2009).

Individuals are also found to follow a pattern similar to those of organizations and teams. One theory that accounts for this can be found in adult development. Levinson (1978, 1986) described an oscillation between periods of transition and stability as the structure develops through a sequence of stable (structure-building) periods and transitional (structure-changing) periods (Levinson, 1986). In addition, Lewin (1958) borrowed concepts from physics to explain individuals’ behavior as an interaction between a person’s needs and personality and external factors stemming from the environment that impact on the individual. The key is in how the individual perceives these factors: as synergetic or conflicting (Burke, 2011).

Increasingly, firms seek to find opportunities to generate synergies by assigning both exploration and exploitation tasks to the same team, which requires the ability to balance contradictory demands and skills simultaneously. In the current literature, this has been referred to as contextual ambidexterity (Gibson & Birkinshaw, 2004) (see also behavioral integration, Birkinshaw et al., 2016b and harmonic ambidexterity, Simsek et al., 2009). Gibson and Birkinshaw (2004) suggested achieving ambidexterity by establishing a business unit context that encourages individuals to act according to their own judgment of how best to allocate their resources between different demands. The prerequisites for contextual ambidexterity (Adler et al., 1999; Gibson & Birkinshaw, 2004) are the management’s support and trust and building the conditions and stimulus that enable and encourage such acts. Contextual ambidexterity is therefore achieved once internal processes, structures, goals and rewards are formulated to properly support the desired behavior (Prange & Schlegelmilch, 2009). Contextual ambidexterity has been proposed to follow the idea of Forrester’s (1968) systems dynamics, where the system’s structure defines the behavior that can be detected within that system. Ultimately, if one wishes to change the behavior within the system, one has to change the structure of the system (c.f. Markides, 2013). Thus, to facilitate contextual ambidexterity, the organizational context must be altered to allow such behavior.

Contextual ambidexterity on an individual level (for a review see Papachroni, et al., 2015)—as opposed to the team or SBU level—is the biggest challenge cognitively but also opens up possibilities for synergies that the other ambidexterity types do not offer. For instance, Jasmand et al. (2012) discussed how employees in a call center engage in sales and service tasks simultaneously; Yu et al. (2013) explored these activities in bank branches. In these cases, contextual refers to the creation of behavioral and contextual conditions for employees to perform the activities so that both principally conflicting
goals are achieved through synergetic efforts by up- and cross-selling. Eisenhardt et al. (2010) studied how managers use their expertise and higher-order thinking to balance efficiency and flexibility. As mechanisms to do so, the authors proposed the abstraction of the problem, cognitive variety and occasional work interruptions; ultimately, the idea is to simplify the cognitive reactions to respond to the complex tensions of exploration and exploitation.

Simultaneous, contextual individual ambidexterity not only indicates establishing more complex behavioral routines but also a more complex mindset, which moves from management research to the domains of psychology and biology. When individuals engage in simultaneous contextual ambidexterity, they are in fact switching between exploration and exploitation tasks very frequently (Good & Michel, 2013). The way in which ambidexterity studies differentiate between simultaneous and sequential ambidexterity is rather ambiguous; how rapid should sequencing be before it starts to be really simultaneous? Essential to cyclical ambidexterity is that if the cycles are very quick, it leads to switching costs and cognitive switching penalty, where some time and effort is needed to orient oneself again to the task at hand (Monsell, 2003). Rillo (2016) explained that simultaneous exploration and exploitation is difficult to achieve without any structural decisions due to the setup of the human brain. Research on the lateralization of the human brain discovered that under standard circumstances, the left and right hemispheres of the human brain carry out contrary functions: the right hemisphere is concerned with holistic, intuitive and creative issues, whereas the left hemisphere is concerned with analytical, logical and sequential operations. Moreover, one function is dominant, and thus tasks demanding logic and creativity cannot be biologically and psychologically conducted at the very same time. Attempts to carry out such opposite tasks simultaneously exposes individuals to a great cognitive strain (Rillo, 2016). Indeed, in their functional magnetic resonance imaging (fMRI) experimental laboratory study, Laureiro-Martínez et al. (2015) found that the tasks resembling exploitation activated the areas allied with reward-seeking, which assess the value of present choices; in turn, the exploration activities were assessing the potential of alternative options.

This doctoral thesis has a special focus on individual ambidexterity but the role of individual is linked to the entire process of building ambidexterity into organization. The thesis also links the cognitive processes related to building ambidexterity and thus discusses all aforementioned modes to handle ambidexterity that have been identified in organizations. The focus is on the individuals and their role in the organization when handling multiple demands simultaneously and in parallel. Individual contextual ambidexterity is discussed as a combination of cognitive processes that are related to the field of managerial cognition as well as the behavioral routines through which decision-makers manage or facilitate mental activities. This thesis also taps onto the creation of new product ideas for explorative and exploitative innovations that were created by new product creation (NPC) teams looking into contextual ambidexterity of a team. However, also the aforementioned study looks at individuals’ perceptions of making duality type of
decisions. Figure 4 below recaps the relationship of exploration and exploitation in different the modes of organizing those activities to achieve ambidexterity.

![Figure 4 Ambidexterity types as per the relationship of exploration and exploitation](image)

Finding the suitable mode for organizing exploration and exploitation activities is a crucial factor that plays a role in building ambidexterity into organization. The fit of exploration and exploitation has been found to bring positive and significant effects on superior performance with regards to innovativeness (Tushman & O’Reilly, 2004; He & Wong, 2004), sales’ growth, company revenue, customer retention rates (Jasmand et al., 2011; Sarkees, 2007; Sarkees et al., 2010; Birkinshaw & Gibson, 2004; Tushman & O’Reilly, 1996), firm survival as well as to resistance to organizational crises, employee motivation and corporate reputation (Birkinshaw & Gibson, 2004). The fundamental logic of ambidexterity is that if there is not proper fit or balance between exploration and exploitation, the unit or individual may be functioning well in the short term but not in the long term, eventually leading to what has been called a success trap or a failure trap (Junni et al., 2013). Extant exploration is risky and does not build on the existing knowledge, and, similarly, over-exploitation bears the risk of lagging behind the competition. Thus, the ambidexterity literature looks at different types of ambidexterity, which refers to the methods through which ambidexterity is built into an organization.

Some studies mention that firms should “achieve greater ambidexterity” (Kim & Min, 2012), which can mean, for instance, 1) doing more exploration, as firms have a tendency to over-exploit until it becomes impossible to rely on the current knowledge or business models, 2) obtaining a better fit between exploration and exploitation or 3) finding a better mode to organize those within the company or across networks. Ambidexterity has been studied via qualitative, quantitative and mixed methods; however, the primary emphasis appears to be on the quantitative given the interest for measurement. For instance, Junni et al. (2013), in their meta-analysis of ambidexterity research, revealed that ‘exploitation’ was generally associated with gaining profit and ‘exploration’ to growth; when and how ambidexterity really affects the business performance is it not evident. Ambidexterity researchers have also found that the “ambidextrous state,” which they define differently, does not lead to positive outcomes only. Studies such as that by Baliga et al. (1996) show
that, for instance, dual roles may have a detrimental impact on firm performance when the chairman of the board and CEO are the same individual. Hence, ambidexterity has been said to be beneficial but when and when not, exactly, remain somewhat vague. This can be due to the unclear definition of the level of analysis in the studies, type of ambidexterity one wishes to contribute to and the versatile and varying methods for measuring ambidexterity. In this thesis, the sub-optimal ambidexterity mode has been considered as the reason for the undesired performance outcomes.

The next section focuses on the specific elements discussed in the duality literature simultaneously mirroring the findings against the extant ambidexterity research.

2.4 Dualities

The previous sub-section discussed the conditions for decision-making, which resemble March’s (1991) notion of exploration and exploitation (and other pairs), which are also described as one type of duality in previous studies (Birkinshaw & Gupta, 2013). This section starts with a background and history of dualities (Evans & Doz, 1989). Then the terms characterizing dualities such as contradictions, tensions and conflicts are described. Then the different types of dualities are discussed: dilemmas, where the relationship of the opposites is seen as conflicting; paradoxes, which see the opposite poles of duality as complementary, synergistic, even irrational that challenge the formal logic: and finally, dialectics, which suggests tensions are transformed through conflict. Given that also dialectics has been mirrored against paradoxes – in addition to dilemmas – in the recent duality literature (see, e.g. Hargrave & Van de Ven, 2016), also this kind of a relationship of the opposites of the duality will be discussed. Notable is, however that dialectics play a lesser role in this thesis. The publications in this thesis mainly contrast dilemma and paradox, as these illustrate the exploration-exploitation type of duality that is characteristic to organizational ambidexterity literature. Whereas perceiving exploration and exploitation as complementary requires paradoxical thinking, dilemma resembles a conflicting relationship of exploration and exploitation (or other dualities). Finally, the last section gives a brief overview of the coping mechanisms of the dualities, the methods through which the tensions stemming from the opposites can be managed or leveraged.

While the dualism or duality debate is a relatively recent trend in management studies, they spread a long way in the history of social theory, such as the works by Hegel and Marx, for example (c.f. Collinson, 2005). Duncan, who coined the term organizational ambidexterity in 1976, described the functional organizational form as the dualistic enterprise, a dual organization, in which the process of managing and organizing necessitates the building of tension (Cameron & Quinn, 1988; Evans & Doz, 1992; Hampden-Turner, 1990; Janssens & Steyaert, 1999). Duality theory has been said to originally be a by-product of Giddens’ (1984) structuration theory—a discussion of the
elements that he called functionalism and structuralism. Giddens’ theory aimed to enlighten the interplay between contradictory elements as ontologically inseparable and mutually constituted, which makes it impossible to describe one without also describing the other (Schad, et al., 2016). Pryor et al. (2015) noted that Giddens’s structuration perspective also provides a framework for examining the dual nature of social structure (the rules and resources) and agency (the individuals who sustain but also alter the structures). Evans and Doz (1992) outlined four main beliefs of dualistic organizations as follows: 1) the attributes of a social system are in general complementary and conjointly denote a duality, 2) the relationship between complementary dualities is not static but dynamic, 3) minimal thresholds are imperative to managing dualities and 4) strong focus on a polarity results in organizational disintegration and instability (c.f. Graetz & Smith, 2008). Building on this, Graetz and Smith (2008), in their review of the characteristics of dualistic organizations, focused on the complementary forms of organizing and found that the dualities literature comprised themes related to simultaneity, relationality and dynamism as well as minimal threshold and improvisation, the latter referring to dualities aiming at creative actions. Simultaneity relates to the simultaneous presence of seemingly contradictory elements and their interdependency. The minimal threshold refers to the minimal maintenance of desirable attributes; in the prevailing state there should be as little consensus as possible to challenge the status quo at all times. Dynamism highlights the dynamic interaction between the poles of the duality, and improvisation is an amalgamation of emergent and intended actions (Graetz & Smith, 2008).

Jackson noted that duality theorists “can maintain conceptual distinctions without being committed to a rigid antagonism or separation of the two elements being distinguished” (1999, p. 549). This thinking applies to decision-making pairs, such as order and disorder, stability and change, predictability and unpredictability, which operate by “mutual specification rather than mutual exclusivity” (Ford & Backoff, 1988, p. 100). Graetz and Smith (2008) suggested that the motivation for organizations to attempt to become dualistic entities (Pettigrew & Fenton, 2000) is that continuity and change symbolize a fundamental, overarching meta-duality required by all healthy organizations (Evans, 1992). Putnam et al. (2016) drew a distinction between dualities and dualism, and define dualities as “[t]he existence of opposite poles, dichotomies, binary relationships that are able to create tensions, but can be separated”; dualism, in turn, refers to the “[i]nterdependence of opposites in a both/and relationship that is not mutually exclusive or antagonistic” (p. 69). There dualities are something that contradict each other, and dualism refers to rather complementary relationship of the poles. The recent literature, however, often discusses both terms rather interchangeably to refer to activities that are somewhat opposite and interdependent.

Duality theorists have redefined the traditional binaries of change as improvisational but bi-directional and dynamically interrelated more than merely pitted against each other (e.g., Farjoun, 2010; Graetz & Smith, 2008; Graetz & Smith, 2009, Putnam et al., 2016). Hence, dualities are regarded as forces that must be balanced and are characterized by contradictory yet complementary elements (Janssens & Steyaert, 1999; Gaim & Wåhlin,
Dualities refer to responding to two opposite elements in parallel (Achtenhagen & Melin, 2003; Gaim & Wåhlin, 2016). Duality is defined as the “twofold character of an object of study without separation” (Farjoun, 2010, p. 203). Farjoun (2010) points toward a synergistic relationship between competing demands and views the demands as interdependent: “the coexistence of competing demands in that, although conceptually distinct, […] are mutually enabling and a constituent of one another” (Farjoun, 2010, p. 203). Therefore, the dualities view on contradictions departs from “a one-dimensional representation” to uncover “the double-sided nature of practices and their conjoint operation” and contributes to “identifying a broader range of complementarities” (Farjoun, 2010, p. 216).

Despite the increased discussion around dualistic demands in management and organizational theory, Poole and Van de Ven (1989) noted that present organizational theory is still struggling to fully explain such contradictions (Benecke et al., 2007). Janssens and Steyaert (1999) noted that organization and management theories are progressively being addressed through terms that are “sub-types” of dualities, such as paradoxes (Cameron & Quinn, 1988; Poole & Van de Ven, 1989), dilemmas (Hampden-Turner, 1990) or dialectics (originally Hegel, 1969; later, e.g., Smith & Lewis, 2011; Putnam et al., 2016). Indeed, just as with dualism and dualities, the current literature often applies terms interchangeably to describe the conditions of opposite goals, processes or actions that share a relationship that has some level of interdependence. Additionally, Putnam et al. (2016) claimed that dualities have become a broader term where the opposites are no longer following the above description with conflicting processes but rather simply different aims, goals and so on. As the notion has been adopted and applied in different contexts, the opposites can denote different functions (e.g., sales vs. service), values (e.g. societal vs. profit-oriented) or strategies (e.g. local vs. global). Sales and service (Jasmand, et al., 2012; Yu et al., 2013), for instance, are activities that are vital to the firm and interdependent and in a way non-substitutable but not ontologically inseparable, as in Giddens’ (1984) theory. The same goes for the discussion of global versus local (Prahalad & Doz, 1987), which are indeed opposite strategies but which cannot be seen as binaries. Also incremental and radical innovations, opposites described especially in the ambidexterity literature; indeed, these functions are opposite what comes to the required skills, resource intensity and mentality, however, those conjointly take the organization toward the same goal, the survival and viability of the firm.

Sánchez-Runde and Pettigrew (2003) suggested that dualities denote an amalgamation of paradoxes, dilemmas and dialectics as well as competing values and goals, which they view as representations of distinctive but related forms of organizing. Also Birkinshaw et al. (2016a) define dualities as an umbrella term for the decision-making pairs that can appear in the form of paradox, dilemma or dialectic. Figure 5 shows the tension areas arising from the contradictions related to different types of dualities.
Generally, the locus of duality is related, for example, to strategic, structural, functional, collective/individual or temporal issues and to organizational values or culture. These resonate similarly to the exploration and exploitation paradigm—the exploitation of current capabilities as opposed to engaging in something new and risky but necessary. Evans and Doz (1992) and Clegg et al. (2002) suggested that, in fact, holding a minimal consensus at all times is important in order to actively challenge current practices and processes. Similarly, Graetz and Smith suggested keeping “the structural pole to a minimum” (2008, p. 272). Figure 6 (adopted from Smith and Graetz, 2011, p. 194) describes the concept of dualities, the contradictions embedded in it and the ongoing dynamism between simultaneity and balance that are shaken by inter-relationality and dynamism. The organizational actors seek solutions to maintain a balance between the opposites, or the poles of the duality, in the prevailing dynamism between those.
Fairhurst (2001) also problematizes additional notable dualities in the area of management communication, such as managership versus leadership, transactional versus transformational, mechanistic versus organic and autocratic versus participative. Janssens and Steyaert (1999) establish a typology for dualities as a response to depart from a static to more processual approach to framing dualities. They categorize dualities as structural, cultural and personal dualities and propose a more dynamic framing of them. Sánchez-Runde et al. (2003) discuss dualities in the light of the systemic view of the firm, which suggests that the firm’s structure and strategy should be aligned with the people’s management dualities as how individuals are handling the dualities ultimately effects on how well those are handled as an organization. The people management dualities are cultural (e.g. general vs. specialist cultures), work organization (e.g. assignment clarity vs. task flexibility), leadership and management (e.g. encouraged vs. forced participation) as well as HR dualities (e.g. collective sanctions vs. reputation preservation). In the new forms of work organizations managing especially the assignment clarity and task flexibility, defined accountability and freedom to execute, specialized professionalism and multidisciplinarity as well as intra-team stability and inter-team adaptability dualities have become central (Sánchez-Runde et al., 2003).

Dualities’ research shares commonalities but also differs from the focus points of ambidexterity research. The dualities and ambidexterity streams of literature have been considered as distinct although they have indeed gained a common ground in academic discussion in recent years. Birkinshaw and Gupta (2013) went back to the meaning of ambidexterity as an organization’s ability to master two different things equally skillfully and noted that organizations are indeed making an attempt to master many types of
dualities (Gulati & Puranam, 2009), such as formal and informal, efficiency and flexibility, strong ties and bridging ties, adaptability and alignment as well as integration and responsiveness, in addition to the previously discussed exploration and exploitation. They note that in all the aforementioned cases, there is no reason not to use the concept of ambidexterity to frame the respective research questions that are being asked. To a large extent, ambidexterity research appears to converge particularly around the duality of exploration and exploitation, which may be due to the broad definition of those (Birkinshaw & Gupta, 2013). Whereas ambidexterity is concerned with obtainment (enough) of the opposites, duality scholars focus more on the tensions that stem from the opposites, and their relation is assessed rather with the structure or the type of the duality, which describes the relationship of the opposites. The tensions are not something that organizations choose to have but emerge from the context and contingencies in the operations: conflicting objectives, resource constraints or skills needed. The duality studies have a qualitative emphasis and thus are less interested in measuring the fit or providing guidance on the optimal balance than ambidexterity research. Generally, it is less prominent how the fit or balance between the opposites of the duality can be achieved, however, duality scholars have offered coping mechanisms to deal with the tensions arising from the dualities. Similarly to the ambidexterity literature, dualities have been suggested to be separated spatially or temporarily to balance the tensions and achieve the ability to obtain both poles of the duality.

Of note is what duality actually is and what differentiates it from ‘monolities’ (Sánchez-Runde et al., 2003), or the ill-defined, fuzzy and wicked problems. In the duality literature, the meta-duality is grounded in continuity and change: whereas the other opposite pole wishes to keep things constant (i.e., the minimum of something new), the other strives for change, which is inevitable sooner or later, challenging the “if it ain’t broke, don’t fix it” thinking.

The literature around different contradictions and tensions in management is very mixed and mingled, and generally the term paradox has been used to signify all tensions in companies. Smith (2014) noted that conceptual confusion between the constructs in the field remains, and scholars often use these terms interchangeably. Tensions in organizations can be broadly studied from the perspective of strategic dualities, which require managerial attention (Birkinshaw et al., 2016a). Strategic dualities vary in terms of the cognitive demands that they place on managers. Dilemma refers to a situation with several competing solutions where the pros and cons of each solution can be identified, whereas paradoxes have to do with the contradictory yet interrelated organizational demands that exist simultaneously (Smith & Lewis, 2011; Gaim & Wåhlin, 2016). The different forms of dualities are discussed in the following sections. The next sub-section presents the definitions and terminology used in this study: First the section gives an overview of contradictions, tensions and the related term conflicts as those are important for describing the relationship of the opposites or the poles of the duality. Thereafter, the different forms of dualities – paradoxes, dilemmas and dialectics, are discussed more in detail in the following sub-sections.
2.4.1 Contradictions, tensions and conflicts in organization

Over two decades ago, Charles Handy (1994) noted that the much used phrase “It’s a paradox” had developed into a management cliché and used this to illustrate divergent forces in complex business and organizational environments (c.f. Putnam et al., 2016). Handy perceived the phrase as overexploited and vague but that it nevertheless symbolized what had become the nature of today’s volatile and turbulent business environment (Ashcraft & Trethewey, 2004). Nowadays, in an effort to stay competitive in this changing business arena, organizations seek to find new solutions that make the nature of work more flexible by utilizing novel technologies, by working from home and by outsourcing the non-core activities. This division between modern and traditional ways of working blurs the organization’s and the individual’s boundaries between leisure and work (Putnam et al., 2016). However, similar phenomena appear much earlier. In management, the organizational theory lays its ground on tensions and contradictions. Early scholars, such as Taylor (1911), Barnard (1938), Follett (1941) and Fayol (1949), among others, were concerned with the tension between organizational effectiveness and employees’ welfare (c.f. Hargrave & Van de Ven, 2016). Lewin (1943) conceptualized organizations as balanced between forces of resistance and change. Also, structural contingency theory (e.g., Burns & Stalker, 1961) was concerned with designing organizations so that they attain operational stability without compromising their responsiveness to a changing environment (c.f. Hargrave & Van de Ven, 2016).

Thus, the frictions in different elements are omnipresent, and, unsurprisingly, the research related to contradictions and tensions has also gained momentum in interdisciplinary social sciences, including education, communication, psychology and sociology, and has led to an accumulation of different concepts and theories that address organizational contradictions (e.g., Fairhurst & Putnam, 2014; Good & Michel, 2013; Putnam et al., 2016). This has only accelerated the research conducted to clarify paradox and the related terms: contradictions, tensions (Ashcraft & Trethewey, 2004; Lewis & Smith, 2014; Smith & Lewis, 2011) as well as conflicts, which will be discussed in the following.

Contradictions

Early psychologists and philosophers had already noted that contradictions surface as oppositional elements that foster a tug of war experience (Schad et al., 2016). Putnam et al. (2016, p. 70), in their comprehensive review, compared the different definitions of contradictions. Contradictions have been defined as “diametrically opposed and mutually exclusive choices” (Putnam, 1986), “dynamic tensions between opposite elements that together form a unity and logically presuppose each other for their very existence and meanings” (Werner & Baxter, 1994) and “bipolar opposites that are mutually exclusive and interdependent such that the opposites define and potentially negate each other” (Putnam et al., 2016). Contradictions are inherent in the human knowledge of reality and become evident in practices, arrangements and artifacts (Hargrave & Van de Ven, 2016). In communication studies, Baxter and Montgomery (1996) described an approach to personal communication where social life is regarded as a “dynamic knot of
contradictions, a ceaseless interplay between contrary or opposing tendencies” (p. 3). In this doctoral thesis, contradictions are used as a general term to describe the relationship of different opposites, be it a paradox, dilemma or dialectic. Contradictions in dualities are seen to cause tensions. Thus, all dualities entail contradictions and subsequently tensions; nevertheless, the tension the contradiction causes is not necessarily harmful or perceived as bad—despite the term’s somewhat negative connotation. Therefore, tensions can also be seen as triggers for the other constructs to emerge in this arena.

**Tensions**

Opposites such as differentiation and integration or change and continuity “can never be reconciled once and for all”, which cause them to create tensions (Evans, 1999, p. 328). Individuals see, sense and cognitively process and often also talk about or express the tensions they encounter (Putnam et al., 2016). Tensions have been described to unfold as anxiety, discomfort or stress or difficulty in making decisions and moving forward in organizational situations (Fairhurst & Putnam, 2014). Putnam et al. (2016) noted that tension, nevertheless, has been used as the widest, and also the most vague, of the concepts within dualities, and academics have indeed applied it to imply all inconsistent forces (Putnam et al., 2016). Tensions can be defined as the feeling states that stem from frustration or uncertainty (Smith & Berg, 1987; Smith & Lewis, 2011; Vince & Broussine, 1996), even causing blockage or paralysis (Lewis, 2000). However, tensions are not always vicious but can also provide a spark for innovation and creativity (Miron-Spektor et al., 2011), making the tension beneficial for the company.

Smith and Lewis (2011) suggested that tensions can be both inherent, and thus exist within the system, and socially constructed, where the tensions arise from cognitive or rhetoric sources. Smith and Lewis (2011) build a tension framework showcasing the areas explored in the prior literature. The categories of the framework also reflect the categorization of the early paradox research—Quine’s (1962) paradoxes of organizing, belonging, learning and performing—and resemble Quinn and Cameron’s (1988) competing values of belonging-clan, learning adhocracy, organizing-hierarchy and performance-market. Smith and Lewis (2011) categorized four paradox themes, representing the core activities and elements of organizations as 1) learning, 2) belonging, 3) organizing and 4) performing (see also the previous works by Lewis, 2000 and the empirical works of Lüscher & Lewis, 2008; Jurzabkowski et al., 2013; Jay, 2013). Across these four contexts, managers must decide what they choose to do or choose not to do—how this action will be implemented, when and by whom. Smith and Lewis (2011) established additional in-between categories (e.g., learning–organizing, belonging–performing), but these were not utilized in the empirical study of this doctoral thesis as the data would have become too fragmented and it would not have served the purpose of clarifying the dualistic decision-making situations that managers encounter.

Each category entails different types of organizational tensions, which have been categorized based on the criteria described above. Learning tensions appear “between
today and tomorrow or between looking forward and looking backward” (Smith & Lewis, 2011, p. 388). These emerge as dynamic systems of change and through renewal and innovation; here, the clash arises because of the need to not only build the future but also to destroy the past to achieve change (O’Reilly & Tushman, 2008). This type of tension addresses the tensions between incremental and radical innovation or continuous and episodic change, reflecting the nature (Abernathy & Clark, 1985; Ghemawat & Ricart Costa, 1993) and pace (Weick & Quinn, 1999) of engaging with new ideas. Belonging tensions emerge as a result of conflicting identities and values (Smith & Lewis, 2011, p. 388). Complexity and plurality act as drivers for such tensions, which refer to identities—others and self, collective and individual—in search of both belonging somewhere and being an individual self. Schad et al. (2016) found in their review that whereas most of the research concentrates on learning tensions, such as exploration and exploitation, very little research focuses on belonging paradoxes (Lüscher & Lewis, 2008; Smith & Lewis, 2011), such as those emerging between competing identities or between the individual and the collective (Schad et al., 2016).

Operative decisions may lead to organizing tensions, which surface as complex systems that create competing processes and designs. Organizing tensions (Lüscher & Lewis, 2008; Smith & Lewis, 2011) examine how firms create such processes and designs to achieve a preferred outcome, referring to dualities such as collaboration and competition, routine and change or the simultaneous needs for control and flexibility (Schad et al., 2016).

Finally, performing tensions (Lüscher & Lewis, 2008; Smith & Lewis, 2011) refer to competing goals or the plurality of stakeholders (Donaldson & Preston, 1995). An example of performing tensions would be corporate social responsibility, where performance depends on both financial and social goals (Margolis & Walsh, 2003) and thus conflicting aspirations of generating value. Figure 7 below shows the tension categories compiled by Smith and Lewis (2011, p. 383).
When talking about tensions and contradictions, the image of a conflict comes to mind. Often the relationship of dualities, including exploration and exploitation, has been described as conflicting (e.g., Smith & Lewis, 2011). Though there is an entire stream of literature dedicated to exploring different types of conflicts and their resolution mechanisms, conflict as a term has also been used in the duality literature to describe the frictions organizations and their actors face. Findings from the conflict literature are useful when conceptualizing the phenomenon described in this doctoral thesis. Several factors that are particularly useful have been identified by the conflict literature; these are related to whether conflict yields positive or negative effects for managerial decision-making (e.g., Amason, 1996; Baron, 1991).

Despite its general negative connotation, Amason (1996) suggested that a conflict that arises from the task at hand can bring about positive outcomes, whereas a conflict that surfaces due to personality differences yields negative outcomes. However, cognitive conflict—the strife between opposing viewpoints or perspectives—can improve the quality of decisions, as the actors come to better conclusions through interactions (Baron, 1991). Pelld et al. found that cognitive conflict “fosters a deeper understanding of task

Figure 7 The main tension categories by Smith and Lewis (2011)
issues and an exchange of information that facilitates problem-solving, decision-making and the generation of ideas” (1999, pp. 22-23).

Baron’s (1991) study and review of the human cognition literature identified various factors that may have a role in determining whether conflict leads to primarily negative or positive effects. Baron (1991) studied the extent to which managers perceived conflicts as positive or negative. The findings showed that managers noted remarkably fewer positive effects than negative effects; nevertheless, all participants had experienced positive conflicts. The factors that are responsible for the negative rather than positive effects stem from strong negative emotions related to cognition, stereotype-driven thinking and attributional processes (Baron, 1991). Stereotypes are cognitive structures (i.e., schemas or schemata) that have an important and powerful role in cognitively processing and retaining information. The study shows that if actors engage in stereotype-driven information processing—making perhaps false generalizations—it is more likely that the conflict at hand will yield negative effects. This calls for guidelines on how to lessen the impact of stereotypes in yielding positive outcomes for conflict. Interaction with others and the evaluation of ideas strengthens the logical structure upon which the decisions are based; discrepancies in opinions may also generate discussion and a better understanding of one another’s ideas (Baron, 1991). Evans (1999) discuss constructive tension related to cognitive conflict, which can be seen as a trigger for positive organizational development by sharing various perspectives or engaging in active debate. Similarly, Brown and Duguid suggested that there are “some organizational tensions and conflicts that managers should not try to resolve” (2001, p. 93) and explained that in isolation these countervailing “forces can destroy a company, but conjointly they produce creativity and growth” (p. 93). Parayitam and Dooley (2011) noted that so far, however, the findings with regards to cognitive conflict are not consistent, and some have also found there to be negative outcomes of cognitive conflict.

In sum, the contradictions that stem from the different nature or requirements related to the opposite poles of the dualities cause tensions and conflicts, which vary in their nature. Based on the relationship of the opposites, the dualities have been described and named differently in the literature. The next sections describe these different dualities: dilemmas, paradoxes and dialectics.

2.4.2 Dilemmas

Dilemmas are described as either–or situations, where one option must be favored over the other (Janssens & Steyaert, 1999; Westenholz, 1993). Dilemma is described in logic as a form of inference where there are two main premises presented in hypothetical form and a minor disjunctive premise (either–or). For example, “If we increase the price, sales will slump—if we decrease the quality, sales will slump. Either we increase the price or we decrease the quality” (Encyclopedia Britannica, 1998).
Smith and Berg (1987) suggested that a dilemma causes *a sense of paralysis, or stickiness*, because it denotes that a choice must be made between polarities, each entailing high costs as well as benefits (Lüscher & Lewis, 2008). Achtenhagen and Melin (2003) noted that dilemmas are an indication of difficulties in selecting between two equally valuable elements. The trade-offs arise gradually as one element is continuously emphasized at the expense of the other (Gaim & Wåhlin, 2016). These choices can trigger vicious cycles, where over-emphasis on one side or precedence over the other hinders creative energy (Lewis, 2000; Gaim & Wåhlin, 2016).

Smith and Lewis (2011), among other scholars, have distinguished dilemma from paradox based on the relationship between the alternatives that decision-makers opt to cope with. According to the dilemma view, the poles of duality are contradictory or conflicting; the paradox view is the opposite—the poles are seen as mutually reinforcing. Generally, the duality literature suggests ways to overcome the dilemma-thinking: Lüscher and Lewis (2008) built a structure or framework showing the stepping stones toward a way of abstracting dilemma to a paradox solution by employing higher-order thinking. In the empirical study of this doctoral thesis, the possible virtues of dilemma-solutions have also been identified and discussed.

This doctoral thesis uses the term dilemma to illustrate the situation when the duality’s poles seem unfitting or investing attention and resources to the one extreme decreases the amount of attention given to the other pole, which is seen as equally important action to be realized, at least in a long-run. Dilemmas have also been linked to the managerial cognition literature; the term dilemma-framing has been used to illustrate the cognitive framing process where the duality is perceived or presented as incompatible, either-or decision.

### 2.4.3 Paradoxes

*Resilience is based on the ability to embrace the extremes—while not becoming an extremist. Most companies don’t do paradox very well.*


The management literature has been increasingly interested in paradoxes. As the early philosophers noted, human life is paradoxical, and, as such, the paradox lens seems to be applicable to myriad circumstances. To discuss the applicability of the paradox perspective, it is sensible to revisit the definition of paradox. According to Cameron and Quinn, “[t]he key characteristic in paradox is the simultaneous presence of contradictory, even mutually exclusive elements” (1988, p. 2). Those seemingly mutually exclusive elements are demands, perspectives, viewpoints, emotions or ideas (Quinn & Cameron, 1988). Poole and Van de Ven characterized paradoxes as “interesting tensions,
oppositions, and contradictions between theories which create conceptual difficulties” (1989, p. 564), at the same time defining the relationship of the constructs discussed in the previous sections. Smith and Lewis defined paradox as “contradictory yet interrelated elements that exist simultaneously and persist over time” (2011, p. 382), thus delineating from rationality and linearity, which is sensed as threatening both emotionally and cognitively, causing abstruseness, obscurity, insecurity and uncertainty (Lewis, 2000). Paradoxes can also, however, be seen as questions that suspend us between too many good answers (Sorensen, 2003).

Ford and Backoff (1988) viewed paradox as a thing that can be constructed, becoming apparent through self-reflection, social reflection or interaction. By “a thing,” they mean that it “denotes a wide variety of contradictory yet interwoven elements: perspectives, feelings, messages, demands, identities, interests, or practices” (c.f. Lewis, 2000, p. 761), which cause mixed messages but can also lead to self-referential loops or system contradictions (Putnam, 1986). Self-referential loops occur when contradictions are inserted within a consistent statement, concept or process (Lewis, 2000); system contradictions refer to the goals, reward systems, resource allocation or needs and the division of labor that entails contradictions of some kind (Putnam, 1986). Finally, mixed messages are inconsistencies in verbal or non-verbal communication. The ambiguity of these messages causes tensions when managers make sense of the abstruse, continuously changing world (Argyris, 1993). Such a brief review of paradoxes is already a good illustration of the reality that paradoxes are omnipresent in organizational decision-making activities.

When the managers or decision-makers wish to engage in paradoxical solutions, they will, metaphorically speaking, “wear the paradox hat” and see the opposite elements entailed, whilst accepting their pertinent existence (Lewis, 2000). For instance, this may mean different kinds of learning activities and engaging in a repertoire of various roles and activities (Mom et al., 2009; O’Reilly & Tushman, 2004; Raisch, et al., 2009; Smith & Tushman, 2005). The current management literature discusses engaging in integrative thinking (Martin, 2007), employing paradoxical frames (Miron-Spektor et al., 2011) or lenses (Smith & Lewis, 2011) or paradoxical logic (Norman et al., 2004), which can facilitate the endeavors of such “multi-thinking” and the subsequent behavior—a multitasking of some sort.

In this thesis, paradoxes play a significant role in a various ways. Paradox-lens has been used to describe the duality’s poles, for instance the relationship of exploration and exploitation: when the relationship of the poles is mutually reinforcing or illogical but functional, it has been described as a paradox. Connection to managerial cognition literature is the following: when the managers use paradoxical cognition they frame the dualities as paradoxes, which indicates the compatibility of the constructs or the need to find ways to engage in opposites conjointly.
2.4.4 Dialectics

The history of dialectics has its roots in the times of Plato, who referred to it as an indication of something positive by means of negation; however, the idea of the “negation of negation” only later became the term we know today (Adorno, 1973). With his book *Negative Dialectic*, Adorno (1973 [1966]) looked to update the philosophical process known as dialectics. Hegel and Marx’s social philosophies discussed the conflicting but coexisting social forces that were to produce a new social order. For Hegel (1969), for example, dialectics referred to a process of realizing that things (forces, aspects, opinions) embed their own negation, and once this is realized, the parts of the things are eliminated to give rise to something that is even better and greater. Thus, in Hegelian dialectics, one starts with a thesis, which gives rise to the antithesis, and finally the tension is resolved via synthesis. The thesis is a representation of “the old” or “what is,” whereas the antithesis denotes “the new” or “what could be.” Eventually, the resulting synthesis is the combination that the contradiction creates (Gaim, 2017, pp. 16-17).

According to the dialectic view in today’s management literature, problems are dualities, where the opposite poles of the duality share an interrelated and dynamic relationship, and the problem is resolved via the transformation of the tensions into a new synthesis (Ford & Backoff, 1988). Putnam et al. defined dialectics as “interdependent opposites aligned with forces that push-pull on each other like a rubber band and exist in an ongoing dynamic interplay as the poles implicate each other” (2016, p. 71). Thus, in dialectics the relationship of the duality is a dynamic one: the balance between opposites is achieved through dialectical transformation, but it rather “emerges in the relationship between these two poles” (Clegg et al., 2002, p. 495).

In the organizational or business context, dialectical forces are in competition for managerial attention and the available resources. Attention must be drawn to organizational elements, features and characteristics that produce such a conflict and the mechanisms through which they can be controlled (see also De Rond & Bouchikhi, 2004; Benson, 1977). For instance, De Ron and Bouchikhi (2004) explored interorganizational collaborations through a dialectical lens by conducting a longitudinal case study of a biotechnology-based alliance. The study shows “the coevolutionary interchange of design and emergence, cooperation and competition, trust and vigilance, expansion and contraction, and control and autonomy” (p. 56), which illustrates well the dialectical nature of tensions. Indeed, dialectics is built on the idea that attempts to discard the tensions that arise from conflicting demands will create a new opposition again and again, infinitely (Gaim & Wåhlin, 2016).

In this doctoral thesis, dialectics has been used to describe a relationship of the opposites or poles of the dualities, which are in movement: in the duality, the dominance varies between the two sides by oscillating between the two and arriving at the synthesis, which the decision-maker may or may not be happy about. In the empirical study (publication 3), dialectic was used to describe the framing process of the duality, which did not
resemble a constant nature but rather a process where managers’ framing of the duality was dynamic, addressing both poles dynamically.

2.4.5 Coping with different dualities

Organizational ambidexterity and dualities provide solutions for coping with the tensions, eliminating the tensions or fostering the tensions that stem from the requirements of the twin structures, processes and mindsets. The organizational ambidexterity literature discussed the modes for balancing (Lavie et al., 2010) by structurally or spatially separating the opposites (e.g., exploration and exploitation), thus facilitating the opposites in parallel in the organization (or within networks) or creating behavioral routines and the context for allowing the opposites to be realized simultaneously.

In dualities, for instance, Janssens and Steyaert (1999) have discussed different ways to deal with the opposite demands. Adopting from Evans and colleagues (Evans, 1992; Evans & Doz, 1992) they discuss what they describe as static solutions of coping with dualities, namely sequencing, layering and the helix type, which remain with the polarity. The sequencing “method” manages dualities by shifting attention between the poles of the duality like the swings of a pendulum. By developing such cycles of crisis and evolution organizations adapt to changes in their environment (Evans, 1992). Layering refers to founding novel, complementary competences on top of the existing, opposite capabilities’ past strengths. Such procedure “encourages transformations that respect the past and link it to the future” (Janssens and Steyaert, 1999, p. 132). The helix solution is a combination of the latter two, sequencing and layering. Such intentional sequencing results in a progressive development, whereby the opposite poles of the duality are tackled in successive cycles as sequencing removes the tension and allows concentration on one pole at a time, and the helix process combines different skills (Evans, 1992; Hampden-Turner, 1990; Janssens & Steyaert, 1999). Janssens and Steyaert (1999) suggested that dualities are treated too much as objects without considering the context wherein they unfold and propose developing a more processual method to dealing with dualities.

As dynamic ways of coping with dualities Janssens and Steyaert (1999) suggest interpenetration and de- and reframing as well as the involvement of a third party. Drawing from communication, organizational change research and therapy, interpenetration denotes the rise of a new concept by eliminating the either–or setting of the bipolarities. De- and reframing involve the development of a qualitatively different and more holistic, novel vision with “a creative jump.” Involving a third party literally means including someone from outside such as a consultant for dispute resolution and organizational development to stimulate reframing via cognitive restructuring or social restructuring.

There are numerous means to deal with dualities that resemble mutuality and thus appear to be better solutions for paradoxes. The study of this doctoral thesis has found evidence
of accepting, confronting, accommodating and transcendence, which have been termed differently by different scholars (e.g., Clegg et al., 2002; Poole & Van de Ven, 1989; Lewis, 2000; Jarzabkowski et al., 2013; Jarzabkowski & Lê, 2016; Smith & Lewis, 2014; Smith, 2014). Acceptance refers to finding ways to learn to live with the paradox (Lewis, 2000). Confronting refers to coping with the paradox by socially discussing the tensions and accommodating those accordingly (Lewis, 2000). Accommodation suggests defining novel, creative synergy that glues the opposing elements together (Smith and Lewis, 2011; Smith, 2014) and finally transcendence, which refers to the capacity to think paradoxically by learning from existing tensions and develop more advanced range of understandings and behaviors (e.g. Lüscher and Lewis, 2008). Duality literature provides also additional examples of coping mechanisms such as repression, which includes refusal and blocking awareness, acting as if that tension does not exist (Lewis, 2000). The coping mechanisms for paradox-dualities aim at synthesis, require creativity and higher-order thinking as well as ability to live with the cognitive challenges resulting from the solutions’ complexity. On contrary, such coping mechanisms open up possibilities for creative solutions through which organizations can for instance find ways to generate innovations that disrupt the market.

Scholars have also presented coping mechanisms for dualities that this doctoral thesis suggests provide solutions for dilemma-type of dualities. Suppression is a compromise involving a one-sided reaction to the tension in that one component is preferred at the expense of the other (Jarzabkowski et al., 2013; Clegg et al., 2002; Gaim & Wåhlin, 2016). Ambidexterity refers to this as an over-exploration or over-exploitation, which are generally not considered as sustainable strategies, although they may be efficient in short-term. The suggestions by Poole and Van de Ven (1989) to split, spatialize or temporalize the opposites to solve the tensions between the duality follow a similar logic with that of structural and temporal ambidexterity. Those distribute the tension attributes across time or space to avoid their harmful impacts. However, those solutions do not allow to reap the benefits that would result from engaging in the opposite activities conjointly.

Studying tensions through a dialectical lens indeed appears to be a potentially useful way to point out the challenge of integrating opposites. Bledow et al. (2009) noted that the key to the dialectic approach is to “integrate and manage” (p. 308), but despite seeking to move beyond contradictions, and even after achieving synthesis (some way to manage the contradiction), the contradiction still persists. In dialectics, innovation is generated through a process in which one element (or affirmation) unintentionally gives rise to its own opposite (or negation), generating a conflict and transformation—the establishment of a new element which then transcends, but also preserves, the affirmation and negation (Hargrave & Van de Ven, 2016).

This thesis addresses the challenge in the coping methods, namely the lack of clarity in regard to which coping mechanism is the most suitable for which kind of a duality (see publication 4), which the current duality literature does not make very explicit. Nevertheless, as outlined in the section dedicated to future research directions, there is
still much to be done in this area to gain a full understanding of the optimal coping methods for different types of dualities or their combinations, especially in long-term.

The next sub-section discusses the role of managerial cognition in decision-making. The processes of cognitive framing and sensemaking as well as analogical thinking are highlighted.

2.5 Managerial cognition

Managerial cognition plays a remarkable role in how managers, and indeed all individuals, come to know about dualities, how they perceive those and eventually decide to behave when confronting those. Thus, it is vital to understand the cognitive underpinnings related to decision-making, dualities and the ability to be or become ambidextrous. This section defines the terminology, overviews the historical roots of managerial cognition research and explains why managerial cognition is a useful lens to better understand dualities and eventually tap onto the micro-foundations of dualities and ambidextrous abilities. This section discusses cognitive frames as the mental structures through which each manager perceives the decisions in their individual way, for instance as complementary or conflicting. Last, analogical thinking is discussed as a useful method to build mental connections through analogs and thereby find linkages between known and unknown or finding creative ways to solve problems and make decisions.

Although the roots of the cognitive perspective date back in the late 1940s and in the work of the Carnegie School researchers discussed earlier in this doctoral thesis, it was J. Porac, H. Thomas and C. Baden-Fuller, together with other revolutionary scholars of the 1980s, who showed the way to address the role of cognition in strategy research (Uotila, 2015). There was also much discussion of the cognitive perspective at the beginning of the 1990s, significantly influenced by Weick (1995) and his concept of sensemaking. Since then, managerial as well as organizational cognition research has burgeoned and spanned various research domains (Kaplan, 2011). Brymer et al. describe cognition in the following way:

“Cognition involves the mental processing that uses, changes, enacts, recalls, stores, senses, and transforms knowledge in a dynamic, recursive manner. To be cognizant is to be actively aware of a set of knowledge, including a framework, within which such knowledge might be used, based on environmental or mental cues.” (2011, p. 121)

There are two main explanations of how the mechanism that formulates managerial cognition works. Laukkanen (1989) studied the causal beliefs of managers and divided these sources into individual processes and social processes (c.f. Uotila, 2015). Humans have an inherent capability to inductively make sense of, classify and catalogue their
environment. Making sense of the environment is not solely data-driven, as the past experiences of the environment also steer action. Moreover, as we do not operate in isolation but our social environment, be that our organizational, cultural or professional surroundings, influences our actions (Laukkanen, 1989; c.f. Uotila, 2015).

In recent decades, managerial cognition as a research topic has diffused, particularly to the field of strategy (Kaplan, 2011). Walsh (1995), in his review, found 77 different concepts that had gained foothold in the managerial cognition field, and this number must only have risen in the last two decades. Managerial cognition is considered to consist of cognitive or mental models, beliefs, processes and even emotions (Hodgkinson & Healey, 2011). Aspara et al. (2011) noted that the extant research on managerial cognition has mostly addressed firm-internal cognitions and that scholars are using terminology such as mental models (Daft & Weick, 1984; Fahey & Narayanan, 1989), knowledge structures (Walsh, 1995), cognitive maps (Dutton et al., 1983; Dutton & Jackson, 1987; Barr et al., 1992), cognitive collages (Tversky, 1993), biases and heuristics (Schwenk, 1986; Schwenk & Thomas, 1983) and world views (Stubbart, 1989; Walsh, 1995).

Regardless of the term used, all of the aforementioned refer to the construction of knowledge structures of some kind, which have an impact on managers' heuristics and biases and play a role when they opt to anticipate market changes and understand the consequences of different choices, eventually leading to a behavior of some kind (Garbuio et al., 2011). Somehow, managers “must see their way through what may be a bewildering flow of information to make decisions and solve problems” (McCall & Kaplan, 1985, p. 280). Managers—and indeed all individuals who make decisions—confront such challenge by employing knowledge structures to make a representation of the information (Walsh, 1995). Multiple studies show that managers who have the ability to anticipate trends and put up appropriate strategies are the most likely to succeed (Laureiro-Martinez et al., 2015).

Managers are assumed to be “information workers” (McCall & Kaplan, 1985, p. 14). By definition, they spend their time on captivating, processing and distributing information about problems and opportunities. The underlying challenge that managers encounter is, however, that the information to be made sense of is tremendously ambiguous, complex and munificent. Furthermore, Adner and Helfat (2003) defined dynamic managerial capabilities as “to underpin the finding of heterogeneity in managerial decisions and firm performance in the face of changing external conditions” (p. 1011). They describe the capabilities that managers employ to create, extend and alter the ways by which organizations earn a living and survive as a means to describe the connection between strategic change and managerial decisions and behavior as well as the performance of the organizations (Helfat & Martin, 2015). Helfat and Martin (2015) list the mental activities required to do so such as perception, attention, problem-solving, reasoning, language and communication.
Decision-makers come to know about, make sense of and cope with the dualities with different processes related to managerial cognition. In the next sections, cognitive frames, sensemaking and analogical thinking are discussed as sub-processes related to managerial cognition, which were used in the empirical studies of this doctoral thesis. While it has been acknowledged that decisions are not made in a vacuum, the focal point of this doctoral thesis is upon the individual cognitive framing processes, where the environment and possible social processes in the background are incorporated inherently as factors that affect the outcomes of the sensemaking processes. Thus, it should be noted that this thesis does not explore the social interactions framing but individuals’ cognition, their understanding of what happens.

Cognitive frames refer to the mental structures, the individual lenses, through which decision-makers perceive the situation, and their characteristics as well as the related terminology of sensemaking will be discussed in the following. Analogical frames is a tool that decision-makers use to try to make sense of the situation by relating the occurrence to something familiar that the actors have perceived or experienced in the past.

2.5.1 Cognitive frames and sensemaking

Cornelissen and Werner (2014) in their review on framing noted that only a few theoretical concepts have attracted such interest in organizational and management theory. The concept of framing was first initiated by Burke (1937) and Bateson (1972[1955]) and later discussed by Goffman (1974) (c.f. Cornelissen & Werner, 2014). Creed et al. (2002) noted that frame analysis has been initialized in sociology and policy analysis as a method to make sense of, depict and engage the variety of arguments that evolve around complex societal issues.

The use of the frame concept in a decision-making context goes back more than half a century to the Carnegie researchers, who were interested in decision-making in organizations (Cyert & March, 1963/1992; March & Simon, 1958; Cornelissen & Werner, 2014). March and Simon (1958) noted that these simplified cognitive depictions of the environment guide us to the extent that “an individual’s frame of reference serves to validate the frame of reference” (March & Simon, 1958, p. 139) through which we observe the surroundings and environment. Further, Tversky and Kahneman elaborate that “the frame that a decision-maker adopts is controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics of the decision maker” (1981, p. 453). Framing is “the skill that is required to manage meaning” (Fairhurst and Sarr, 1996, p. 3, c.f. Achtenhagen et al., 2003, p. 51). The most strategic decisions are made through a filter—managerial cognitive frames (Schön & Rein, 1994)—which is ultimately the manager’s personal understanding of what the best thing to do is. Thereby, managerial cognitive frames explicate why managers observe decisions differently, are attentive to different aspects and attach certain socioemotional information to decisions (e.g., Smith & Tushman, 2005). Past experience, historical precedents, complexity and inexperience cause a misalignment of managers’
Theoretical background

2

sensemaking and thereby the managerial capacity to recognize, understand and interpret events differ in the complex environment (Weick, 1979). Cornelissen and Werner (2014) noted that in addition to organizational and management theory, the term frame or framing also became popular in linguistic anthropology (Hymes, 1974), sociology and social movement research (Snow & Benford, 1988), cognitive psychology and behavioral economics (Kahneman & Tversky, 1979) as well as journalism and communication research (Scheufele, 1999).

In their review of cognitive framing, Cornelissen and Werner (2014) identified three levels where frames and framing had been studied. The micro level is interested in decision-making as well as managerial cognition in organizations (Hodgkinson, et al., 1999); the meso level is concerned with strategic framing and the construction of meaning across and within organized groups and social movements (e.g., Kaplan, 2008); and the more macro-oriented field-level frames look at institutional change (Fligstein & McAdam, 2011). At the micro level, which concerns this study, the concept of framing has also spread to increasingly explain and conceptualize the cognitive processes of individuals’ sensemaking (e.g., Weick, 1995). Framing has also attracted great attention in the recent literature, making the importance of the concept evident and illustrating that its application within organizational and management research is only increasing (Cornelissen & Werner, 2014).

Pryor et al. explained that individual beliefs are initial assumptions that are to a large extent “unexplained and unfomed” (2015, p. 3) information embedded in individuals’ minds. Despite the unstructuredness of the information, it can still serve as a basis for understanding the events that individuals encounter. As individuals go on to make new assumptions, they may try to attach a meaning to the new belief by mirroring it against existing knowledge and subsequently the implications that those may have for the future. These new beliefs can stem from both exogenous and endogenous sources (Alvarèez, et al., 2013). New assumptions from exogenous sources arise when individuals are faced with unexpected environmental conditions and thus experience uncertainty or deviance from the individual’s projection, which addresses gaps in their knowledge or false expectations (Balogun & Johnson, 2004). Endogenous sources include creative thinking or using the imagination to generate and formulate new assumptions. When individuals gain novel insights, they are trying to make sense of and apply structure to what they have perceived to understand the situation (Felin & Zenger, 2009). Regardless of the source, external or inherent, sensemaking takes place at the interaction between an individual’s cognition and the environment (Weick, 1979).

The afore-described cognitive process is called sensemaking (Weick, 1979) and describes the individual’s way of finding meaning in a gap in their understanding, making sense of events that they are not familiar with. The sensemaking process involves a sequence of attention, selection and retention. Pryor et al. described attention as an individual’s own observations of new beliefs: individuals gear their attention “around cues that signal potential deviance, and they train their focus on them” (2015, p. 3). Selection refers to...
the interpretation of what the new beliefs mean in this particular context by matching the belief with prior knowledge and the environmental context. Finally, retention refers to the individual’s procedure of storing their interpretations. How well individuals are able to retain new information depends on how the new information fits with the individual’s existing cognitive frameworks, which define the plausibility, effectiveness and even adequacy of this new information. This information is considered as “the truth” as long as novel insights challenge this assumption. Thus, the end-product of the sensemaking process is the elucidation of novel beliefs, which are consequently transformed to guide an individual’s behavior (Pryor et al., 2015).

The publications in this doctoral thesis frequently discuss cognitive framing and sensemaking as a somewhat interrelated process: while decision-makers perceive the occurrences through their individual cognitive frames, they start to make sense of the contradictions, each of which refers to a way of seeing and understanding a tension. Analogical reasoning is discussed next as a means to solve problems and generate novel ideas—the process of drawing information from another context.

2.5.2 Analogical thinking

Transferring existing knowledge from the past and applying it to new strategic actions simplifies the search process when looking for alternatives, assessing options and eventually deciding which one to choose (Gavetti et al., 2005). To make sense of such vagueness, reduce uncertainty in a novel situation or purposefully create new ideas, decision-makers often extrapolate from their knowledge of seemingly similar situations they have experienced in the past (Gentner et al., 2001; Lee & Holyoak, 2008). This is the essence of analogical thinking or analogical reasoning. Well before its use in the context of business, cognitive scientists and psychologists also expressed great interest in analogical reasoning (Gavetti et al., 2005). In psychology, knowledge transfer is defined as the ability to apply acquired knowledge from one context into another or to understand “how knowledge acquired in one situation applies—or fails to apply—in other situations” (Singley & Anderson, 1989, p. 1, c.f. Gary, et al., 2012).

The reasoning process that uses analogies from prior situations to resolve novel strategic problems has different phases, which authors interested in analogies have generally agreed upon (Kolodner, 1997; Gentner et al., 2001). In the first phase, the manager identifies and encrypts the most important features or characteristics of the target (i.e., a novel product and a problem he or she wishes to solve) (Gary et al., 2012; Gavetti et al., 2005). Secondly, the manager goes through their library of experiences—the knowledge stored in the long-term memory—in order to retrieve prior situations that have some similarities (straightforward or “distant” similarities) to the new problem (Gary et al., 2012). This phase may be an iterative process, where the manager tries and retries to find some similar characteristics, or he or she may find a “hit” with one shot. Thereafter, the source is used for drawing inferences about the novel situation—the target problem. This process implies a comparison of two thoughts, which are both rather concrete images, for
example, the heart and the water pump (Gick & Holyoak, 1983). Finally, transferring such insights from prior experience to the novel context may involve a suggested solution for the target—a candidate solution (Gavetti et al., 2012)—and additional information such as the potential issues or problems that selecting this option involves (Gary et al., 2012). This information generated from past experiences (the source) must be carefully weighted and possibly iterated to find the best possible fit for the target. For instance, when generating product design ideas for a family car, one might first think about an image of a running gazelle but then change the image to a lion because it better resembles the brand image (strong and powerful rather than delicate and fast). Thus, inferences derived from the source analog must be assessed and, if needed, reassessed and amended to fit the distinctive requirements of the target problem (Gary et al., 2012). Figure 8 below depicts the aforementioned process.

![Analogical transfer process](image)

Figure 8 Analogical transfer process

How well the analogy does its duty, how powerful it is, depends not only on the legitimacy of the mapping process between source and target but also on the quality of the solution stemming from the source context (Gavetti et al., 2005).

In this thesis, analogical reasoning is explored in the NPC context, where the teams create ideas for both explorative and exploitative innovations utilizing different kind of analogies. There the duality relates to finding optimal analogical distances for product ideas that vary in their level of radicalness and newness: exploration refers to radical and disruptive ideas and exploitation ideas that improve the existing products.

The next section draws together the insights gained from organizational ambidexterity, dualities and managerial cognition and presents a framework for what is called cognitive ambidexterity.

### 2.6 Cognitive ambidexterity

This section addresses the core constructs of the present doctoral thesis. Here the disparate findings from organizational ambidexterity, dualities and managerial cognition are stitched together. Together they show the significance of cognitive capabilities in helping to overcome the inertia related to decision-making in complex, turbulent situations, which characterize the businesses environment today and will more so in the future. This section
conceptualizes cognitive ambidexterity and positions it at the intersection of the aforementioned research domains to address the gap in the organizational ambidexterity literature in particular.

Cognitive ambidexterity refers to the cognitive dimension related to all organizational ambidexterity modes. The current literature defines cognitive ambidexterity as an ability or capability to engage simultaneously or sequentially in contradicting but also complementary processes that relate to improving old practices incrementally and in parallel creating new practices. The term has been used very little in the past ambidexterity literature, and no unequivocal definition has been coined. Chandrasekaran (2009) was the first to use the term in his doctoral thesis to showcase how high technology firms simultaneously innovate and improve to gain competitive advantage. Chandrasekaran (2009) views cognitive ambidexterity as a sort of strategic level dynamic capability, the managerial capability to resolve strategic contradictions arising from simultaneous innovation and improvement, which results in overcoming failures or termination traps. Thus, the success of overcoming the risks related to innovation-improvement decisions depends on the level of cognitive ambidexterity amongst the senior management. Cognitive ambidexterity facilitates decisions with “the right balance of innovation and improvement” (Chandrasekaran, 2009, p. 5).

Greenberg et al. studied entrepreneurial leadership—the necessity of leaders to “introduce new products and processes, to enact new strategic directions, to solve complex business, social, and environmental problems, and of course to start new companies” (2013, p. 57). In her book chapter, Neck defines contextual ambidexterity as “a way of thinking and acting that is characterized by switching flexibly back and forth between prediction and creation approaches” (2011, p. 26). Greenberg et al. (2013) view cognitive ambidexterity as a facilitator of entrepreneurial leadership, which is carried out by integrating two different ways of making decisions into a one approach to seize business opportunities. The authors use the terms predictive and creation approach or logic. The prediction approach can be used under conditions where there is no or a low level of uncertainty and existing information can be utilized as a basis for analysis. Prediction logic protects from threats or controls for the future through in-depth investigations. The creation approach, which is suitable for uncertain or unknown environments, seeks to generate new data. The underpinning notion of creation logic is that in fundamentally new or complex conditions where traditional cause-and-effect relationships cannot be identified, gathering appropriate data is not possible, and forecasting based on historical trends is not an applicable coping method. Hence, the need to learn to comply with action, discovery and creation arises. Regardless of the contradictions embedded in these two logics—which at first sight are seemingly discordant approaches to thought and action—they are seen to complement each other and to create greater value when used together (Neck, 2011; Greenberg et al., 2013).

These existing conceptualizations of cognitive ambidexterity share the need to engage in both exploration and exploitation and the demands that arise from their differences. This
study extends the definition of cognitive ambidexterity, which is anchored in the logic of dualities and March’s (1991) exploration/exploitation construct. The definitions in the current academic literature are further crystallized, and in this study cognitive ambidexterity has been defined as the “ability to engage parallel mental processes that are paradoxical or in contradiction (which may then result in a particular behavior)” (Karhu et al., 2016, p. 5). The complexity of the managerial cognitive process and the simultaneous presence of contradictory dualities ignite the push for cognitive ambidexterity. This is related to each ambidexterity-building mechanism to varying extents (i.e., structural, temporal, contextual and individual contextual) but becomes increasingly important when particular dualities are to be dealt with simultaneously (i.e., individual level contextual ambidexterity).

The framework suggests that in the structural solution for ambidexterity or spatial ambidexterity, managers (or decision-makers) select the ambidexterity type based on the cognitive complexity of exploration and exploitation as well as their compatibility. When managers use their cognitive frames to make sense of the duality and perceive the decisions at hand as incompatible, they pursue solutions that structurally separate the duality in the organization—into different business units, for example. The framing process and subsequent sensemaking produces a resulting dilemma, which opts to separate the poles of the duality (or opposite activities) spatially. In the paradox literature, Poole and Van de Ven (1989) discuss such spatial separation. Similarly, Tushman and O’Reilly (1996) suggest establishing separate structures in the same organization to house what are considered contradictory competencies, systems and practices of exploration and exploitation. For example, a prevalent culture that favors incremental innovation and adheres to familiar routines brings out a hostile attitude and atmosphere toward disruptive innovations, which compete for scarce resources (Papachroni et al., 2015). Thus, spatial separation calls for managers’ cognitive understanding of what the opposite activities are and the benefits of separating (rather than merging) them. Therefore, O’Reilly and Tushman (2004) highlighted the senior management team’s role as the “corporate glue” that holds the entire organization together by taking care of the tensions that surface as a result of the different demands of dualities.

For cyclical or temporal ambidexterity, managers must recognize opposite activities and then consider how to compartmentalize those in time. To adopt this type of ambidexterity, the dualities must be separable and offer more value when not conducted simultaneously. Poole and Van de Ven (1989) discussed the temporal separation of A and B from the accommodative, simultaneous perspective (see also temporal switching, Knight & Harvey, 2015). The contingency approach is based on choice (Clegg et al., 2002), where actors oscillate between opposite demands: once they place their attention on one opposite (e.g., exploitation), they are urged to focus on the other, too (e.g., exploration) (Gaim & Wåhlin, 2016). The cognitive demands managers focus on exploration and exploitation when it is on the agenda and the ability to vacillate between those two. Sequential ambidexterity has the benefits of temporary concentration. Psychologists have discussed the cognitive models of multitasking ranging from concurrent multitasking to task
switching to sequential switching (e.g., Monsell, 2003). The downside of the switching, which cognitive psychologists call the \textit{cognitive switching penalty}, is the wasted time and effort when one reorients in the task again. Thus, it is questionable how such switching works in practice if the sequencing is very rapid. Also, research on emotions in contradictory situations calls attention to the direct connection of emotions to workplace burnout, stress and employee turnover (Putnam et al., 2016). Drawing from this research, it can be seen that frequent fluctuation between two poles builds up feelings of frustration as well as anger (Apker et al., 2005), particularly when there are myriad different tensions that intensify one another’s affect (Putnam et al., 2016).

Therefore, temporal ambidexterity should be carefully considered when applied. The positive side to such oscillation lies in its potential to make the job more versatile, less monotonous, and offers possibilities to adjust actions according to the season or to fully concentrate on one objective at the time, without completely losing the expertise of the other task, as in the next sequence the focus will shift back toward the opposite.

When the decision-makers frame the duality’s opposites as reinforcing and complementary, the managers opt for contextual ambidexterity solutions. This exposes managers and their subordinates to complex dualities, which, to reap the synergies, cannot be separated in time or space but rather must be done simultaneously. Gibson and Birkinshaw (2004) discussed contextual ambidexterity on a business unit level. The challenge is not to oscillate from one configuration to another but often to maintain numerous, even competing frames (activities) simultaneously (Gilbert, 2006).

The utmost cognitively challenging option to organize dualities is individual ambidexterity (i.e., contextual ambidexterity at the individual level), which requires paradoxical cognition and parallel mental activities. The ability to master this paradoxical solution has been defined as a paradoxical cognition (Lewis, 2000), which holds exploration and exploitation activities as reinforcing and corresponding to the requirements for realizing individual contextual ambidexterity. In psychology, Festinger (1957) discussed the \textit{theory of cognitive dissonance}, which refers to the mental discomfort due to the need to of holding simultaneously two or more values, beliefs or ideals that contract with the individual’s personal ones. In order to overcome the possible mental stress the simultaneous demands may cause, one needs to develop sufficient \textit{cognitive flexibility} (Cañas et al., 2006), the need of which only increases when the organizations move from structural to behavioral and contextual modes. Graetz and Smith (2008, 2011) suggested that decision-makers should develop a “duality-sensitive mindset” that identifies the virtues of both sides of “the duality continuum” and is thus able to fulfil the simultaneous challenges such as “short-term and long-term imperatives, differentiation and integration, external and internal orientation, flexibility and efficiency, and dependence and independence” (Graetz & Smith, 2008, p. 266).

This shows that all organizational ambidexterity modes entail a cognitive component yet become particularly prominent in the individual contextual ambidexterity setting. From
management, this calls for the ability to assess not only their own capabilities to master such actions but also the sensitivity to see these abilities (or inabilities) in their employees. The role of cognitive ambidexterity is illustrated in Figure 9.

Figure 9 Cognitive ambidexterity’s role in duality framework

Cognitive ambidexterity is coined as a concept to unite the findings from dualities, organizational ambidexterity and managerial cognition. Organizational ambidexterity literature is interested in different performance outcomes, antecedents, moderators and contextual factors that increase, lessen or bring balance or ambidexterity. Ambidexterity can be seen to differ in the definition of dualities that the opposites must be interdependent and non-substitutable to the firm whereas dualities relationship has been described as *one pole cannot be described without describing the other pole*, although many scholars discuss the dualities merely as opposites that would both need to be fulfilled. The endeavor to tackle the dualities and obtain the ambidextrous capabilities can be done with the combination of paying attention that different ambidexterity modes require different cognitive capabilities at different levels of the organization. Whereas structural ambidexterity allows full focus on similar tasks, cyclical ambidexterity brings variety but also higher cognitive switching costs when the tasks are circulated. Many employees in the organization, and especially all managers, are subject to simultaneous opposite demands, which refers to contextual or individual contextual ambidexterity. In addition, the duality coping modes, such as accepting, suppressing, or differentiating all involve a
cognitive component: be it accepting the paradoxical nature of the opposites or accepting to neglect one option, or finding a creative way to leverage the duality. Together these literature streams assist in explaining what the micro-processes are underlying the decision-making dualities, what kind of opportunities and challenges do different individual mental structures pose to firms, why managers choose to cope with decisions differently. The way how decisions are perceived by managers shows how those are handled in the organizations. This, in turn, may have a positive or negative influence on organizations’ performance, the resource allocation decisions, also their employees in terms of how satisfied and well performing they are in their work. The next chapter will discuss the research methodology, research approach, data collection and analysis procedures used in this doctoral thesis.
3 Research methodology

This chapter gives an overview of the philosophical and methodological choices that have been adopted in this study. The chapter begins with an introduction to the selected philosophical stance. Then the chapter focuses on explaining the reasons for selecting the particular research methods, and gives an overview of the usage of those research methods in the publications of this doctoral thesis. Thereafter, the quality of the present research is discussed, and the last section describes the data collection and analysis processes individually for the different publications and/or studies included in the overall work. Olsen and Morgan (2005) distinguished methodology from the method, arguing that the methods are techniques of data collection. Methodologies, in turn, refers to using combinations of methods, the practices required to implement those and the interpretation actions carried out by the researcher (see also Downward & Mearman, 2007).

3.1 Research approach and design

The choices that led to the selection of a particular research design are guided by beliefs and assumptions that are grounded in some particular philosophical perspective. Kuhn (1996[1962]) made the discussion of paradigms prominent in social science methodology. However, in his later works, he criticized the use of the concept paradigm for “looseness” and having multiple meanings (c.f. Morgan, 2014). Later, Lincoln and Guba (1995) (see also Guba, 1990; Guba & Lincoln, 2005) coined the term paradigm triad, consisting of concepts called ontology, epistemology and methodology, which have been referred to as the main philosophical concepts in the social sciences (Burrell & Morgan, 1979, p. 1; Guba & Lincoln, 1994, p. 108). These three form assumptions about the nature of reality (ontology), what can be known about that reality (epistemology) and how we can generate such knowledge (methodology) (Morgan, 2014, p. 37). These beliefs give guidelines for selecting the most appropriate research design. In addition to these dominant paradigms, philosophical pragmatism is a research paradigm that emerges as a more practical viewpoint to approaching research. Pragmatists accept multiple realities (Sefotho, 2015) and are geared toward resolving the real world practical problems (Feilzer, 2010). It suggests that “…ideas and practices should be judged in terms of their usefulness, workability and practicality” (Reason, 2003, p. 104).

Given its endeavor to produce theoretical but also managerially relevant knowledge, this doctoral thesis as a whole adopts a pragmatic philosophical approach. The purpose of this thesis is to understand a real-life phenomenon, the micro-foundations of dualities and ambidextrous decision-making. Therefore, the philosophical approach was selected so that it supports the research objectives in the best possible way. Therefore, it should be
acknowledged that through the lens of the traditional epistemological viewpoints, the qualitative studies included in this thesis take a more socially constructed position, where different contextual and contingency factors are considered to influence the observations; whereas the experimental setting is geared toward a positivist approach, where the observable reality is considered as the reality, and its aim is to provide explanations and predictions. Thus, the philosophical paradigm adopted in this thesis is pragmatic with the aim of solving practical problems; of note, however, is that it adopts elements from constructivism as well as positivism. Table 4 illustrates the philosophical as well as the ontological, epistemological and methodological choices adopted in this doctoral thesis (cited from Guba & Lincoln 1994; Sefotho, 2015).
Table 4 Philosophical research approach

**Research problem:**
How do organizations identify, value and cope with contradictory and complementary dualities in pursuing organizational ambidexterity?

<table>
<thead>
<tr>
<th>Research decisions</th>
<th>Dominant paradigms</th>
<th>Philosophical positions</th>
<th>Choice justification in this thesis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positivism</td>
<td>Post-positivism</td>
<td>Constructivism</td>
</tr>
<tr>
<td>Research approach</td>
<td><strong>Ontology:</strong> the study of being</td>
<td>Observable reality is real, aims at prediction and explanation</td>
<td>Critical realism: Reality exists but it is imperfectly apprehendable</td>
</tr>
<tr>
<td></td>
<td><strong>Epistemology:</strong> the nature and forms of knowledge</td>
<td>Objectivist: Investigator and object are independent entities</td>
<td>Modified dualist/objectivist: ideal, external guardians of objectivity</td>
</tr>
<tr>
<td></td>
<td><strong>Methodology:</strong> how to discover</td>
<td>Experimental, manipulative, quantitative methods, testing hypotheses</td>
<td>Critical multiplicity: falsification can include qualitative or quantitative methods</td>
</tr>
</tbody>
</table>

This thesis adopts a combination of pragmatism, which is concerned with solving real-world problems by taking the best fitted combination of philosophical positions. The approach is assessed by usefulness, workability and practicality. The qualitative studies in this thesis follow the constructivist approach and view dualities to be constructed via cognitive frames and in social interaction. In the research method, qualitative interviews, the researcher becomes a part of the research playing the role of interpreter of the observed events. The experimental study, in turn, gears toward the positivist approach and tests, validates and explains a particular phenomenon in a laboratory setting, which was discovered in the qualitative studies.

Mixed methods approach: Qualitative interviews and experimental methods have been used together. The primary method is qualitative, which is used to gain an understanding of the overall phenomenon, and experiment is used to explain a particular finding obtained in the qualitative studies.
As discussed, this thesis has adopted a pragmatic view but it should be noted that the qualitative studies follow the logic of constructivism and the experimental study a more positivist approach. Constructivism, or more particularly social constructivism makes assumptions from an interpretive epistemological position, and the emphasis is on the social and cultural context and collaborative learning. Thereby, all cognitive processes are believed to stem from social interactions and are explained as collaborative processes, where all learning is a product of social interactions as individuals are a part of larger knowledge communities (Cruickshank, 2012). The core of social constructivism is that individuals shape reality in collaboration with others, but through their individual cognitive processes, which guide their individual thinking, they respond to situations and act.

Constructivism makes assumptions that are characteristic of qualitative research—that all individuals are unique in their beliefs and experiences, and therefore there is no reality outside of those perceptions (Morgan, 2014). Hence, for the qualitative research part, this doctoral thesis adopts a philosophical position that leans towards a (social) constructivist view. This choice is well supported as in constructivism, knowledge is created through personal experiences, and every individual holds a different interpretation as a result of their different individual knowledge construction processes, which have their origin in their past experiences, as well as environmental influences.

Smith and Lewis (2011) and Lewis (2000) suggested that tensions are inherent perceptually constructed phenomena that exist within the system, but can also be socially constructed when they are created by actors’ cognition or rhetoric. These characteristics of paradox suggest a sensemaking process (Weick, 1995) described as symbolic interactionism (Blumer, 1969) and the social construction of reality (Berger and Luckmann, 1967). Also, Lê and Bednarek (2016) noted that practice-based studies to extend paradox theory perceive paradoxes and responses to paradoxes to be socially constructed, manifested within organized activities. In this light, adopting constructivist stance for the qualitative studies can be considered as appropriate. However, it must be noted that the focus of this doctoral thesis is not to examine shared cognition (Brown, et al., 1988), which may be a more obvious lens for a social constructivist to approach the research topic at hand.

Commonly quantitative or experimental research is “supported by the positivist or scientific paradigm, [which] leads us to regard the world as made up of observable, measurable facts” relying on the supposition that “social facts have an objective reality” and “variables can […] be identified and relationships measured” (Glesne & Peshkin, 1992, pp. 6-7; Golafshani, 2003). The positivist paradigm, from which the experimental study of this doctoral thesis draws, stands in strong contrast to constructivism and assumes there is a ‘real world’ that is external to the experiences of all individuals, and the aim of research is to understand that world. In the experiment conducted as a part of this overall study, the purpose was to test (implicit) hypotheses drawn from the duality literature, and thereby take a different approach to deepen the current understanding of the micro-foundations of dualities and ambidexterity.
As the endeavor of this doctoral thesis is to understand the micro-foundations of dualities and ambidextrous decision-making, pragmatic approach was adopted, which allows adopting a combination of the philosophical approaches that are the best suited to obtain as much as possible knowledge on the research topic. Also Golafshani (2003) recommends using multiple methods in order to acquire a valid and reliable picture of those diverse realities. In this thesis this has been done by adopting a pragmatic view, which is supported by the combinative view of constructivist and positivist views as well as the versatility of mixed methods used in this study.

The next section describes reasoning choices in combination with the research approach and research design.

3.2 Reasoning

The current research discusses two general approaches to reasoning through which the researcher can generate or acquire new knowledge. These are called inductive reasoning and deductive reasoning. Inductive reasoning refers to a process of theory building, which starts with the acquisition of information, making observations of certain instances with the aim of building generalizations about the particular phenomenon (Hyde, 2000). Deductive reasoning refers to a theory-testing process, which begins with an existing theory and tests whether the adopted theory holds true in a specific context or instance (Hyde, 2000), and it has been adopted as a way of reasoning in the experimental study. While qualitative research has principally been labelled as an inductive process, qualitative researchers also commonly include elements from deductive inference. Kirk and Miller (1986, p. 25) explained that applying a combination of inductive and deductive techniques is indeed a useful way to arrive at conclusions; this has been referred to as an abductive approach, which has been adopted for the qualitative studies in this thesis. Table 5 presents the core differences between induction, deduction and their combination, abduction (adapted from Morgan, 2014, p. 51, Reichertz, 2004).
Table 5 Difference between induction, deduction and abduction

<table>
<thead>
<tr>
<th></th>
<th>Induction</th>
<th>Deduction</th>
<th>Abduction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>When to use?</strong></td>
<td>Well suited for qualitative research, e.g., allows interview topics to emerge</td>
<td>Tests pre-planned assumptions and tests outcomes; hypothesis testing</td>
<td>Alternation of inductive and deductive processes: pattern-matching/theory matching; extending existing theories</td>
</tr>
<tr>
<td><strong>The means</strong></td>
<td>Listens to others’ interpretations and perspectives. Assess the interviewees’ interpretation of the topics (Subjectivity)</td>
<td>Follows procedures that have be reproduced by other researchers at another point in time (Objectivity)</td>
<td>Makes discoveries to establish meaning-creating rules (Objective but subjective)</td>
</tr>
<tr>
<td><strong>The gain</strong></td>
<td>Allows in-depth data collection and details of the topic can be reached (Contextuality)</td>
<td>Concentrates on the key variables by “controlling” other factors (Generalizability)</td>
<td>Provides explanations to surprising facts (Explanation seeking)</td>
</tr>
</tbody>
</table>

Given the emphasis on qualitative methods, the primary method of reasoning in this thesis is the abductive approach, resembling neither pure qualitative or quantitative research patterns but rather seeking to find insights by alternating or combining these processes. Abduction as a way of reasoning is intended to assist social researchers in making new discoveries in a logically and methodologically accepted way—in fact it has been noted that the most of the great advances in research were not made by following strictly inductive or deductive reasoning (Reichertz, 2004). The benefit of abductive reasoning for qualitative studies is when the researcher discovers some surprising findings; abduction seeks to create rules to establish meanings and well-suited explanations for the observation drawn from other theories, which may actually wipe away what was first seen as a surprising result.

The qualitative studies included in this thesis benefited from abduction, as pure induction may hinder the researcher from seeing some theoretical perspectives and concepts that might help to understand the phenomenon. Kovács and Spens (2005) noted that the abductive approach begins with a real-life observation. This, however, does not hold true for all abductive research, because researchers often begin with some expectancies of the phenomenon and also often have some predefined theoretical lens in mind. Therefore, an abductive research approach can also include having a predetermined theory before any observations have been made; but even in this case, abductive reasoning can be seen to start when the empirical observations no longer match the obtained theory, and a creative, iterative process of “theory matching” or “systematic combining” begins (Dubois & Gadde, 2002, p. 554), which was also used in the qualitative study of this thesis. The aim of this procedure is to either find a new matching theory or framework or to extend...
existing theory, which was originally planned for the study. The researcher can also add novelty and bring new insights by introducing a creative component through the application of a new theory or a new framework to an already addressed researched phenomenon. That process seeks to understand the new observations and to propose a new theory by providing new propositions or hypotheses (Kovács & Spens, 2005).

In this thesis, qualitative studies (Study 1 and Study 2, see section 3.4. Data collection) took an abductive approach: the theoretical framework was in place; however, it was extended based on the findings in the data or explained with additional theories. Moreover, the qualitative data were analyzed abductively through an interactive process between existing theory and the data gathered (Dubois & Gadde, 2002). The clear benefit of using qualitative interviews is the ability to explore topics that emerge during the course of the discussion and draw tentative conclusions from the earlier interviews. The realization of the experiment (Study 3, see section 3.4. Data collection) followed a deductive approach, which tested (implicit) hypotheses drawn from the existing literature to gain a better understanding of particular aspects of dualities in decision-making. Figure 10 shows the abductive and deductive approaches linked to the qualitative studies and the experiment.

**Figure 10** Abductive and deductive approaches used in this thesis

<table>
<thead>
<tr>
<th>Abductive approach</th>
<th>Deductive approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qualitative data</td>
<td>- Experiment</td>
</tr>
<tr>
<td>- Interviews</td>
<td></td>
</tr>
</tbody>
</table>

**Study 1: Empirical findings mirrored against tension categories**
- Pattern matching: Matching findings with existing tension categories by Smith & Lewis (2011)
- Theory extending: Extending the tension nature categories. Two tension categories emerged from the empirical data during the analysis.

**Study 2: Empirical findings mirrored against different analogical distances**
- Pattern matching: The definitions for analogical distances were adopted from the literature. In the analysis, the new product ideas were matched with the existing categories finding evidence of each category.
- Theory extending: Showcasing novel evidence in the new product idea creation context, and how companies use different types of analogies in parallel to come up with ideas for incremental, radical or disruptive innovations.

**Study 3: Exploring the performance and preference towards different duality types**
- Theory testing: Existing literature discusses the advantages but also the challenges of paradox and dilemma decisions or solutions. The laboratory experiments empirically test the implicit hypotheses on different dilemma and paradox decision-making situations.
The next section discusses the details of the mixed methods approach adopted in the empirical studies included in this doctoral thesis.

### 3.3 Mixed methods approach

Mixed methods research has often been discussed as "combining qualitative and quantitative methods" or "integrating multiple methods" (Morgan, 2014, p. 5). However, involving different research methods is more than just putting the methods together in the same project (Morgan, 2014). In mixed methods research, the benefits of qualitative and quantitative or experimental methods should not be assessed separately but jointly as an integrated set of strengths. The primary approach of this doctoral thesis is qualitative, and an experimental method is used as a supplementary method. Interviews were selected as the qualitative research method, and the experimental study was conducted in a laboratory setting.

Methodological eclecticism (Hammersley & Atkinson, 1995)—an “anything will do” attitude toward mixed research design—has been considered a challenge when using mixed methods, in particular the problem of how to integrate the results generated by different methods. Whenever the researcher needs to show that the results of the research are not dependent on the strengths of one particular method, there will be value in showing that other methods with different strengths lead to the same or at least similar results (Morgan, 2014, p. 70). The integration of different methods was considered to be suitable in light of the research questions this doctoral thesis addresses. In order to gain a better understanding of the micro-foundations of dualities and ambidextrous decision-making, qualitative methods allow to explore the phenomenon, which is not yet well understood and we know little about. But it is notable that the selection of mixed methods was made due to particularly interesting finding in the qualitative study, which examination was sensible only through experimental methods. The next sections further highlight the reasons for selecting particular research methods.

**Motivation for qualitative method: interviews**

Qualitative research, as opposed to quantitative inquiry, applies different philosophical assumptions, strategies of inquiry, including the data collection methods, data analysis as well as interpretation (Creswell, 2009). Qualitative research does not measure observation by numerical means, or use experimental designs, but underscores the quality of processes and meanings (Denzin & Lincoln, 2000). In other words, qualitative research explores the ambience and descriptions: the definitions, characteristics, concepts, meanings, symbols and metaphors (Berg, 2007). Qualitative direct interviews were chosen as the research method to be employed in studies 1 and 2 of this doctoral thesis. The method was considered as well-suited, as the topic under scrutiny has not been extensively studied empirically. To gain as much knowledge as possible, a qualitative method appeared as the only feasible option. Qualitative methods are recommended to explore subconscious
feelings: values, emotional drives or motivations (Malhotra & Birks, 2003). Given that the thesis explores the cognitive dimension and micro-foundations of decision-making with regards to dualities and ambidexterity, qualitative method was suitable to gain an initial understanding of the phenomenon and the variables that play a role in constituting the entire phenomenon. Qualitative methods also allow for the investigation of complex phenomena, where the responses may not be possible to be gained with structured questions and when the respondents may have a difficult time explaining why they feel in a certain way. Another important reason for selecting a qualitative method as the primary research method was the endeavor to gain a holistic understanding of the phenomenon and the context where it occurs. The qualitative method allows the researcher to attempt to understand the multilayered and interrelated context and the situation as a whole. As the attempt of this thesis was to connect the disparate research fields of organizational ambidexterity, dualities and managerial cognition, qualitative means served this purpose well. The most ambitious endeavor of this doctoral thesis relates to developing guidance towards theory of cognitive ambidexterity, where qualitative methods are the only reasonable alternative to carry out such explorative study of a topic of which we have only a limited understanding.

Motivation for an experimental approach

To support the primary qualitative method, a quantitative experimental method is used as a supplementary method; this is used in a way that is called sequencing. Sequencing means that after the core research has been conducted, a supplementary study can be used to follow-up the primary study method (Morgan, 2009). The experiment was planned to address a phenomenon that arose from the qualitative interviews. Thus, only after the results of the qualitative study had been obtained, an experiment was planned.

This doctoral thesis uses qualitative study as definition-oriented input for the experimental study, where qualitative methods first specify the actual operational content for the key issues, which are then scrutinized with the experiment. Morse (1991; c.f. Morgan, 2014) discussed mixed methods in terms of primary and supplementary methods, which are paired with core methods. This doctoral thesis uses sequential priority design, where the contributions of the qualitative are extended to a quantitative follow-up study—more specifically an experimental study. The sequential nature of this refers to how the data were collected rather than when the data were collected and enhances the effectiveness and strength of the other method and allows the researcher to accomplish more than if one method had been used in isolation (i.e., the results of the experimental method were used to deepen the understanding of the phenomenon studied first with the qualitative method). Generally, the integration of findings has been discussed as problematic in mixed methods research, but this is less the case in sequential contributions (Morgan, 2014). Experiments are a useful way to go beyond the conclusions reached in the primary qualitative study. Experiment is a feasible supplement to qualitative research, as it shows that the findings were not limited to the specific context of the qualitative study, thus increasing the results’ generalizability. The reason that experimental designs
are far less common than surveys is the assumed higher cost and higher complexity associated with conducting them (Morgan, 2014).

This doctoral thesis takes the results from the qualitative studies and adds depth and detail to those by exploring the most interesting and the least known phenomenon with an experimental method, namely dilemma and paradox framing (Study 3, publication 5). The experimental study also serves as additional coverage—using mixed methods for a wider spectrum of research goals than would be possible with a single method—adding breadth or depth to the analysis (Morgan, 2014). Thus, additional coverage speaks for the integration of the findings via different methods to build a more holistic understanding of the phenomenon (Morgan, 2014) which in this case relates to gaining a better understanding of how decision-makers perform in dilemma and paradox framed tasks and given that the tasks largely differ in their cognitive demands, which type of tasks they prefer. Gaining in-depth knowledge about such research objective would not have been possible to reach if the research subjects would have reported their perceptions of their individual performance regarding different tasks. Thus experimental method was selected to gain real time and as objective as possible knowledge about the phenomenon.

In order to make credible inferences of the conducted research, ensuring the quality of research is crucial. The qualitative and experimental studies can be further supported by triangulation or cross-validation, which will be discussed in the next section.

3.3.1 Quality of the research

To ensure the reliability, validity and quality of research, a variety of different methods have been used, which are discussed in the following. This doctoral thesis has an emphasis on qualitative methods; however, the quality measures for quantitative research have also been briefly discussed to highlight the quality considerations taken with regard to the experimental study (Study 3, see section 3.4. Data collection). Qualitative study was followed by the experiment, which was conducted to further explore a finding discovered the qualitative studies.

One method employed in the studies included in this thesis to ensure the quality of the qualitative and experimental research is called triangulation. Thereafter, the measures taken to ensure the quality of the qualitative studies and experimental studies that are a part of this doctoral thesis are discussed. To ensure the reliability, validity and quality of the research, a variety of different methods were used, which are discussed in the following section.

Donald Campbell and his colleagues coined the term triangulation to illustrate the pursuit of convergent findings as a purpose for combining methods. Denzin (1970) expanded the idea, showing that triangulation is a powerful technique to use as a data validation tool, which also helps to avoid problems related to intrinsic biases or weaknesses that are usually the danger of employing a single method. Investigator triangulation refers to including at least two researchers in an investigation, who assist in collecting and
analyzing the obtained data, which were used in all studies included in this thesis throughout all steps—from data gathering to the analysis and interpretation. **Theoretical triangulation** implies using more than one theoretical scheme when interpreting the phenomenon (Denzin, 1978). Given the aim of this thesis to merge the findings from disparate research tenets of organizational ambidexterity, dualities and managerial cognition, theoretical triangulation was also used in each study. **Data triangulation** has been used as an additional support to the interviews (i.e. company reports and websites). **Methodological triangulation** involves the combination of different research methods and is further divided into within methods and between methods of triangulation (Denzin, 1970). Whereas within methods of triangulation utilizes different variations of the same method, between methods triangulation makes use of different methods together (such as qualitative and quantitative methods). The present thesis as a whole employs methodological triangulation; however, the individual publications rely on a single research method. Table 6 shows the methods used in the thesis and the means that assure the quality of the studies used in the publications that contain an empirical study.
This doctoral thesis has an emphasis on qualitative methods (Studies 1 and 2 of this thesis, see section 3.4. Data collection); however, the quality measures for quantitative and experimental research have also been discussed to highlight the quality considerations taken with regard to the experimental study (Study 3, see section 3.4. Data collection). Although the assessments of quality for the qualitative and experimental research paradigms share similarities, there are elements that do not apply to both (Golafshani,
2003). In this sense, these research approaches are fundamentally two different paradigms (Kuhn, 1996 [1970]). Generally, whereas reliability and validity are handled independently in quantitative studies; in qualitative research these are usually discussed with the terms credibility, transferability and trustworthiness (Golafshani, 2003). However, for the sake of clarity, here the reliability and validity considerations are divided into sub-sections, as the discussions encompass both qualitative and experimental methods.

In qualitative research, the replicability of results is not a real concern (Glesne & Peshkin, 1992). Credibility, precision, transferability, dependability, consistency, reliability (Golafshani, 2003) and carefulness (Stenbacka, 2001) provide the means for evaluating the findings of qualitative research. Whereas quantitative research has the “purpose of explaining” good quality research, qualitative studies have the purpose of “generating understanding” (Stenbacka, 2001, p. 551). A qualitative study aims to find certain qualities that are common for the phenomenon or that make the particular phenomenon different from other phenomena (Stenbacka, 2001). Thereby, a good qualitative study can help us to “understand a situation that would otherwise be enigmatic or confusing” (Eisner, 1991, p. 58; c.f. Golafshani, 2003). The qualitative method of interviews was selected to illuminate the context and contingencies of dualities in decision-making. This would not have been possible with quantitative methods. However, a specifically interesting problem was explored via an experiment, which was discovered in the interviews.

In this thesis, similarly, triangulation was used to ensure the validity of the research. Some researchers view the term validity as non-applicable to qualitative research, as it is not really measuring anything in terms of numbers or quantities (Stenbacka, 2001). However, simultaneously they acknowledge the need for some kind of proxy for their research quality assessment (Golafshani, 2003). Validity is an indication that the findings are accurate from the researcher’s, participants’ or readers’ viewpoint (Creswell, 2009). In a qualitative approach, the degree of validity depends on the researcher’s perception of validity, which is often generated or adopted in relation to the particular study at hand and considered in terms of quality, rigor and trustworthiness (Golafshani, 2003). The accuracy or rigor of the findings can be warranted by applying a combination of various validity insurance strategies, such as triangulation, of which investigator triangulation, methodological triangulation and theory triangulation were used also in this doctoral thesis.

The measures that enhance the reliability of qualitative research include the documentation of all steps and procedures into a detailed protocol if possible (Creswell, 2009, p. 191). In this study, the interview transcripts were proofread to check for mistakes. The transcripts were translated and analyzed several times with the co-authors, which forced close scrutiny. The research team also coordinated so as to maintain up-to-date documentation and to avoid using wrong versions of any files. Creswell (2009) noted that in the coding process, there should be a consistent definition and application of codes,
and the research team should cross-check codes with different researchers by comparing results that have been independently derived. This was done by discussing each code thoroughly in the investigator triangulation process (examples of the coding procedures are presented in section 3.5.1). Here, the doctoral student acted as Researcher 1 and the co-author, Researcher 2, challenged the codes as a “devil’s advocate.” Coding the qualitative data was done, as it helps researchers to consider alternative meanings and handle masses of raw data and also build or extend theory (Malhotra & Birks, 2003).

Reliability refers to the replicability or repeatability of results or observations (Golafshani, 2003). As for quantitative research, Kirk and Miller classify reliability measures into three different categories: the degree to which a measurement, when applied repeatedly, stays the same; the stability of a measurement over the course of time; and the similarity of measurements within a certain time period (1986, pp. 41-42).

Experimental research is concerned with drawing valid conclusions about causality and its conditions and making generalizations. Internal validity refers to the measurement accuracy and that the real cause–effect relationship is ensured, and external validity determines whether the results from the sample also hold true for others in the world (Malhotra & Birks, 2003). Whereas interviews provide retrospective or snapshot view of the phenomenon, experiments entail some unique features that enable extraction of knowledge of the phenomenon. The experimental study presented in this thesis was conducted in a laboratory setting, which is an environment that allows the control and isolation of factors that are not closely related to the studied phenomenon. As opposed to the naturally occurring real-world data, laboratory conditions provide clean and observable data, which is free of noise. This is in contrast to a field experiment, where the subjects (decision-makers) would not have been solving identical problems but rather problems that were context-specific—problems in their original environment—which cannot be controlled (Malhotra & Birks, 2003). Moreover, experiments are replicable, which means other researchers can reproduce the experiment and confirm the findings independently (Croson et al., 2007). Therefore, experimental design was selected as a supplement to the main research method, qualitative interviews.

To examine the research problem—the differences between dilemma and paradox decisions—maintaining ceteris paribus was important, and therefore the laboratory setting was selected. The reliability of the experimental study was achieved through testing with different participant groups at different points in time in a laboratory setting, which allows for the control of a variety of factors that may have an impact on the results. Following Malhotra and Birks (2003) during the experimental studies, the laboratory settings remained the same, which makes them reliable across time (in this study 96 participants were divided altogether into five test groups). In this study, the reliability across samples was confirmed, as very similar patterns in the results between the groups emerged. Other quality insurance methods used were, for instance, random computing, where the figures shown in the experiments were randomly computed to avoid any researcher bias. Also, the tasks in the experiment were named X, Y and Z (instead of A,
B and C or 1, 2 and 3) to avoid directing the participants to form any hierarchies or presumptions about the task difficulty.

The next section describes the data collection for the empirical qualitative and experimental studies.

3.4 Data collection

The overall empirical study was conducted in three data collection phases on different datasets (see Figure 11) at different times and with different respondents. The first dataset consists of qualitative interviews and was gathered to acquire knowledge about the tensions that managers encounter in their daily decision-making activities. In this study, 18 executives operating in the traditional beverage industry in Austria were interviewed (Study 1) for their decision-making activities with regards to their operations. The second dataset similarly uses qualitative interviews as the research method and explores creativity and innovation activities related to decision-making in new product development teams. This dataset includes eight interviews with representatives of the teams from different countries who were closely involved in generating ideas for new products from different organizations operating in the international sports equipment industry (Study 2). Both qualitative studies, which can be considered as exploratory in nature, used semi-structured interview guides to steer the interviews toward the explored phenomena, and the guide was improved as experience was gained. (The key themes of the interviews have been presented in the Appendices 1 and 2)

The third study is an experiment, which was conducted in two phases in February and March of 2017 at a laboratory at the University of Trento, Italy (Study 3). The 96 participants were university students, and the purpose of the experiment was to gain knowledge about a particular issue that had arisen from the qualitative interviews, namely the differences in decision-making activities regarding two clearly distinctive duality types, dilemmas or paradoxes. The experiment was considered to add value to the current duality and ambidexterity discussion, and it appears to be the first of its kind to explore the differences in decision-makers’ cognitive processes with regard to dualities in a laboratory setting. Figure 11 shows the key details of the data collection phases, which are discussed in more detail in the following sub-sections.
The following section describes the data collection for the Studies 1, 2 and 3 in more detail. Before that the justification for the selected sampling method is provided.

### 3.4.1 Sampling

The sampling for the qualitative studies was purposive, and was done by bearing in mind who can contribute to the research question at hand the best. For the qualitative studies, Studies 1 and 2, the aim was to describe the research phenomenon and the context as much as possible. Due to this the respondents were selected as per their expertise.

In Study 1 (publications 3 and 4), the respondents were marketing managers or the equivalent from a traditional beverage industry. The traditional beverage industry (i.e. beer, wine, lemonade, and so on) was chosen as it was assumed to provide a useful platform for exploring tensions given the contradictions between continuity and change, as they keep up in modern business while retaining their heritage, which often dates back centuries. The industry well represents and demonstrates the classical dualities addressed in the ambidexterity literature, namely, stability and change as well as continuity and renewal. The industry has a long history and ancient values, however, it needs to respond to the internal and external change demands in order to ensure the future viability. Marketing executives were also considered to be in an intersection with other departments—such as manufacturing, R&D, sales and customer service—as well as being
in close connection to the field, which made it possible to study a wide range of tensions they face in their decision-making activities, and they were also considered to have the expertise to assess the tensions.

The Study 2 similarly followed sampling, which aimed at gaining as much as possible knowledge about the context and perceive the world in the eyes of the respondents. In the Study 2, the respondents were representatives of NPC teams from the international sports equipment industry. The respondents were highly involved in generating the ideas for new products and thus considered to be valuable for contributing to generating knowledge about the present research problem. The NPC team members were questioned for the processes for creating ideas for different kinds of innovations, thus subsequently their decision-making and problem-solving practices.

The sports equipment industry was selected due to the rather short lead times (as opposed to pharmacy, for example) and the supposition that a company’s competitive advantage is highly dependent on its ability to create novel ideas for innovative products. In addition, it was assumed that the industry is a fruitful area to look at the processes related to – another classic duality – incremental and radical innovation, separately. Given the technical context of new product development (NPD) teams, interviewees were assumed to be able to label their products more clearly as incremental or radical innovations, as opposed to a very service-oriented domain, and were able to compartmentalize the different processes that led to different innovation types. In other words, it was assumed that the interviewees would be able to assess, whether the idea generation process was aiming at exploiting current capabilities or exploring something new.

Notable is that throughout this thesis, managerial decision-making and managerial cognition have been discussed. However, at the same time, it has been acknowledged that all individuals at all levels of the organization are required to make decisions and they are confronted with dualities, which in turn entail a cognitive dimension that they have to cope with. The interviewees of this study include top managers but also other NPC team members who have been highly involved in the NPC processes and have experience in making decisions regarding decisions that differ in their level of cognitive complexity. NPC involves difficult decisions, many stakeholders, problem-solving and making decisions that aim at improving and fine-tuning the existing products and creating novel ideas for completely new products, which can attract and serve new markets and ensure competitiveness in the future markets.

The sampling procedure for the Study 3 can be considered as method-driven. Given that the laboratory setting is the best suited way to explore a research problem, the differences in dilemma and paradox decisions, where the research setting and context should remain stable. The participants in the study were university students from different faculties, who can be considered as well-suited respondents and showcasing how decision-makers perceive decisions or problems, which are presented in an abstract form (as opposed to very detailed description of management problems, where managers would have been considered as more knowledgeable respondents).
The following sections describe the data collection for the Studies 1, 2 and 3 and the procedure of data analysis in more detail.

3.4.2 Qualitative data collection

The process of data collection in the Study 1 and 2 was different, and therefore those are described separately in the following sections.

Study 1 (qualitative)

The 18 interviewees in qualitative Study 1 were executive-level marketing managers or the equivalent in the traditional beverage industry in Austria in seven of the nine federal states, and the interviews were conducted during the year 2011. This dataset was used in publications 3 and 4 included in this doctoral thesis. The managers in these positions were expected to face contradictory and conflicting demands (i.e., dualities) in their decision-making related to the marketing and developing of both existing and new products and offerings but also to other decisions (e.g., Kyriakopoulos & Moorman, 2004).

The acquirement of the interviewees began with a search process utilizing secondary data sources, which provided the contact information, after which an email was sent to the largest 26 companies of the industry. After reminder emails or phone calls, this round yielded 11 conducted interviews. The second round included smaller operators in the market, and emails were sent to 23 companies, resulting in seven conducted interviews. All interviews, except one, were conducted face to face at the company’s offices or a company-owned location. The interview guide contained questions regarding operational and strategic decision-making activities that managers juggle in the context of marketing management and new product development. The interview guide was fine-tuned several times as experience was gained in the process of conducting interviews.

Study 2 (qualitative)

Qualitative Study 2 consisted of eight qualitative interviews conducted during 2011–2012 with company representatives who were highly involved in the companies’ NPC processes in the international sports equipment industry. The interviewees’ positions were commonly founder or CEO, innovation and technology manager, industrial designer or product manager. The data were collected via telephone or Skype. This dataset was used in publication 6 included in this doctoral thesis.

The companies were searched in the Amadeus European company database and the process was supported with an additional manual online search. A total of 60 suitable sports equipment companies were shortlisted, which were representative of the global sports equipment industry and included companies that were developing gear and equipment for winter sports, such as cross-country skiing and snowboarding, as well as other sports like climbing, running and surfing. Finally, eight companies were interviewed and included in the study. Five of the eight companies that took part in the
study were headquartered in Switzerland or Austria, with two in the USA and one in Canada/Sweden. Those that agreed to take part in the study received the central interview questions via email prior to the interview. This procedure allowed the interviewees to get familiar with the questions and the study, probably improved the focus of the interviews as well as permitted the interviewees to acquire the sufficient information prior to the interview, and gave them the opportunity to suggest a more knowledgeable company representative for the interview if needed. After the first interview, necessary amendments were made to the interview guide to ensure the understandability of the questions and gain more valuable insights.

3.4.3 Experimental design and treatments

Study 3 (experiment)

After conducting the qualitative studies, an experiment (Study 3, Publication 5) was conducted in 2017 to explore a particularly interesting phenomenon discovered during the qualitative studies 1 and 2. The qualitative studies indicated that decision-makers do perceive different decision-making dualities and that they cognitively frame them as complementary or conflicting. However, those studies carry the limitation that the interviewees observed the decision-making situations retrospectively. Additionally, it was not possible to test whether the decision-makers were better performing in dilemma or paradox decisions and whether they had a preference toward one or the other. Aside from this, the experimental study was conducted to gain more knowledge about decision-making and problem-solving of dilemma-framed and paradox-framed decisions.

Two laboratory experiments (sub-study 1 and sub-study 2) were planned with the co-authors and were conducted at the Cognitive and Experimental Economics Laboratory (CEEL) at University of Trento in Italy. The participants were students from the University of Trento. The first sub-study had an important task in gaining experience in terms of reliability and validity, fine-tuning the experiment and allowing to benchmark and calibrate for the complexity of the figures for the second experimental sub-study.

The first experimental study (sub-study 1) was conducted in February 2017. The study was carried out with two groups—a total of 40 participants—with a balanced mix of males and females. The second study (sub-study 2) was carried out in March 2017 and included 56 participants, again with a mixture of female and male students. In this experiment, the general functionality of the treatments was adjusted as a result of learning from the first sub-study: the complexity level was reduced remarkably, and the time allowed for completion was increased. The studies included three tasks that involved operating with abstract figures in a competitive, time-limited setting. Abstract figures were chosen for their potential to provide context-free and generalizable results following the recent study by Mittone and Papi (2017). The motivation for using abstract rather than concrete figures was to make the study as generalizable as possible and to provide all participants with the same knowledge about the issue; this would not have been the case in examples drawn from business decisions, for example. In addition, the abstract figures
allowed the study to constitute the paradox task (both/all) so that it was a direct combination of the two dilemma tasks (either–or), which is well in line with the current duality literature. The setting also resembles the complementarity or conflicting nature of exploration and exploitation discussed in the organizational ambidexterity literature.

The participants knew they were in competition with each other, and this was further fostered by monetary rewards and by restricting the time they had to complete each task. The participants played a total of twelve tasks—four sub-tasks of each task type—which were named as X ‘build’, Y ‘memorize’ and Z ‘memorize and build’. Task X was about building a figure, which resembled the target figure as closely as possible with bigger building blocks, so the exact replication was not possible but participants had to use divergent thinking to come to a closest possible solution. In task Y, participants were shown a figure, which disappeared after some time. After this, sixteen figures were shown and participants were advised to select the closest one to the target figure shown previously. Finally, task Z included a combination of the aforementioned tasks: the participants were advised to first memorize the target figure, which disappeared after some time, and then to construct the figure using the available blocks relying on their memory.

3.5 Data analysis

Given that this doctoral thesis employs a mixed method approach, the qualitative and experimental data analyses are discussed separately for clarity in the following sections. Hyde (2000) notes that quantitative/experimental inferences are drawn through a deductive process and qualitative inferences through an inductive process. However, as discussed earlier, the qualitative studies followed a method in the data analysis that can be described as abduction: both extending current theories and adopting additional theories to explain the observed phenomena. The analysis of the experiment followed a deductive approach.

The following Figure 12 describes the mixed methods design used in this overall study, and outlines the data analysis processes conducted.
The primary study method was qualitative, and it was used in the Studies 1 and 2. The data collected in the Study 1 was used in the publications 3 and 4. For the publication 4, a content analysis was conducted in order to understand the managerial cognitive framing processes related to dilemmas and paradoxes as well as the coping mechanisms for dualities. For the publication 3, the raw interview data was coded to find the decisions entailing a duality, understand the managerial cognitive framing of different dualities and eventually the nature of those dualities. In the Study 2, for the Publication 6, a content analysis was made to understand the cognitive process of analogical reasoning in creative problem-solving and decision-making in NPC. The secondary study method, experiment, involved two data collection phases (called sub-study 1 and 2). The studies were analyzed to understand the performance of decision-makers regarding different duality types, assess the difficulty and test their preference towards paradox or dilemma solutions. The following sections describe the data analysis more in detail.

3.5.1 Qualitative data analysis

The empirical qualitative data gathered in Study 1 (publications 3 and 4) and Study 2 (publication 6) were analyzed differently and are therefore discussed separately in the following sections.
In Study 1, the interviews revealed the decision-making situations the marketing managers faced in daily operations as well as their strategic decisions. In the analysis, the decision (e.g., Kaplan, 2008) or problem was taken as a unit of analysis. It was not possible to identify the decisions prior to conducting the study. However, the researchers had predefined that the data collected in Study 2 would be mirrored against the tension framework of Smith and Lewis (2011), and the results are reported in Publication 3. Therefore, the study operationalizes an abductive approach. The framework was theoretically extended by adding the nature of the detected tensions that emerged from the data. Publication 4, which also employed the data gathered during Study 1, aimed at finding the coping mechanisms for dilemma- and paradox-framed solutions but utilized the existing solutions, which had been at least conceptually highlighted in the academic literature (e.g., by Lewis, 2000). The extension to the previously known was the separation of coping mechanisms for dilemma and paradox solutions extracted from the interviews during the coding process for Publication 3, which is described in the following section.

For Publication 3, the pre-analysis of the interviews was made with the aid of a spreadsheet by data-driven categorization of the tensions that managers perceived. Building on this initial analysis, the elements of the coding procedures suggested by Strauss and Corbin (1998) and Miles and Huberman (1994) were followed. Due to the large amount of data gathered, software was needed to analyze it, and, thus, the interview transcripts of 357 pages were analyzed with the aid of NVivo 11. To ensure the rigor of the coding procedure and to minimize the bias of a single researcher, investigator triangulation (e.g., Flick, 2008) was used extensively. The first-order NVivo nodes were created inductively from the collected data, and second-order categories were drawn deductively from the existing literature, which were then merged to aggregate categories. Thereby, this study also employed elements of a theory matching approach.

The first NVivo nodes were created inductively from the collected data as raw data themes. In the first coding round, Researcher 1 created nodes for all quotes that resembled a tension situation of any type and gave them temporary node labels. The nodes consisted of a phrase or multiple sentences. Thereafter, the coded tensions were reviewed again by Researcher 2, who acted as a “devil’s advocate,” challenging the inclusion of the nodes. Only the tensions that served as evidence of a duality in a decision-making context were retained, reducing the number of nodes from the initial 179 to the final number of 112 by combining redundant nodes and deleting those nodes that described general or fuzzy problems rather than dualities.

During step 2, each tension was mirrored against the Smith and Lewis (2011) categorization of organizational tensions of belonging, learning, organizing and performing. Given that these categories are drawn from past studies on organizational tensions (see Schad et al., 2016), they could be considered as comprehensive. Accordingly, each node of our dataset could be placed in one of the four categories after
a thorough iteration and discussion between researchers 1 and 2. In this process, the node labels were again considered (given their tension category), and the labels for opposite poles of the duality were also created for clarity and transparency (see Table 2 for details). During this step, a few nodes were still merged into aggregate nodes.

In the third coding step, the perceived nature of the tension for duality was defined. Initially, vicious and virtuous tensions were scanned for. Over the course of the analysis, however, the set of codes was extended over tension natures by two further emergent codes, namely dialectical and neutral. Vicious tensions resonate with different levels of anxiety, frustration or fear. In the case of virtuous tensions, managers framed tension as generating excitement or satisfaction. Emerging from the data, dialectic tension corresponds to the recognition of the need to respond to opposite demands simultaneously and to oscillate between the poles (for discussion, see, e.g., Costanzo & Di Domenico, 2015; Putnam et al., 2016). Finally, there were also situations that were recognized as a duality while being framed as neutral—that is, noticing a tension but no specific ‘tone’ attached to it. Figure 13 shows the coding steps in detail for Publication 3.

Figure 13 Coding steps of cognitive frames and duality nature (Publication 3)
In practice, the coding procedure of the previous step, was a semantic interpretative analysis of the interviews. To illustrate the coding procedure, a coding example for Company I is provided. A marketing manager of a wine producer operating since the 1930s and employing 85 people explains:

*Much ad hoc basis. Quite frankly, yes [...] so I say, so long [...] I have a line that I go, and that is constantly torpedoed from left and right. So, the line then becomes like this [shows “serpentine”]. Whichever torpedo is shooting the most powerfully, I have to react to then. That is not always so, but in principle I share my day [...] five hours of my day I plan. In the morning I write down what I have to do today, and the rest I leave open, because I know that things come up anyway. And in the evening I take three out of the six things I wrote down and write them up for the next day again, because I have not managed it. This is now my personal story. Company I (vicious)*

Firstly, the tension had been recognized by Researcher 1. Together with Researcher 2, who continuously challenged the initial coding, it was decided that the quote fulfils the criterion of a duality in general (as opposed to wicked or ill-structured problems), as the manager describes his planned activities and compares those to those that suddenly require immediate attention. After nine other similar quotes emerged from the data, the nodes were combined and labelled together as *Degree of Planning*. The opposite poles of this duality we named *Improvisation vs. Precision*. Smith and Lewis (2011) noted that tensions of organizing “surface as complex systems create competing designs and processes to achieve a desired outcome” (pp. 383-384), and hence the tension was placed in this category. In the third round, the nature of the tension was analyzed. For this node, the tension was labelled as vicious due to the anxiety and frustration that the manager experienced due to not being able to accomplish his tasks within the given timeline.

*Study 2 (qualitative)*

The aim of Study 2 (Publication 6) was conducted to test the analogical reasoning and cognitive distance in the context of creating ideas for incrementally new products and radically new products. In addition, the research aimed to study the role of cognitive ambidexterity in this novel setting. Study 2 was analyzed f a pattern-matching approach (Campbell, 1975; Hyde, 2000). The content analysis approach assists in abductive reasoning and was used to analyze the results, which were thereafter mirrored against the framework of near, medium-far and far analogies in conjunction with the concept of cognitive distance. The abductive approach was selected, as prior to conducting the empirical research, the theory or the concept the researcher was testing was known (i.e. different analogical distances in NPC setting) and also expressed before the data-gathering.

Data interpretation correctness was verified via investigator triangulation, which in practice meant analyzing the first round of the results together with the co-author to minimize the investigator bias. The primary data source analyzed comprised of the
conducted interviews, which were supported by secondary data sources—the information provided on the companies’ websites.

Kalogerakis et al. (2010) showed that the employment of analogical thinking in new product idea generation processes assists the generation ideas for both incremental and radical innovations. The definition depends on the “conceptual distance” between the source and the target of an analogy—in other words, whether a near and far analogy is in question. The cognitive distance between domains in new product ideation can be operationalized with product categories. Dahl and Moreau (2002) defined an analogy as near when the source domain is located in the same use context (product category) as that of the target problem. In turn, a far analogy implies the transferred problem solution (source) is situated in a use context other than that of the target (or a non-product category, meaning something abstract). In addition, to distinguish between near and far analogies, Dunbar (1997) suggested a third category: medium-far analogies. A medium-far analogical transfer takes place when the source knowledge used to create the new target emerges from another context (another product category).

First, the analysis included an identification phase to classify whether companies used analogies for idea creation in radically new and incrementally new product development. Second, when such evidence of analogies was found, they were categorized through idea generation styles based on the type of analogy, the knowledge transfer distance to build the framework of analogies and the cognitive distances used to create new products. Figure 14 illustrates this process.

![Figure 14 Data analysis based on cognitive distance (Publication 6)](image)

In the following a coding example of arriving at a medium-far analogy is presented, which was produced as a result of the content analysis. It concerns a company selling a variety of sports equipment for summer and winter sports as well as functional sports that used medium-far analogies to generate product ideas for lightweight Gore-Tex jackets for ski touring. As the medium-far analogy was defined to be an inference from another product category, the example quote was labeled as a medium-far analogy:
For example, we implement at the moment on the radical innovation side a completely new line in the winter outdoor segment. The ski touring unit tries out a completely new stuffing material from the motor race [area]. They convert extremely lightweight stuffed motor race jackets to extremely lightweight Gore-Tex jackets.”

- Product Developer/Product Manager

The medium-far analogy was defined to be an inference from another product category, and in this case the idea for light jackets was brought from the motor race area. Therefore, the example quote was labeled as a medium-far analogy.

In the next section, the analysis process of the experimental study, Study 3 (corresponding Publication 6), will be discussed.

3.5.2 Analysis of the experimental study

The experimental Study 3 consisted of two laboratory studies (discussed as sub-study 1 and 2). The primary goal was to better understand the decision-makers’ performance and preferences regarding the two clearly different types of dualities, dilemma and paradox decisions, in real-time decision-making situations, and therefore a laboratory experiment was selected as a research method to explore this sub-research area of this doctoral thesis. Dilemma decisions refer to the poles of duality (i.e. the opposite decision alternatives) being contradictory, and in paradox decisions the poles of the duality are complementary. The analysis was conducted slightly differently for the two sub-studies. The studies were analyzed, in addition to the results, also for the functionality of the treatments. In the analysis of the experiment results and the reporting of those results, the differences in decision-makers’ performance in different duality tasks and their preference toward different duality types were scanned. Also the difficulty level between different tasks (labelled as X, Y and Z)—dilemma and paradox types of tasks—was assessed and analyzed.

In the first sub-study, the difficulty of the tasks was assessed by two different methods: by the mistakes that participants made when completing three different tasks (X, Y and Z) and by calculating the gap between the best and the worst performances in the tasks. The mistake meant the participant placed red building blocks in a wrong place or memorized a wrong figure. The second sub-study was carried out with new figures with a decreased complexity level, and the participants were given more time to complete the tasks.

The perceived preference toward dilemma or paradox was measured with a survey after participants had completed the X, Y and Z tasks. Participants’ willingness to switch from their original choice was used as an assessment to explore their preference toward dilemma or paradox tasks. The perceived preference toward the tasks before and after the experiment was measured by the participants’ willingness to switch tasks if they had the opportunity to do so. To avoid participants to be biased, it was not possible to expose the participants to any questions about their preferences prior to the tasks but their preferences
had to be questioned after completing the tasks. Thus, participants rated their preference as per their assumptions: they were asked after the experiment which task they thought they would have preferred and their real-time assessment of which task they would prefer after completing the tasks.

Both studies confirmed that the suitability of the abstract figures was a well-fitted approach to study the performance with regards to dilemma and paradox ‘framed’ decisions and participants’ preferences toward one or the other.

The next section discusses the objectives and contributions of the six publications included in this doctoral thesis and their findings. Finally, the main findings and contributions of the studies are summarized.
4 Summary of the publications and review of the results

The following sub-sections summarize the main research objectives and the key findings of each individual publication. Finally, the results are discussed together, and the overall findings of this doctoral thesis are outlined.

The overall purpose of this thesis has been to reveal the micro-foundations of dualities and the capabilities that underline organizational ambidexterity in a decision-making context. This endeavor encouraged the researcher to look for insights from the managerial cognition literature and the research stream of dualities—including paradoxes, dilemmas and dialectics—as well as broader terms comprising tensions, contradictions and conflicts. Smith and Graetz (2011) noted that many dualities relate to the frictions that the willingness to maintain stability and the simultaneous necessity to change pose to managers and indeed all individuals in the organizations. The dualities that have also been explored in this study are heavily geared toward stability and change. This is mostly due to the context of marketing and innovation, which was present in the qualitative empirical studies. However, duality can be seen as a pertinent part of organizational life in general, both within and outside of those domains.

Overall, this study has discussed the role of an individual in an organization when organizing different modes for ambidexterity—structural (spatial), cyclical (temporal) and contextual/behavioral. However, the thesis touches upon the structural means for ambidexterity only very lightly, merely when indicating the role or challenges of individuals in such organizational form. The primary objectives of this doctoral thesis, as established early on, are the cognitive, mental operations that the decision-makers employ when they identify, recognize, make sense of and evaluate the structure and nature of the problems they encounter in the endeavor to make the best possible decisions. In this doctoral thesis, the structure of dualities has been referred to as dilemma (conflicting view toward duality) and paradox (complementary view toward duality), which have been empirically explored through qualitative and experimental methods. The nature of dualities refers to the positive, negative, mixed or neutral feelings, attitudes or perceptions that the dualities generate for the decision-maker. A secondary objective has been to explore the resulting behavioral means that facilitate the actual realization of a decision. This thesis makes a distinction between the behavioral means to organize the suitable solutions for paradox and dilemma decisions, which have been often discussed interchangeably in the current literature. The means are grounded within the preceding cognitive processes, which make sense of and categorize the decision-making problem at hand.

In the following section, the objectives, main findings and contributions of individual publications are discussed briefly. Publications 1 and 2 are conceptual papers, which lay
the ground for the empirical examination of the topic. Those papers unite the disparate research tenets of organizational ambidexterity and dualities as well as the cognitive dimension in the context of decision-making. Publication 1 focuses more on building the theory toward cognitive ambidexterity, and Publication 2 enlightens the pre-process of decision-making by illustrating the cognitive framing, sensemaking and search processes with regards to different ambidextrous solutions. Publication 3 contributes to extending our understanding of the different types of dualities as well as the nature of those dualities as a result of a cognitive framing process. Publication 4 looks at the different coping mechanisms that have been adopted to deal with the various tensions that stem from the dualities. Publication 5 takes an experimental approach and explores the decision-makers’ performance and preferences toward different duality decisions. Finally, Publication 6 looks at the parallel creation of incrementally and radically new ideas for new products by utilizing creative problem-solving, further pinpointing the role of cognitive ambidexterity in a new product idea development setting. In all, the publications of the present thesis shed light on the micro-foundations of cognitive ambidexterity and its role in individuals’ decision-making as well as its role in the organization as a whole. The subsequent sections discuss the objectives and contributions of the individual publications more in detail.

4.1 Publication 1: Toward the Cognitive Dimension in the Organizational Ambidexterity Framework

Research objectives

This publication is a book chapter that enlightens the cognitive micro-foundations of management decisions in relation to the ambidexterity framework. To do this, the publication integrates the literature streams on organizational ambidexterity, dualities and management cognition. This publication is a conceptual work, which can also be considered as a type of literature review included in the doctoral theses. This publication discusses the role of cognition in achieving spatial, temporal and contextual ambidexterity and introduces the concept of cognitive ambidexterity as a manager’s ability to deal with contradictory dualities in their decision-making.

Main contributions

This publication discusses the role of the cognitive dimension and cognitive ambidexterity as managerial micro-foundations related to organizational ambidexterity. In doing so, it contributes to a persistent problem in the ambidexterity literature: how are different modes of ambidexterity selected, and what is the reasoning behind being able to do this in an optimal way? This publication highlights that, in reality, spatial, temporal and contextual ambidexterity modes exist in parallel at different levels of the
organization, and, therefore, we need to better understand the underpinnings of decision-making in this regard.

The primary contribution of this publication can be considered to be to the organizational ambidexterity literature—however, it adds value to the dualities and managerial cognition discussions as well by shedding light on the underlying cognitive micro-foundations of how managers frame their decisions regarding different ambidexterity modes that have been widely discussed in the organizational ambidexterity literature. This publication makes comparisons between the literature streams and discusses the equivalents presented in the ambidexterity literature, the managerial framing process of the duality, the suggested coping mechanisms for those in the duality literature and the cognitive requirements regarding each option.

Thereby, the publication contributes particularly to merging the discussions in the distinct literature streams of organizational ambidexterity, dualities and managerial cognition by building a framework to pave the path toward a conceptual understanding of cognitive ambidexterity—the ability to master parallel or simultaneous strategic or operational processes that are opposite in terms of differing goals, skills or resources needed. This publication is the first to conceptualize and illustrate the concept and show its relation to the other ambidexterity types. Generally, in the extant literature very little is known about cognitive ambidexterity: there are less than a handful of conceptual papers, and especially empirical research is very scarce. Thus, this publication taps into an emerging stream of literature: as the complexity of decision-making rises, the cognitive dimension becomes even more crucial to be understood and eventually managed consciously. The publication works as the glue between different literature streams, filling the gap addressed by other scholars from different domains. However, the novelty and the utmost substance of this work lie in its delivery of a more profound understanding of the cognitive challenges and opportunities that different ambidexterity modes give rise to. Furthermore, this underlines the contributions’ importance to the managers: whereas some dualities may be best solved by separated processes, sometimes it is better to seek for contextually flexible arrangements and leave the problem-solving to individual experts who can divide their time according to what they feel is appropriate.

4.2 Publication 2: Cognitive ambidexterity – Towards a theory of cognitive underpinnings of organizational ambidexterity

Research objectives

This publication makes a conceptual contribution to the literature by adopting the problem-based view of the firm (PBV). The PBV view takes the problem as the unit of analysis, and makes distinctions between the solution search processes for problems that
vary in their level of familiarity and complexity. The paper integrates the view to the literature on ambidexterity, duality and cognitive processes and suggests how managers recognize, identify and label problems and their characteristics, adopt corresponding solution search processes and optimize ambidextrous solutions accordingly in the organization to respond to the opposite demands.

Main contributions

This paper advances the extant knowledge on cognitive ambidexterity by developing a set of theory-driven propositions related to the solution search process in the quest for cognitive ambidexterity. By adopting the PBV, this paper proposes a novel problem recognition, sensemaking and solution-finding process as a way to optimally utilize the entire process for different organizational ambidexterity solutions incorporating the learning from the duality literature on the duality types and combining those with the extant knowledge on the different modes of ambidexterity.

The particular value of this paper is that it conceptualizes “the preface” of what ambidexterity and duality generally discusses and enlightens what happens before the selection of a particular ambidexterity mode. This paper further extends and deepens the cognitive ambidexterity framework by taking a more holistic approach and a more processual outlook. Hence, it illustrates a process from identification of the problem structure (i.e. its (de)composability), its familiarity level, solution search distances, eventually to the management mechanisms of those problems. In particular, the paper proposes that when recognizing and identifying the problems, managers employ corresponding cognitive frames—dilemma, dialectic and paradoxical frames—and conceptualizes how differences in the problem familiarity and complexity, and cognitive processes influence the solution search processes. Finally, the paper suggests how managers deploy different ambidexterity modes to effectively tackle the recognized problems. Thus, the novelty and contribution of this paper is that it dives deeper into the cognitive microprocesses, filling the gap addressed in the organizational ambidexterity literature but also in the fields of psychology and neuroscience.

For managers, acknowledging the inherent cognitive and behavioral patterns is significant; without giving special attention to this, managers cope with tensions not only consciously and intentionally but also subconsciously and purely by chance or luck. Thus, better reflection of cognitive ambidexterity can help in dealing with the thorny decision-making problems that managers confront in contemporary business environments where familiar and non-familiar, also at the same time contradictory problems, need to be handled. Especially, ad hoc problem-solving decisions must be made with incomplete information and under time pressure, a little less so in longer-term strategic planning activities. This paper’s contribution is to raise awareness by acknowledging and approaching the problems consciously in such a way that managers “know what to look for”.

4 Summary of the publications and review of the results

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4.3 Publication 3: Multiple faces of tension: Dualities approach to managerial decision-making

Research objectives

This paper addresses the dualities that managers face in their decision-making activities. Such dualities surface as competing goals, conflicts between units or diverging interests, for example. This paper addresses the gap in the literature related to how the opposites of the duality implicate each other and moves beyond abstract themes to showcase the more grounded, daily interactions through which opposite demands are handled. The paper also extends the current understanding of how tensions are framed in terms of the possible poles of the dualities. This empirical paper answers the following research questions: what kind of dualistic decision-making activities do managers encounter, and how do the managers perceive the nature of these tensions? The current literature knows little about the conditions, or rather the contingencies, of the decision-making situations where such dualities appear and the particular nature of the tensions that arise from those dualities. Managerial decisions and their effectiveness depend largely on the initial framing process of the duality. In total, more than 100 decision-making situations entailing duality were recognized from a dataset consisting of qualitative interviews with 18 marketing managers in the Austrian traditional beverage industry.

The main findings of the study were to recognize a variety of duality pairs, label the poles of those dualities, recognize the framing of the dualities and extend the Smith and Lewis (2011) framework by attaching the nature of the dualities. This study found evidence that managers do recognize a diverse range of tensions across various organizational duality contexts. Dualities were found in all the categories of Smith and Lewis’s (2011) framework—learning, organizing, belonging and performing—the latter two being the largest tension groups. The characteristics of vicious tensions foster anxiety, uncertainty and ambiguity, leaving individuals feeling threatened and defensive. The virtuous tensions, in turn, increase a company’s creativity and stimulate innovation. The last two categories, dialectical and neutral, emerged from the empirical data during the coding process, revealing the multidimensionality and complexity of managerial decision-making. When managers deployed dialectical frames across different duality categories, they oscillated between competing interpretations without framing the duality clearly as an opportunity or a threat, positive or negative. Neutral tensions were used to illustrate the decision-making situations where managers in their narratives identified the opposite demands, but their reaction toward dualities was neutral. Figure 15 below summarizes the results of the study and shows the number of vicious, virtuous, dialectical and neutral tensions found across different tension categories by Smith and Lewis (2011).
Main contributions

The publication makes several important contributions. First, the study showed decision-makers' cognitive capabilities for recognizing organizational dualities in their decision-making activities. This finding extends the current understanding of whether the managers perceive decision-making instances as dualities in the first place, which this study confirms. It also shows what kind of decisions take up a form of a duality and in which areas of the decision landscape. It also shows how the decisions are perceived in terms of what the poles of the dualities are—the extremes of the alternatives that the managers perceive when they decide on the best way to go. These findings contribute particularly to the managerial cognition literature, extending the extant knowledge on managerial cognitive framing processes.

Second, the study contributes to the nascent area of the nature of dualities. Whereas several duality and ambidexterity scholars have mentioned the vicious and virtuous cycles that the different decisions may put forward, very little has been discussed on the perceived nature of the dualities, which inevitably influence the way those should be coped with: manage to lessen their impact or leverage to release the positive potential of the tension? This study shows that the managers perceive the tensions as vicious, virtuous, dialectical or neutral as a result of their cognitive framing process. This publication contributes to advancing the popular framework compiled by Smith and Lewis (2011) by documenting and explaining over 100 decision-making situations, and it appears that with
regards to the nature of dualities, this study makes a unique contribution to academia as well as to the managerial audience. The empirical findings of this paper contribute to the academic literature streams of organizational dualities from the management cognition perspective, as well as to the broader literature of organizational ambidexterity, by providing insights into the early phases of the managerial recognition of dualities requiring cognitively ambidextrous solutions. For managers the paper showcases that the variety of tensions—despite their negative connotation—are not always detrimental but can also work towards the company’s objectives, helping to increase creativity or make the job more enjoyable. The study gives examples of tensions related to strategic and operational activities that managers face in the context of marketing and NPD. This contribution brings novel insights and a deeper level of understanding of dualities and points toward additional gaps in the literature in the area of the nature of dualities.

4.4 Publication 4: Dealing with managerial dilemmas and paradoxes

Research objectives

This study provides empirical evidence of how managers frame challenging decision-making problems as dilemmas or paradoxes and what kind of coping mechanisms they invent to execute the preferred solutions. By adopting a cognitive framing perspective, this study explores managers’ accounts of decision-making problems and how they solve them. While the current literature tends to emphasize the benefits of framing the problems as paradoxes, the present findings demonstrate the usefulness of dilemma-framed solutions and the conditions under which they may be useful. A better understanding of these processes can help managers make more thoughtful and better decisions.

Qualitative interviews with 18 managers from the Austrian beverage industry were analyzed to identify the kinds of decision-making problems they encounter and to understand how they solve those problems. The participating managers perceived challenging decision-making problems as either a dilemma or a paradox. Dilemmas were resolved by committing entirely to one alternative or by focusing on one alternative at a time. In the case of paradoxes, managers looked for creative solutions, blending experimentation, humor and past experiences to create outside-the-box solutions to simultaneously engage in all alternatives.

Main contributions

The major contribution of this study is the identification of the duality type based on the compatibility or conflicting relationship of the opposites the duality entails. Subsequently,
this study contributes to understanding the importance of finding the suitable coping mechanisms for dilemma and paradox types of situations. Previous studies have mostly discussed the coping mechanisms without addressing the structure of the duality (i.e., paradox or dilemma) as the focal point. Building on the coping mechanisms outlined in the previous studies, this study addresses and divides the solutions as suitable for paradox or dilemma dualities, making a novel contribution to the current literature on dualities and managerial cognition.

The study also adds value to the fundamental debate in the ambidexterity literature in regard to the complementary or conflicting nature of the opposites and its influence on the subsequent actions that managers need to take. Previous studies have suggested that on an organizational level, splitting helps managers view conflicting demands as complementary. Therefore, the managers solved dilemma decisions by suppression, where one of the alternatives is emphasized, or splitting it into separate tensions temporally (e.g., first focusing on A then on B) or spatially (e.g., half of the team focuses on A and the other half on B), thus enabling a more workable certainty. Paradoxes in turn are solved through acceptance by learning to live with the paradox; confrontation by socially discussing the paradox; accommodation by defining creative synergy and finding the way to engage in both; or through transcendence by learning from the past and developing an advanced range of understanding.

The study makes contributions to the academic community that are important in moving the field forward and decreasing fuzziness in terminology. The publication refines the typology of dualities and ambidexterity, addressing that in order to make meaningful contributions to the literature, one should clearly define whether the opposites are seen as complementary or conflicting and how the individual different dualities are coped with instead of referring to them as “a bulk.” Such precise definitions help to increase the explanatory power of the concepts and protects those from becoming vague, “impotent terms,” where their measurement and comparison become true challenges. For managers the study demonstrates real-life decision-making situations and departs from the myth that all problems are to be solved; for some the optimal solution is to accept the paradox and invent ways to live with it. Or alternatively, the takeaway for managers may be finding ways to solve problems that they had previously considered as “mission impossibles.”
4.5 Publication 5: Paradox versus dilemma framing in sustaining innovation: an experimental investigation

Research objectives

This publication is based on an experimental design that tests decision-makers’ perceptions regarding the difficulty of and preference for dilemmas and paradoxes in a laboratory setting using abstract figures. Whereas some dualities are solved by emphasizing one option at a time and neglecting the other, some dualities must be handled simultaneously by decision-makers. This publication reports the findings from an experiment that simulates the decision-making situations regarding dualities in a laboratory setting and thereby explores the cognitive framing processes of the decision-makers. The core idea is to test the performance of participants in paradox decisions (simultaneous opposite decisions) or dilemma decisions (concentration on one task) under a competitive environment and a varying level of time pressure. The decision-makers are financially motivated to perform as well as they can against other participants. Additionally, the study explores the decision-makers’ preference toward paradox and dilemma decisions.

Two different experimental studies (called sub-study 1 and 2) were conducted. Both studies consisted of three tasks—build, memorize, and memorize and build—of which the first two represent two different dilemma options, and the last was a simulation of a paradox where the participants had to memorize a target figure and then build it relying on their memory. The best performed decision in sub-study 1 was a dilemma, the building task, which in the study design was cognitively less burdensome that the other dilemma task, memorizing the target figure and selecting the closest figure after the target had disappeared. In sub-study 2, dilemma was again the best performed: the memorizing task represented the cognitively least demanding decision, and it was the most preferred decision for the participants over the building task, which required constructing a target figure but with an insufficient amount of building blocks for its construction. In both studies, it was found that the participants’ performance was lowest in the paradox decisions.

Additionally, after completing the aforementioned three tasks, the participants were asked for their preferences regarding the tasks—their assumptions in regard to their preference before and after completing the tasks. The findings show that participants were generally more satisfied with the less cognitively demanding dilemma options and the least satisfied with the paradox option, of which the latter’s superiority has, nevertheless, been widely discussed in the recent management literature. Also, some participants who were initially interested in the paradox solution changed to the dilemma option as their preferred task much more often than the other way around.
Main contributions

Given the growing interest in paradoxes and other types of dualities in the management literature, little is known about which type of tasks individuals prefer and how they perform in these tasks. The findings of the study indeed show that decision-makers do differ in terms of their preference and performance regarding dualities, the dilemma versus paradox solutions in particular. To provide actual behavior-based evidence on this issue, a laboratory experiment was carried out, which appears to be the first one to demonstrate the differences between dilemma and paradox choices. Experimental methodology, which has been relatively scarcely used in ambidexterity and duality research, allows researchers to explore the dualities and ambidextrous abilities from a novel angle, making a unique contribution by adding depth and value to the extant research.

The findings contribute to the literature streams in a novel way by showing the actual decision-making process instead of the participants’ retrospective analysis of their behavior. Knowledge on such real-time decision-making processes related to different types of dualities is rare, and thus the contributions of this study can be considered as path-paving and hopefully inspire further research in the area. The managerial contribution of this study relates to pointing toward the importance of becoming aware of managerial cognitive processes when analyzing complex strategic decisions.


Research objectives

This publication addresses the need companies have to master both poles of the duality, the exploitative and explorative knowledge processes in the context of NPC to generate ideas for incremental, radically new or even disruptive innovations. This study shows how the cognitive process of analogical reasoning helps decision-makers to enhance creativity and overcome the problems related to an over-reliance on exploitative cognitive activities. By conducting eight qualitative interviews with NPC team members in the international sports equipment industry, the aim was to discover the differences in analogical thinking processes for different product ideas that had been launched. In this context, cognitive ambidexterity refers to the NPC team’s ability to successfully generate ideas using different degrees of cognitive complexity.

This study found that the cognitive process of the deployment of near, medium-far and far analogies in NPC processes can enable the development of both radically and incrementally new products. The findings also reveal that the creation of promising
conditions for analogies to be generated; team configuration; and team composition matter when pursuing the utilization of analogies for cognitive ambidexterity. Interestingly, the far analogies leading to radically new products were not purposefully generated and these ideas often arose outside working hours when alone. Generation of far analogies is cognitively the most demanding and the most unpredictable, yet a particularly useful tool for companies to tackle the widely acknowledged problem of over-reliance on exploitation.

Main contributions

While the organizational ambidexterity literature has frequently underlined the top management team’s role in the facilitation of dualities at the organizational level, this study provides knowledge on team level cognitive processes in the context of engaging in novel idea generations.

This study contributes to the literature on organizational ambidexterity regarding dualities in terms of creation of incrementally and radically new product ideas in parallel, and the related cognitive processes, with a special focus on analogical reasoning. This study also adds value to the discussion of cognitive ambidexterity and shows its role in a new product idea generation context.

The novelty of this study is to address the means regarding how to create ideas for the widely discussed duality of incremental and radical innovations in the ambidexterity literature. For managers, mastering this duality is crucial for ensuring sustainable innovation flows. The greatest importance of this publication is to show that exploration and exploitation activities are both needed to generate different types of innovations. This study shows that the idea generation process can greatly benefit from purposeful analogical thinking and through empirical examples gives guidelines to practitioners.

4.7 Summary of main findings and contributions

This thesis contributes to the literature streams of organizational ambidexterity; of duality and its different forms, such as paradox and dilemma; and of managerial cognition. Table 7 outlines the research questions and summarizes the key findings and contributions, which are discussed in more detail in the next sub-section.
The last section of this doctoral thesis gives the final conclusion, the theoretical and practical implications and the limitations and avenues for further research.

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### Table 7 Summary of the publications

<table>
<thead>
<tr>
<th>Publications</th>
<th>Sub-research questions</th>
<th>Main finding</th>
<th>Main contribution</th>
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<tr>
<td>1, 2</td>
<td>SRQ 1: What are the conceptual underpinnings of managerial decision-making in organizational ambidexterity?</td>
<td>Organizational ambidexterity, dualities and managerial cognition together give a good explanation for how and why organizations deal with complementary and contradictory demands.</td>
<td>Conceptualization and identification of the role of cognitive ambidexterity in decision-making processes. Building a cognitive ambidexterity framework, which is rooted in the literature streams of organizational ambidexterity, dualities and managerial cognition.</td>
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<tr>
<td>3, 4</td>
<td>SRQ 2: How do the decision-makers perceive and cope with the tensions related to organizational dualities?</td>
<td>Decision-makers differentiate dualities according to their willingness or ability to respond to all alternatives simultaneously or the feeling of having to choose. Based on the structure and nature of the tension, decision-makers establish solutions and coping mechanisms to deal with them.</td>
<td>Identification of the concrete dualistic decision-making activities, recognizing the poles of dualities and assessment of the structure and nature of the dualities as well as finding the optimal coping mechanisms for dilemmas and paradoxes, which can be considered as the main duality categories.</td>
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<tr>
<td>5, 6</td>
<td>SRQ 3: How do organizations make use of cognitive ambidexterity in facilitating creativity?</td>
<td>Decision-makers cognitively process the possible solutions, and perform better at and primarily also prefer the cognitively less burdening options. Decision-makers solve problems requiring creativity by matching the cognitive distance between the base knowledge and the target knowledge in order to find solutions to facilitate the coexistence of dualities.</td>
<td>Elaboration of the cognitive mechanisms related to decision-making processes aiming at generating creativity or solving complex problems. Challenging the view that decision-makers should (always) aim at paradoxical solutions. Utilization of novel methods to study these particular phenomena: interviews for analogical thinking and experiment for understanding the decision-making with regards to dilemma vs. paradox solutions.</td>
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5 Conclusions and limitations

Overall, this doctoral thesis contributes to the research that addresses the cognitive micro-foundations of organizational ambidexterity. The thesis looks at the tensions in the organizations, the origin for those to emerge and situations where such “double-dealing,” or addressing different tensions, is needed. The thesis shows that as a result of a cognitive framing process tensions differ in nature and thus bear different kinds of meaning for the organization. This leads to the notion that tensions have to be handled differently and that they can also be utilized for creative purposes. Notable is that not all tensions are equal and that the difficulty level of different tensions varies. This study approached the research topic both conceptually and through empirical qualitative investigations and laboratory experiments, building on the research of dualities and managerial cognition to contribute to the organizational ambidexterity literature.

The main research question of this doctoral thesis has been answered through three sub-research questions. The sub-questions are answered via both conceptual and empirical methods, and they explore the main research question from different perspectives. However, these are all concerned with the way complex but necessary decisions are made in a dynamic business environment. The use of different theoretical approaches and experimental nature of research allowed the research question to be scrutinized in various ways to establish a comprehensive representation of the phenomenon. In the following section, the main research question and the sub-research questions are recapped, and finally the theoretical and managerial implications of the study are summarized. The thesis will conclude with the limitations and avenues for future research.

The first sub-question deals with the micro-foundations of ambidexterity. Many scholars, including Laureiro-Martinez et al. (2015), noted that we still have to come a long way before fully understanding how exploitation and exploration decisions are made to provide the micro-foundations for organizational ambidexterity. In fact, this is a key limitation that has been addressed in the organizational (Mom et al., 2009; Raisch et al., 2009), psychological (Laureiro-Martinez et al., 2010) and neuroscience streams of literature (Aston-Jones & Cohen, 2005; Laureiro-Martinez et al., 2015). While some studies have discussed the behavioral requirements that ambidexterity exposes the individuals to, they do not shed light on the individual differences of those who are managing the actual contradictions or the differences with regard to the cognitive burden those decisions cause. Therefore, the first sub-question of this thesis is as follows:

SRQ 1: What are the conceptual underpinnings of managerial decision-making in organizational ambidexterity?
This sub-research question brings novel insights to fill this gap by conducting qualitative and experimental studies, both of which are used in a minority of the ambidexterity or duality studies when compared to quantitative methods. Together, organizational ambidexterity, dualities and managerial cognition provide a good explanation of how and why organizations deal with complementary and contradictory demands. By conceptualizing and identifying the role of cognitive ambidexterity in decision-making processes and building a conceptual framework, this study enlightens the conceptual underpinnings of organizational ambidexterity.

The study highlights that dualities can relate to dichotomous, opposite poles, where one element of the duality automatically defines the existence of the other, making those opposites mutually exclusive. However, it is notable that dualities, as well as ambidexterity, also encompass merely opposite tasks, which are both important and co-exist, sharing some similarities, but which are not opposites or binary. For example, functions such as sales and service require different skillsets and mindsets, but eventually they target retaining or acquiring new customers and the survival of the firm. Another example is the pursuit of incremental and radical innovations, which are often discussed as opposites: companies establish NPD units, but ultimately the tasks share the same target of offering new products and keeping up with the competition.

The duality literature addresses what seems like an impossibility by encouraging individuals to establish solutions that—despite their contradictory nature—facilitate the co-existence of both. The attempt to attain both is paradoxical, more so on the cognitive level, where psychologists have proven that the human brain is not made for this and that the trials can lead to anxiety and stress. Therefore, this thesis suggests that it is of utmost importance to recognize the need for paradoxical solutions. The current literature proposes paradox as a better solution, yet Smith (2014) noted that simultaneous solutions should be used only when they are really needed. This study therefore emphasizes managers’ cognitive ambidexterity and the role it plays in facilitating appropriate search mechanisms to identify and recognize the dualities in the organization and understand their structure, nature and impact in order to opt for suitable solutions that build ambidexterity into an organization.

After clarifying and gaining a better conceptual understanding of the micro-foundations of organizational ambidexterity, the second sub-research question is concerned with how the key elements of ambidexterity, exploration and exploitation as well as other decision-pairs are recognized, identified, assessed and eventually coped with and addresses these processes through an empirical study. Therefore, the sensemaking and cognitive-framing processes of different dualities play a central role in examining this. The second sub-question of this thesis is as follows:

SRQ 2: How do the decision-makers perceive and cope with tensions related to organizational dualities?
In the course of the study, it was found that many complex decisions, as the previous literature states, appear in pairs similar to dualities due to the high-velocity environments organizations operate in. In the interviews, the decision-makers were wondering how to come up with, for example, creative thoughts and think about the future, as routine tasks and engrained ways of doing things seem to consume all the resources. An interesting finding was that on top of describing the decision-making situations as dualities, the interviewees described the dualities as paradoxes or dilemmas in different tension categories, also attaching a certain nature or tone to the tension arising from the duality type, describing it as “the exciting part of the job” or “business as usual,” for example.

Cornelissen and Werner (2014) found in their review that the dominant assumption in the literature is that organizational actors cognitively distinguish systematic patterns in environments and compress them into much fewer comprehensive cognitive frames of reference, which guide their inferences, perceptions and behavior. When individuals “activate” such familiar frames of reference, this generates presumptions—which may be right or wrong—meaning that the decision-maker’s perception of the environment becomes reference-dependent. Such a frame, which is built on previous experiences, is activated to guide the observation of signals and stimuli in real-time. The prevailing frame may indeed be a dominant individual response in all or at least the most novel situations (Cornelissen & Werner, 2014). This study found that the decision-makers did identify and recognize the structure of the dualities (paradox or dilemma) and also showed evidence of assessing the nature of the duality (positive, negative, dialectical or neutral). However, interestingly, they were not always faithful to their familiar frames, and their framing process appeared irrational, based on emotional reactions. For instance, while some managers perceived a certain tension as negative, other managers viewed a similar situation as positive. Also, although the interviewees seemed to opt for profitable business, they also made decisions that represented the “right thing to do” or the “fun factor.” The study contributes to extending the existing tension framework (Lewis, 2000; Lüsher & Lewis, 2008; Smith & Lewis, 2011) by clarifying the nature of the tensions in addition to their structure.

Based on the structure and nature of the tension, decision-makers establish the solutions that they perceive to be best suited for the dualistic decision. Existing studies have highlighted and discussed the coping mechanisms (Lewis, 2000; Smith, 2014; Jarzabkowski & Lê, 2016; Jarzabkowski, Lê, & Van de Ven, 2013) for dualities. This study further elaborates upon the coping mechanisms that can be best suited to different duality types based on their structure and nature.

Finally, the third sub-research question concerned the utilization of cognitive ambidexterity in creative problem-solving. As discussed in previous sections, increasingly more evidence has been gathered supporting the view that senior managers make decisions, unconsciously and consciously, using analogical reasoning. When managers face a problem or an opportunity, they mirror it against something that they have seen, heard or experienced in the past and try to use this knowledge to tackle
situations they encounter in the present. Indeed, there is evidence that managers use analogies drawn from their experiences to cope with complex and multifaceted decision-making problems (Gary et al., 2012; Gavetti et al., 2005). However, prior studies have shown that this is not easy for decision-makers (Gary et al., 2012). The challenge is in finding structurally similar situations that they can use for knowledge transfer. The studies answering the third sub-question relate to identifying how the ideas are generated in the NPD teams and their utilization of analogies. In the experimental study, the participants showcased their ability to perform in dilemma and paradox decisions. The third sub-research question explores cognitive ambidexterity’s role in facilitating creativity, as follows:

SRQ 3: How do organizations make use of cognitive ambidexterity in facilitating creativity?

The contribution of this study can be considered to lie in the methods selected, which bring novel insights about decision-making related to creativity. Decision-makers make sense of the decision duality through cognitive frames by building near, medium-far and far analogies with past experiences. It was found that near analogies support exploitative (incremental) innovations and the fine-tuning of existing products. The medium-far analogies generated ideas for more radical innovations, and far analogies generated ideas for disruptive innovations. Gary et al. (2012) noted that even in the case where managers know about analogies and their principles, they still find it challenging to actually use them. Far analogies are especially demanding; they appear to be the most difficult to control and steer and are also often generated outside office hours and when alone. Many companies are indeed already seeking more space for creativity by offering home office opportunities and breaks that are mandatory getaways from work to facilitate such actions. The process of becoming aware of analogies without doubt needs practice, and the contribution of this study is the framework with empirical examples of how different situations can trigger the generation of an analogy.

The experimental study revealed that decision-makers are better at less complex cognitive tasks and that they also tend to prefer those. The paradox decisions were generally performed worse and also less preferred by the decision-makers, despite the fact that paradoxes have been widely appreciated in the duality literature. The decision-makers’ performance was better in the dilemma tasks, which expose the decision-makers to lower cognitive strain and probably provide a feeling of a more certain outcome. This further confirms and explains the tendency toward the over-emphasis on exploitation tasks discussed in the ambidexterity literature. Thus, it is important to highlight the benefits, such as the synergies and enhanced creativity, of the paradoxical solutions to encourage decision-makers to find ways to reach out to those. Nevertheless, it is an unnecessary waste of resources to frame decisions as paradoxes when dilemma solutions can provide quick solutions without excessive cognitive effort. This furthermore calls for recognizing the initial framing of the decision and application of optimal solutions.
Overall, our findings provide an improved understanding of duality-related decision-making and cognitive processes. While the extant literature has highlighted the characteristics of decision-making dualities and their management (see, e.g., Putnam et al., 2016), very little is known about the micro-foundations affecting the initial framing process. In particular, our study shows the cognitive framing of paradox to be more difficult for decision-makers. In a business context, this means that tasks that are seemingly contradictory may be abandoned under the (false) presumption that they will be too difficult. This may lead to an over-emphasis on dilemma solutions, especially those that require markedly less creativity. This might be detrimental to contexts where renewal, innovation and creativity would benefit from paradox framing (e.g., Gaim & Wåhlin, 2016).

The main research question

The overall objective of this doctoral thesis is to understand and conceptualize the micro-foundations of organizational ambidexterity in the context of decision-making, which has been identified as a gap in the ambidexterity literature. This endeavor led the researcher to draw from the literature streams of dualities and managerial cognition, to which this thesis also brings contributions. The main research question of this doctoral thesis is as follows:

How do organizations identify, value and cope with contradictory and complementary dualities in decision-making activities?

This doctoral thesis highlights the micro-foundations of complementary and conflicting dualities and shows the role of achieving cognitive ambidexterity both conceptually and empirically. In the following section, the process for cognitive ambidexterity facilitation is described step-by-step, and the publications corresponding to the steps are addressed.

First, the decision-maker needs to pay attention to his/her degree of duality awareness (Graetz & Smith, 2011). This refers to acknowledging and becoming conscious of the complexity of the decisions. This relates to the identification of the contradictions in decision-making. Publications 1 and 2 of this doctoral thesis conceptualize this process drawing from the literature on ambidexterity, dualities and managerial cognition.

The second step is to recognize the structure of those dualities. Publications 4 and 5 discuss the managerial framing of the duality as a dilemma or paradox, which ultimately defines how the duality should be dealt with by suggesting coping mechanisms that are suitable for dualities with different structures (i.e., dilemma versus paradox). The experimental study reported in publication 5 shows the level of difficulty of dilemma versus paradox solutions and the decision-makers’ preferences toward those options.

Thereafter, the decision-makers should assess the nature of those dualities. Publication 3 discusses the nature as vicious, virtuous, dialectical or neutral, referring to the relationship of the poles of the duality, which has to be recognized to have a holistic
understanding of the duality. Once the nature and structure of the duality have been understood, a suitable coping mechanism can be adopted.

Publication 4 discusses strategies for managing paradoxical solutions. In the paradox literature, Lewis (2000) outlined acceptance, confrontation and transcendence as strategies that facilitate paradoxical mechanisms, appointing the potential power of paradox to assist in change and creativity (Smith & Lewis, 2014; see also Gaim & Wåhlin, 2016; Jarzabkowski & Lê, 2016). In the ambidexterity literature, these refer to different types of contextual ambidexterity. For dilemma-structured dualities, the suggested coping mechanisms are suppression (Gaim & Wåhlin, 2016), spatial separation (Poole & Van de Ven, 1989) and temporal separation (Poole & Van de Ven, 1989), the latter two of which are in line with structural and cyclical ambidexterity solutions.

Creativity refers to reassembling elements within the existing knowledge base in a novel fashion to produce new ideas (Dahl & Moreau 2002). Gavetti et al. (2005) examined how managers can utilize analogical thinking to overcome the double challenge of complexity and novelty. When managers encounter new and complex situations, they categorize the elements that seem the most relatable, and dive into their “memory library” to search for similar encounters in the past and the kind of solutions that worked in the previous situations (Gavetti et al., 2005). The aforementioned creativity is often what managers call for in their endeavor to maintain current activities whilst seeking new business opportunities, a pertinent challenge described in the duality and ambidexterity literature (Gavetti et al., 2005). The role of cognitive ambidexterity in creating ideas for incremental and radical innovations is discussed in publication 6.

In this doctoral thesis, managerial cognition has been used as the theoretical rooting but also as a lens through which the studies have been operationalized. Individuals’ cognitive frames and sensemaking have been used as a framework to analyze the interviews, to identify and label the micro-processes of individuals and to understand how the interviewees formulate their own truth of the decision-making situation. Such frame analysis seeks to understand how actors employ frames to: 1) make sense of a decision context and 2) shape the outcomes (Creed, et al., 2002). Figure 1 addresses the processual steps related to cognitive ambidexterity describing the decision-makers’ cognitive processes with regards to dualities, and the publications addressing a specific phase of the overall process.
Individuals, especially managers, are faced with complex decisions—resource allocation decisions, non-matching goals or different skillsets needed—that with a closer examination resemble a duality. Essential about dualities is that they cause tensions, which are not only difficult to comprehend in the first place but also to articulate to others. The tensions unfold explicitly and implicitly in the organization and, in fact, across its networks. This doctoral thesis contributes to the clarification of the typologies within and across the literature on duality, organizational ambidexterity and managerial cognition, the streams that have tapped into decision-making where the central issues are the opposite alternatives. Furthermore, the studies have taken the individual as a focal point and his/her role in building ambidexterity in the entire organization, asking what the dualities mean to a person, a manager in the organization, at which instances the dualities unfold and what kind of tensions they put forward. There managerial cognition, as already pointed out by some ambidexterity scholars (e.g. Smith & Tushman, 2005), serves as the missing link in explaining the cognitive micro-level processes related to dualities and ambidexterity.

Ambidexterity scholars have been attentive to the relationship of the opposites, most often discussed as the differences between exploration and exploitation, and the analysis of the relationship of the opposites has been merely restricted to their complementarity or conflictiveness. To deepen this discussion, the present doctoral thesis has drawn from the duality literature, principally paradoxes and dilemmas, to better understand the complementary or conflicting aspects that the dualities entail. Merging these discussions
has furthermore opened avenues to look at the nature or the impact of the tensions resulting from the oppositeness inherent in dualities, taking the ambidexterity discussion further into unexplored waters.

Through putting the individual in the spotlight, which in fact has been traditionally less common in the ambidexterity literature, the thesis looks at the micro-foundations of what it takes to build ambidexterity into an organization. The publications of this thesis enhance our current understanding particularly of the “pre-phase” of ambidextrous decision-making, shedding light on what happens when the individuals are confronted with such complex decisions: how they make sense of them, how they come to know about the structure and nature of the dualities and how they assess the tensions that the opposite alternatives may cause to the organization. In addition, the publications tap into the process of how to cope with the dualities, which hopefully will spark further research in the future. Drawing from the more mechanistic means to handle the opposites in the ambidexterity literature and the yin-yang ideology of paradoxes described in dualities helps us to understand how humans encounter opposites and how tensions and contradictions are in fact omnipresent and characterize life itself. The managerial cognition literature, which borrows from psychology and neuroscience, has assisted in maintaining the focus of the highly fascinating theme in organizational issues and restricting the depth of examination to the level that makes contributions to organizational behavioral and management tenets (instead of psychology or neuroscience fields).

The ultimate contribution of this thesis is rather to show the potential that is hidden in the disparate research fields and address the notion that, as a whole, the academic community knows more about dealing with opposites inherent in decision-making than the ambidexterity literature alone has brought forth. The rationale for bringing together the disparate fields of knowledge can be well argued: together those can enlighten and even begin to explain the micro-foundations of ambidexterity, which could not have not been done within the knowledge boundaries of one of the discussed research areas alone. By looking into the dualities literature, it becomes evident that dualities appear in different forms such as paradoxes and dilemmas. Less evident in the duality literature it is, why this is so and how these different duality types should be handled in order to build ambidexterity into organization. Organizational ambidexterity and the building modes of ambidexterity, furthermore do not fully explain the differences of complementary or conflicting aspects of exploration and exploitation and why the opposite activities should be separated or combined. By drawing from managerial cognition literature, we can arrive to a better understanding of the entire phenomenon. By utilizing the knowledge from these different literature streams, this doctoral thesis conceptualizes and demonstrates the presence of cognitive dimension in dualities at all phases in building ambidexterity into organization, and makes these connections more explicit in the presented cognitive ambidexterity framework.

The next sub-section discusses the theoretical and managerial implications of this study in more detail, highlights the key limitations and suggests possible future research avenues.
5.1 Theoretical implications

Overall, the publications of this doctoral thesis make three notable contributions to the extant academic literature by utilizing the cross-pollination of the literature streams of organizational ambidexterity, dualities and managerial cognition.

First, this study makes theoretical contributions to the organizational ambidexterity literature. This doctoral thesis addresses the entire organizational ambidexterity framework and the cognitive component related to each ambidexterity type. It extends our current understanding of contextual ambidexterity, particularly that of the individual but tapping also onto the team level and the parallel engagement of exploration and exploitation activities. Ambidexterity stream has addressed the advantages of synergetic and higher-order managerial thinking when discussing the success factors for individual ambidexterity or project work requiring both exploitation and exploration (Aubry & Lièvre, 2010; Gebert et al., 2010; Lewis & Smith, 2014). Scholars (e.g., Eisenhardt et al., 2010) have addressed the gap in knowledge with regard to the cognitive micro-foundations related to achieving organizational ambidexterity. By bringing together the knowledge from the duality and the managerial cognition literature, this gap in the ambidexterity literature—the lack of understanding of the micro-foundations and thereby the underlying cognitive processes—was highlighted.

Second, this study makes a theoretical contribution to the duality literature working towards filling the gap identified by duality scholars; Sánchez-Runde et al. (2003) noted that duality management “has been a recurrent but superficially treated theme” (p. 252). Generally, the duality literature has underscored the superiority of paradoxical solutions over dilemma solutions. For instance, Eisenhardt et al. (2010) proposed that managers should facilitate the concurrence of contradictory cognitive agendas (Smith & Tushman, 2005), pronounced as balancing between exploration and exploitation on the individual level (Eisenhardt et al., 2010; Smith & Tushman, 2005; Good & Michel, 2013). Smith and Tushman (2005) suggested that senior managers should develop “paradoxical cognition,” managerial frames and processes that recognize and embrace contradiction (p. 523). At the same time, adopting paradoxical solutions both increases cognitive complexity but also warns about the unfavorable effects of cognitive simplicity in the unpredictable, turbulent and complex world of business (Levy & Scully, 2007). This study extends this notion.

By clarifying the micro-foundations of each solution, this thesis addresses the cognitive relief related to dilemma options and suggests that it is important to recognize the structure rather than trying to change the structure of the problem. The thesis also adds value to the discussion with regard to the duality terminology. It also expands the widely cited and central framework of Smith and Lewis (2011)—the tensions of belonging, learning, organizing and performing. This study further attached the nature of those tensions, recognized the wide diversity of dualities that managers encounter and examined the contradictory and competing poles of each duality. Previous duality studies have tended to focus on lower-level managers (Knight & Paroutis, 2016). This study also
Conclusions and limitations

offers insights into senior executives’ framing processes. Using experimental methods brings a valuable contribution and novel insights regarding dualities and sheds light on the issue, which thus far has lacked empirical research, namely the decision-makers’ performance in decisions representing different duality types and their preference towards those. Notable is that in its newness, this study serves as a discussion opener and shows that there is still much to be explored in the area of dualities in decision-making. Experimental methods are still rare in the duality literature (for an exception, see Miron-Spektor et al., 2011) but can tap into issues that narrative studies cannot report as reliably or precisely, such as the preference for or perceived difficulty of the tendency to formulate problems as conflicting or complementary, dilemmas or paradoxes.

Third, this thesis contributes to the management cognition perspective by extending the current understanding of the nature of tensions that managers observe through their cognitive framing processes. In particular, this study provides empirical evidence to support recent studies that have discussed vicious and virtuous cycles from the paradox perspective (see, e.g., Gaim & Wählin, 2016; Putnam et al., 2016; Lewis & Smith, 2014). Cognitive framing has been claimed as an abstruse concept (Cornelissen & Werner, 2014). The contributions of this study are targeted to deepen the extant knowledge in this area.

Fourth, this study makes theoretical contributions to the cross-section of the literature on managerial cognition, organizational ambidexterity and dualities by addressing the cognitive and behavioral challenges and opportunities that are embedded in the complex decision-making environment. This doctoral thesis also highlights the processes related to cognitive ambidexterity—the (cognitive) process that ranges from identifying dualities to recognizing their structure, assessing their nature and finally responding to them with a suitable coping mechanism. The thesis builds a theoretical framework for cognitive ambidexterity, addresses its role in relation to other ambidexterity types and highlights the coping mechanism for those adopted from the duality and ambidexterity literature.

The findings also extend the current understanding of the dualities aware perspective (Graetz & Smith, 2009; see also Jarzabkowski et al., 2013; Knight & Paroutis, 2016), showing how decision-makers understand and interpret dualistic forces within organizations. The study provides broad evidence of managerial awareness and recognition of dualities, which these managers encounter in their everyday operational decision-making and their long-term strategy-building activities. This is important, as “understanding the characteristics of dualities allows for managers to chart what they are seeking from their organizing forms of managerial interventions” (Graetz & Smith, 2008, p. 269).

The findings also add value to the discussion of cognitive distance (Nooteboom et al., 2007) and analogical reasoning (Gick & Holyoak, 1983). This thesis shows that medium-far analogies are easier to apply, and are more frequently applied, than far analogies, while contributing to more radical product innovation than near analogies. This is in line with the notion of optimal cognitive distance, where the newly integrated knowledge is not so
close that it makes no difference but also not so distant that it appears to be entirely dissimilar and unrelated. However, when a decision-maker seeks completely novel and groundbreaking ideas, the search distance for the ideas should be greater. This finding is also supported by findings regarding unfamiliar knowledge searches for non-routine change and organizational renewal (Tripsas & Gavetti, 2000). The results of this doctoral thesis also propose broader implications for organizing and managing knowledge processes in NPC activities by showing the usefulness of analogies in creating innovative ideas and solving problems by challenging the extant mental models.

It can be concluded that strong ties between organizational ambidexterity, dualities and managerial cognition already exist in the current management literature. However, this relationship has not been made explicit. The literature streams, although distinct, continuously draw from each other. For instance, several ambidexterity studies (e.g., Andriopoulos & Lewis, 2009; Raisch & Birkinshaw, 2008) have used the term paradox to highlight the persistence and simultaneity of tensions between exploring and exploiting, and they have drawn from managerial cognition and cognitive framing (e.g., Smith & Tushman, 2005); and dualities studies have referred to organizational ambidexterity as one type of duality (e.g., Graetz & Smith, 2008). Smith and Lewis (2011) in turn discussed dualities as one type of an organizational tension and contrasted that to paradoxes, dilemmas and dialectics. Thus, the main contribution of this doctoral thesis to the management literature is to clarify the typology and their interrelationship, bring these streams together and show how they can feed off each other to create a more complete picture of the complexities of decision-making in the dynamic environment of today, which thus far has been rather fragmented.

5.2 **Practical and managerial implications**

*The style of leaders should be similarly gentle and soft, but also persistent and powerful. (Lee et al. 2008, p. 93)*

The decision-making environment of the 2010s poses myriad challenges for managers—but also opportunities. While the abundance of options should be seen as a valuable asset, Seo et al. noted that organizations “are not generally equipped to cope with fragmentation and high ambiguity” (2004, p. 102) but house a limited knowledge of how to deal with the dualities related to organizational change (c.f. Graetz & Smith, 2009). In addition to fulfilling the gaps identified in the academic literature, this doctoral thesis seeks to make valuable contributions to practitioners.

MacDuffie (1997) contends that with a well-chosen frame may organizations can evade conflicts, enabling them to pursue a single strategy that inherently balances contradictory goals (c.f. Adler et al., 2009). Nevertheless, the process of coming to the point of choosing a frame, and doing this well, may not be a straightforward process, as this doctoral thesis explains. The managerial learning point of this study is in the first place the improved
understanding of the importance of developing “duality awareness.” This study educates practitioners and managers to identify, recognize and assess the dualities that appear in their decision-making and provide insights into the types of tensions that could be perceived as a source of creativity or that entail the potential for detrimental conflicts.

While current research has suggested ways to manage dualities, we are still lacking an understanding of how they are framed and perceived by managers and become salient in the first place (Knight & Paroutis, 2016). Such insights are particularly important since the eventual managerial decisions and their effectiveness depend to a great extent on the initial framing process of the duality. This study specified and showcased some practical insights about the decision-making dualities, such as those between self and collective or financial and social goals. Additionally, the study pointed out the structure and nature of tensions, which should indicate the way forward, where managers can learn how to adopt suitable mechanisms for managing or utilizing tensions in their organization. The study also brings clarity: whereas some tensions do appear as “one must choose,” others persist and are pertinent over time. Some studies have discovered that holding these opposites together is problematic and the endeavor often collapses to favoring one pole over the other (Putnam et al., 2016). Paradoxical framing is not without challenges, as wearing two hats at the same time (Gibson & Birkinshaw, 2004) may become a heavy cognitive burden. Therefore, managers should not always seek to facilitate paradoxical solutions as a default but should also aim at specialization and simplicity when such structural solutions better permit the co-existence of the dualities in the organization.

The results from the experimental study also point in this direction. As managers need to operate in increasingly complex and uncertain environments to succeed, they very often must solve conflicting demands. Therefore, research scrutinizing the factors that trigger the utilization of paradoxical frames or dilemma frames unfolds significant aspects: indeed, sometimes going for a simple either–or decision is preferable for clarity and resourcing, while paradoxical thinking might be crucial to tackle wicked, complex problems and systemic transformations. Dilemma solutions allow one to optimize the cognitive loading, allowing quick decisions to be made. Thus, this thesis advocates a more pragmatic approach where best-suited organizational ambidexterity solutions are related to the organizational context regarding a particular duality as well as the individual context, the decision-makers’ cognitive abilities.

Pascale (1990) suggested that the potential for long-term sustainability and self-renewal stems from the ability to respond positively and constructively to the dynamic tension between opposites (c.f. Smith & Graetz, 2011, p. 197). Moreover, the study also makes the alternative solutions for organizing the tensions transparent by offering a toolkit or solution palette. To keep up in the changing and dynamic business environment and match the internal with the external conditions, an important role for managers is their engagement in change management. In cases where this is ignored or underestimated, it may become a toxic force hindering the development of the organization (Smith & Graetz, 2011, p. 197).
When managers are exposed to change in a source context, the ability to transmit knowledge to different contexts improves in the long-term (Gary et al., 2012; Helfat & Martin, 2015). Through such abilities, managers can obtain a better understanding of the demands within the organization and subsequently attempt to find new ways to integrate (even more) disparate needs in their resource allocation decisions, which take into account the requirements of both poles of duality. By adopting cognitive frames that identify and embrace strategic contradictions, the managers and management teams can deploy complex strategic acts such as deepening existing competences and developing new competencies (Mihalache, et al., 2014). Overall, the evidence suggests that developing some degree of contextual ambidexterity at all levels of the organization could indeed be a good long-term solution to, for instance, grasp possible business opportunities but also maintain the current activities viability.

Strategy scholars increasingly recognize managerial cognition as a significant explanation for performance differences (Gary, 2005; Gary & Wood, 2011; Gavetti et al., 2005; Kaplan, 2008; Kunc & Morecroft, 2010), and the different levels of managers’ ability to engage in analogical thinking may be an important factor in underscoring the reasons why some firms are more successful than others (Gary et al., 2012). Similarly, Gavetti (2012) proposed that some managers have the aptitude to establish connections between knowledge structures in different contexts that allow the managers to probe cognitively distant yet potentially very rewarding market opportunities. Prior research shows evidence that analogical transfer is an effective way of not only solving problems but also generating ideas but that it is often poorly done, which is at the same time worrying, as there are also research findings suggesting that policy-makers and senior managers make frequent use of analogies (Gavetti et al., 2005).

This thesis defines cognitive ambidexterity, which calls for cognitive complexity and requires managerial ability to redefine problems, balance contradictions, acceptance for ambiguity and ability to take alternative viewpoints into consideration. Managers who manage to cope with such issues pursue for more distant and novel information, use more time to interpret it, observe several dimensions and thus make several complementary but also competing interpretations (Levy & Scully, 2007).

5.3 Limitations of research

There are some limitations to this study that are worth discussing. In the following, the limitations regarding the methodology, the generalizability of the results and the scope are highlighted.

A limitation that warrants consideration is the selected methodologies. Cognitive framing has also often been studied by using cognitive mapping techniques in laboratories (Hodgkinson et al., 1999). In addition to a laboratory experiment, this study does not
utilize such mapping techniques but instead uses qualitative interviews. This may be considered a rather subjective method for looking at cognitive and behavioral structures. Analogies have also usually been tested in a laboratory setting or by simulations and computational models (Gary et al., 2012; Lee & Holyoak, 2008). Using qualitative interviews for this purpose can be seen as a more unusual method and, due to this, also raises concern. Whereas qualitative methods provide more knowledge about the actual process, the limitation compared to a laboratory setting is that it was not possible to measure the actual reasoning process. This has been the case for most of the studies of analogical reasoning, because isolating the various interrelated and parallel cognitive processes involved is very challenging even for simple tasks (Gary et al., 2012). The definition of near, medium far and far analogies was made in an abductive manner from the interviews, matching the responses to the existing definitions of analogy types. While the findings were very interesting, this method has its subjective value-laden limitations in interpreting the findings. The limitation regarding qualitative interviews does not only concern the method itself but more how this method was used in this study. Although this study generated interesting and novel insights, the rather short interviews with one representative of each firm can be seen as a limitation when considering, whether the method enlightens the studied phenomenon thoroughly.

The previously mentioned limitation also leads to another one. This thesis does not utilize methodology triangulation to its full potential. This study uses a combination of quantitative and qualitative methods, but the triangulation could have been utilized even more in the same research paper. In their longitudinal ethnographic study on paradoxical tensions between exploration and exploitation, Knight and Paroutis (2016) utilized a range of different methods (interviews and direct observation in addition to archival documents) to document how the top management team passed on its appreciation of paradoxical tensions to the business units. The obvious limitation of the present study— including the qualitative and experimental studies—is that it is a cross-sectional snapshot, where the participants attended the study only once. Also one limitation concerns the theoretical standpoint: despite organizational learning is discussed, this doctoral thesis does not measure the learning per se or the change in the managers’ mindsets, which similarly would be possible only by conducting a longitudinal study.

The question about the generalizability of the results is also notable. Although interviews were collected from two different industries—traditional beverages and sports equipment—the studies each take a different angle, and therefore the results obtained cannot be compared to make a cross-industry validation of them. Generally, it remains unclear whether different industries would be less or more prone to such dualistic decision-making activities. Therefore, a comparative case study may produce further insights on this matter.

One important limitation of this study can be considered to be the broad scope it takes. The study does not concentrate on any particular duality type but rather looks at the dualities emerging across the operational or strategic level and the individual, team, organizational and network/ecosystem levels. This is justified with the premise that, for
the individual respondent, the source of the duality does not have a major impact on the
cognitive constraint that the individual is confronted with. However, to confirm this
premise, further research is recommended.

The strength of the aforementioned limitations is that those point toward further gaps in
the literature that are worth examining.

5.4 **Avenues for further research**

The limitations explained in the previous section themselves reveal interesting avenues
for future research. Up till now, the empirical examination of cognitive ambidexterity has
appeared to limit the quantitative multilevel study by Chandrasekaran (2009). In his
doctoral thesis, he examined how high technology organizations simultaneously improve
and innovate to maintain a competitive advantage. Cognitive ambidexterity was defined
as a dynamic capability that facilitates decisions with the right balance of innovation and
improvement (Chandrasekaran, 2009). The present study appears to be the only one
exploring cognitive ambidexterity using qualitative and experimental methods, and yet
leaves plenty of room for further empirical testing of cognitive ambidexterity and the
related issues. To ensure quality and maximal knowledge generation, future studies could
also better utilize the power of methodological triangulation by better combining the
qualitative and quantitative data in the same publications instead of collecting different
subsets of data at different points in time and utilizing one dataset in one publication, as
was done in this thesis.

An interesting avenue of future research relates to the coping methods of dualities. This
thesis also addressed that the suitable coping mechanism depends on the structure of the
duality and differentiates between the coping methods for dilemma and paradox decisions
(Publication 4). However, still little is known as to how different coping mechanisms
should be used in conjunction or in a processual way. Future research is recommended to
tap into that issue.

As this doctoral thesis does not ascertain causal relationships, it does not enlighten the
antecedents or outcomes of certain framing processes. For example, establishing a link
between different personality traits and cognitive ambidexterity processes would greatly
add value to the current discussion. This would be a fruitful area to look into and gain
insights that would be theoretically but also managerially very important. In addition,
better understanding on the nature of dualities – virtual, vicious, dialectical and neutral –
would be valuable and there are many questions to be answered in this regard: Do
systematic patterns emerge in how decisions are framed? Can framing be manipulated?

For researchers, dualities pose a challenge with regards to their testing. Dualities require
departing from “mono-dependent and mono-independent variables” (Sánchez-Runde et
al., 2003, p. 275) and develop more complex variables so that the causal relationships of
the dual-continuum interactions could be verified. This will highly valuable and interesting future research area but at the same time a challenging task.

This thesis also neglects the interactions or shared perspective to learning and looks at the individuals’ framing and sensemaking processes. Lewis (2000) defined paradox as something inherent but also socially constructed. The present study explores the cognitive processes through individual cognitive frames, which include contextual factors, contingencies and the past experience of the actor, but it lacks insights derived from social interaction in terms of the shared or distributed cognition of the top management team or the entire organization. This doctoral thesis looks at the individuals’ cognitive frames also the case in Publication 6, which looked at the teams’ creativity and problem-solving, but the study design did not allow for comparisons or an examination of shared or distributed attributes but instead provided a view based on the single actor’s understanding of how the team operates when creating ideas for new products. An interesting research area would be not only the individual cognitive framing and sensemaking but looking at the shared cognition and sensegiving processes in the organization. Achtenhagen et al. (2003) discuss the sensegiving process, through which managers attempt to influence the sensemaking and meaning construction of other organizational members towards the desired redefinition of the reality (see also Goia & Chittipeddi, 1991). Thus, future studies could explore the dualities by putting the social context in the spotlight (see e.g. Knight and Paroutis, 2016).

Gary et al. (2012) noted that reasoning by analogy engages multiple cognitive processes, conscious and subconscious, and that studying such processes in real-time is very difficult. This thesis includes a laboratory experiment, which proved to be a sufficient way of studying and demonstrating the differences inherent in decision-making. However, modern novel technologies, such as eye tracking devices and brain imaging, appear to be a promising future research avenues, filling the gap in the extant methods with their ability to isolate and measure the reasoning processes for strategic decisions. A notable exception in ambidexterity research is the fMRI study by Laureiro-Martinez et al. (2015) on exploration and exploitation.

As was also noted by Gary et al. (2012), more research is needed to recognize the occurrences or strategic decision-making situations where managers should and should not use analogical reasoning. It is known that analogies are a powerful tool in solving problems and creating novel ideas; however, it is not known whether analogies can also hinder such processes or what factors may hamper otherwise successful analogical transfers. An example of such a factor could be, for instance, the impact of stress in handling duality decisions. Chajut and Algom (2003) discovered that analogy tasks were more difficult under higher-stress than under lower-stress conditions. Stress was amplified by a variety of means, including task difficulty, time pressure and threat to the ego (Chajut & Algom, 2003), which are the very conditions that characterize complex decisions in organizations.
An important aspect to study in the future would be the establishment of a process perspective on ambidexterity, which is generally a nascent topic in the current ambidexterity literature (for exceptions, see, e.g., Zimmermann et al., 2015). In the future, conducting longitudinal studies—which would show cognitive ambidexterity’s role in different situations and how much the framing of similar situations varies among decision-makers across time—would add value to the ambidexterity literature but also to the managerial cognition and duality literature streams. An important aspect regarding the framing process is that the frames are not static but are constantly being reproduced, disputed, transformed and even substituted. Therefore, framing is a dynamic and enduring process, which does not transpire in isolation from structural or cultural factors; instead, the framing process, even though we look at individual frames, is affected by various factors from the sociocultural context in which it is embedded (Creed et al., 2002; Cornelissen & Werner, 2014). Given that the studies in this thesis allow only for cross-sectional examination, future studies could benefit from longitudinal studies that show not only the evolvement of the framing process but also the dualities themselves. For instance, dialectical dualities may appear as paradoxes when scrutinized within one point in time. Also, Smith and Lewis (2011) distinguished paradoxes, dilemmas and dialectics as different types. Smith et al. (2017) highlighted some of the recent developments of duality research and brought up constraints in the current studies. However, there is still much to explore how dualities and even the irrational relationship of the opposites constituting the duality unfold in time in high-velocity operating environments. For example, dynamism and a process-perspective would add value to the discussion. Some dualities emerge or evolve so that their certain labeling can take place only if its evolution has been scrutinized over time. When taking a snapshot of a duality, it may resemble a paradox, but, in time, the thesis-antithesis-synthesis process would label it as a dialectic. Thus, longitudinal and process perspectives would add remarkable value to ambidexterity, duality and cognition streams of literature as well as their intersection where the locus of this thesis also is.

In all, the cognitive ambidexterity framework presented in this thesis leaves plenty of room for empirical testing, and there are myriad open issues to be explored and empirically validated. What this doctoral thesis has done is established that cognitive ambidexterity has value and a place at the intersection of the organizational ambidexterity, duality and managerial cognition literature. The challenge in making meaningful contributions in this field lies not only in the scarcity of existing evidence of this intersection but also in the fuzziness of the typology in the individual research fields, especially in organizational ambidexterity and dualities but also managerial cognition. Each individual research area would benefit from clarification of the typology. Scholars have interpreted the terminology to mean so many different things that almost no authors mean the same thing when they use the terms. This becomes evident in the review papers in all the aforementioned fields. For instance, the questions such as “what is ambidexterity?”—even “what is not ambidexterity?”—would be helpful in conducting more meaningful research. Also, indications of whether the research aims to make a contribution to the spatial, temporal and contextual or behavioral ambidexterity mode brings more sense to the literature. The unit of analysis for ambidexterity research has
varied from the networks to the different brain hemispheres of an individual person (Laureiro-Martinez et al., 2015). One could argue that it may increase confusion when the same term has been used to demonstrate such micro-level and strategic-level tasks.

The duality literature in a similar vein is a mixture of different levels of analysis and similarly lacks coherency. Even a fundamental question of what duality means has not yet been univocally established or agreed upon. As opposed to that on ambidexterity, the duality literature is richer in explaining how these different opposites can be organized and begins to differentiate the styles for managing based on the conflicting or complementary nature of the dualities, acknowledging that the duality can be static or dynamic, among other contingencies.

Similarly, the reviews on the managerial cognition literature have revealed the great number of terms used to describe the cognitive or sensemaking processes. While the endeavors to clarify the terminology should be recognized, there is still work to be done in building a typology for managerial cognition especially when it is linked to understanding twin structures and processes, which ambidexterity and dualities are concerned with.
6 References


References


References


References


References


References


Appendix A: Key themes of the interview (Study 1)

1. Introduction
   - Background
   - Education
   - Professional experience

2. Description of the company
   - Distinguishing the company from its competitors
   - Description of the business unit
     - Organization of the unit
     - Diversity of the team (age, gender, background etc.)
     - Unit’s position in the organization chart and analysis of the stakeholders
   - Structure and relationships in the company
     - Interaction with the stakeholders
   - Product range analysis
     - The most successful product
     - The oldest product
     - Recently launched products

*It has been discussed in the literature that managers’ task is to share their attention and resources on something new, searching and experimenting on the one hand and refining and improving existing on the other hand. (Raisch and Birkinshaw, 2008, p.376)*

3. Recall situations when and where the aforementioned applies in the interviewee’s work

4. Activities related to the existing products (*so called exploitation activities*)

5. Activities related to the new and future products (*so called exploration activities*)

6. Organization of the aforementioned activities
   - Collaboration with stakeholders in this context
   - Problematic situations and analysis of the reasons for those

7. The synergies gained and frictions faced in the strategic and operational activities

8. Attitude, feelings, perceptions regarding the identified exploration and exploitation activities

9. Analysis of the unsuccessful vs. successful products
Appendix B: Key themes of the interview (Study 2)

1. Introduction
   - Company
   - Professional background and current role in the company

1. Innovations and team
   - Involvement in new product creation activities
     o The project types, the team compilations and responsibilities
     o Decision-making and communication activities
   - The types of innovations, the amount/number and their role/purpose
   - The time needed to generate innovations
   - Simultaneity, cyclicality or separation of different types of innovations

2. Idea generation activities
   - The typical steps of idea creation (where, how etc.)
     o From an idea to the product
   - Identification of incrementally new and radically new innovations and differences in the idea generation processes

3. Performance analysis against competitors regarding innovation activities
   - Comparison against competitors and assessment of the position in the market
Appendix C: A sample task of the experiment (Study 3)

An example of the memorizing task (task Y) in the sub-study 1. The participants were shown the target figure for 20 seconds (participant group 1) or 8 seconds (participant group 2). After the figure disappeared, the participants had 90 seconds time to select the figure that they perceived as the closest one to the target out of altogether 16 available options.
PART II: PUBLICATIONS
Publication I

Karhu, P. and Ritala, P.
Toward the Cognitive Dimension in the Organizational Ambidexterity Framework

A book chapter in
“Handbook of Strategic Renewal: Core concepts, antecedents and micro-foundations”
A. Tuncdogan, A. Lindgreen, F. Van Den Bosch and H. Volberda (Eds.)
Routledge

Approved for final submission (Authors’ final version submitted)
Publication II

Karhu P. and Ritala, P.
Cognitive ambidexterity - Towards a theory of cognitive underpinnings of organizational ambidexterity

Proceedings of the EURAM 2017 conference, 21st-24th June, Glasgow, Scotland
Publication III

Karhu, P. and Ritala, P.

Multiple faces of tension: Dualities approach to decision-making

Further revised and resubmitted
(Earlier version presented in ISPIM 2016 conference, 19th-22nd June, Porto, Portugal)
Publication IV

Karhu, P. and Ritala, P.
Dealing with Managerial Dilemmas and Paradoxes

Accepted for publication in Journal of Business Strategy
Publication V

Karhu, P., Morreale, A., Ritala, P. and Mittone, L.
Paradox versus dilemma framing in sustaining innovation:
an experimental investigation

Proceedings of the ISPIM 2017 conference, 18th-21st June, Vienna, Austria
Publication VI

Karhu, P., Ritala, P. and Viola, L.
How Do Ambidextrous Teams Create New Products? Cognitive Ambidexterity, Analogies, and New Product Creation

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How Do Ambidextrous Teams Create New Products? Cognitive Ambidexterity, Analogies, and New Product Creation

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For long-term survival, companies must master both exploitative and explorative knowledge processes in new product creation (NPC). Cognitive ambidexterity refers to the NPC team’s ability to successfully combine exploration and exploitation. However, insights on how cognitive ambidexterity is achieved in NPC processes are scarce. This study adopts one promising approach, the use of analogies and analogical thinking, as knowledge processes that help to achieve cognitive ambidexterity in NPC. The first empirical results in this paper confirm that the utilization of near, medium-far, and far analogies in NPC processes facilitates the development of both radically and incrementally new products. The results show that creation of favorable conditions for analogies to born, team composition and configuration matter when pursuing utilization of analogies for cognitive ambidexterity. Copyright © 2016 John Wiley & Sons, Ltd.

INTRODUCTION

The challenges of the current business environment require companies to maintain customer satisfaction by providing improvements to their existing products and recognizing new business opportunities or trends worth following while also creating unique products to attract new customers and widen their market share. This challenge is enforced by the typical tendency of established businesses to lock in to current technological and product trajectories (Tripsas and Gavetti, 2000). Thus, companies are faced with an ambidexterity problem—the simultaneous need to exploit and explore knowledge in their product development and innovation activities (Bledow et al., 2009; Revilla et al., 2012; Lin and McDonough, 2014). Academic literature often refers to the organizational tensions, dilemmas, or paradoxes under the umbrella term “ambidexterity,” wherein businesses engage in opposing or conflicting tasks through individual- or group-level cognition or via behavioral or organizational arrangements (Smith and Tushman, 2005).

Research on innovation ambidexterity provides evidence of innovation being supported through organizational structures (Taylor and Helfat, 2009; Chang et al., 2011), management of the related tensions (Andriopoulos and Lewis, 2009), and team- and individual-level learning (Lin et al., 2013; Lin and McDonough, 2014). However, there is still a lack of micro-foundational, knowledge process-level insights on how ambidexterity can be practically achieved in new product creation (NPC) processes. Despite the immense attention the ambidexterity phenomenon has received during the past decade in academic literature, very few scholars expound on the knowledge processes that enable businesses to become ambidextrous in an NPC context.

To bridge this research gap, this study integrates the insights from several recent conceptualizations on cognitive ambidexterity and cognitive frames (Smith and Tushman, 2005; Chandrasekaran, 2009; Greenberg et al., 2011, 2013; Lin and McDonough, 2014). This study portrays cognitive ambidexterity on a team level as the combination of exploitative and explorative knowledge processes. In examining cognitive ambidexterity, this paper adopts a dialectical perspective on innovation that focuses...
on combining exploitation and exploration (Bledow et al., 2009) with analogical reasoning (Ward, 2004) as a cognitive tool to enable such a combination.

Analogical reasoning and use of analogies was recently discovered as a useful way to facilitate the development of both incremental and radical innovation (Kalogerakis et al., 2010). Analogies build on the idea of combining knowledge from different domains together in order to create novelty to the knowledge processes. Analogies can originate from a source domain, which is more or less (cognitively) distant, and this likely has an effect on innovation novelty (Ward, 2004; Kalogerakis et al., 2010). This study examines how analogies can be utilized in achieving cognitive ambidexterity in a NPC context. This perspective is quite novel, as there is very little literature focusing directly on the role of analogies in NPC (Kalogerakis et al., 2010, is a notable exception). Exploration of the link between ambidexterity and analogical thinking in a real-life business context would fill the gap in the existing literature. This paper outlines a qualitative study of the sports equipment industry in the attempt to provide evidence addressing the phenomenon of cognitive ambidexterity in NPC.

The intended contribution of this paper is threefold. First, it will shed new light on the organizations' knowledge processes in an NPC context. Second, it will extend the current limited understanding of cognitive ambidexterity. Third, the paper will open avenues for idea generation in NPC and suggests that acknowledging analogies may assist in the creation of both incremental and radical new product ideas.

The remainder of the paper is organized as follows. First, it will discuss the theoretical background in terms of ambidexterity in innovation, the concept of cognitive ambidexterity, and analogical thinking as a tool to create new products. Then, the research methods and research design will be presented. Finally, the results of the study are discussed and the implications and future research avenues are shown, as well as highlighting the limitations of this study.

THEORETICAL BACKGROUND

Ambidexterity and innovation

In biological science, the term ambidexterity refers to the exceptional ability to use both left and right appendages with equal skill. Duncan (1976) introduced the term ambidexterity in business context, and it was later defined by March (1991) as a company’s ability to explore new options (referring to activities such as “search, variation, risk-taking, experimentation, play, flexibility, discovery, and innovation”) and simultaneously exploit the current knowledge (described as “refinement, choice, production, efficiency, selection, implementation, and execution” tasks). In an innovation context, the notion of ambidexterity is used to represent the paradox of exploitation and exploration (Andriopoulos and Lewis, 2009; Lin et al., 2013) at the organizational, branch, unit, or individual employee levels. The exploitation and exploration in innovation activities refer to the simultaneous need for businesses to not only incrementally improve their existing products but also pursue radically new product ideas (Andriopoulos and Lewis, 2009).

While there are many perspectives analyzing ambidexterity (O’Reilly and Tushman, 2013), this study conceptualizes ambidexterity as a cognitive phenomenon where the NPC team is simultaneously engaged in exploitative and explorative knowledge processes. To this end, reaching ambidexterity is something to strive for as ambidextrous organizations are proven to be innovative by nature and to possess self-renewal ability by creating breakthrough products for emerging markets and capitalizing on established markets (Caldwell and O’Reilly, 2003; Gibson and Birkinshaw, 2004; O’Reilly and Tushman, 2004; Raisch and Birkinshaw, 2008). Prior research supports this by revealing positive links between an ambidextrous strategy and a higher number of new product introductions (He and Wong, 2004; Sarkees and Hulland, 2009; Sarkees et al., 2010; Tempelaar, 2010). This means that businesses engaging solely or very extensively in exploitation (i.e. focusing on incremental improvements) cannot obtain sustainable competitive advantage in NPC as they continuously lag behind their competitors. In a similar vein, companies’ over-exploration (i.e. intensive focus on radical innovation) might consume their resources, as they do not reap the benefits from small, incremental improvements to their existing products but continuously think “outside the box” without linkage to their previous innovations. Ambidexterity, if successfully realized, can be a sustainable solution for a company’s NPC strategy as it facilitates the creation of both incremental and radical innovation. The following sections discuss how cognitive ambidexterity relates to innovation novelty and how analogies can be used in this regard.

Cognitive ambidexterity and innovation novelty

According to Kaplan (2011) “cognition” and all of the concepts related to interpretive processes can be seen as a sort of “general purpose technology” (for discussion see Bresanhan and Trajtenberg, 1995) that has become an important part of theorizing in many different fields of management and strategy. In ambidexterity literature, cognitive
perspective is discussed, but no unequivocal definition has been coined, and the literature in this regard can be argued to be in a quite emergent state. The current literature delineates the term as an ability or capability to engage simultaneously or rotation-wise in contradicting yet complementary processes of creating new and improving old (Chandrasekaran, 2009; Greenberg et al., 2011, 2013). These existing conceptualizations share a common goal and are grounded in the need for engaging in both exploration and exploitation. This paper introduces a definition of cognitive ambidexterity that is rooted in March’s (1991) exploration/exploitation concept and further crystallizes the current definitions found in the academic literature. Cognitive ambidexterity is here defined as the ability to engage in parallel mental processes that are paradoxical or in contradiction (which may then result in a particular behavior). This study examines cognitive ambidexterity on a team level as the combination of exploitative and explorative knowledge processes.

Cognitive ambidexterity has been examined mostly at the organizational level of analysis. Chandrasekaran (2009) views cognitive ambidexterity as a strategic-level dynamic capability, the ability to resolve contradictions between innovation and improvement. Greenberg et al. (2013) suggest that cognitive ambidexterity is an enabler of entrepreneurial leadership, where two different methods of pursuing opportunities are integrated (Greenberg et al., 2013). They use the terms “predictive and creation logic,” which correspond to exploitative and explorative ways of making decisions. Despite the juxtaposition and seemingly incompatible methods of thought and action, these two logics complement each other and create greater value when used in conjunction (Greenberg et al., 2013). Based on these initial notions of the relevance of cognitive ambidexterity, this study suggests that achieving the balance of exploitation and exploration is especially relevant in innovation contexts and, in particular, NPC.

In an NPC context, knowledge from both existing trajectories, as well as from new developments and markets, is needed. This corresponds to exploitation and exploration in knowledge searching and requires cognitive ambidexterity from the NPC teams. Existing research has shown that different types of intra- and extra-organizational knowledge is needed to successfully create incremental and radical innovation (Sherman et al., 2005; Henttonen et al., 2011). Research indicates that cognitive distance matters when companies search for new knowledge (Nootboomp et al., 2007). In particular, there is an “optimal cognitive distance,” where too closely related knowledge holds little novelty value but too distant knowledge will fail in providing knowledge because it cannot be integrated or comprehended (ibid.).

Cognitively ambidextrous NPC teams could better reap knowledge within different cognitive distances and integrate it together to create incrementally and radically new products. To facilitate NPC teams’ cognition in this regard, this paper pinpoints the relevance of analogical thinking, which will be discussed in the next section.

Analogical thinking and cognitive ambidexterity in NPC

Analogical thinking includes the possibility to think and act dialectically in innovation and NPC (Kalogerakis et al., 2010). Analogical thinking rests upon the idea that individuals use information from a familiar domain (“source”) to construct new ideas (“target”) by transferring their base knowledge to the target domain (Finke et al., 1992; Gick and Holyoak, 1983; Perkins, 1997; Kalogerakis et al., 2010). This process of activating knowledge from a source domain reflects the first of three stages in analogical thinking: access. In the second stage, the mapping stage, people adjust similarities between the source and the target domains, so that in the last stage, the transfer stage, knowledge associated with the base can be moved toward the target (Gentner, 1989; Gregan-Paxton and Roedder, 1997). In doing so, individuals can borrow both attributes and relations from the source domains and utilize them in NPC in the target domain (Dahl and Moreau, 2002). Figure 1 illustrates this process (adopted from Holyoak and Morrison, 2005).

There are several documented descriptions of analogy use in NPC. For instance, inventors familiar with inflatable splints, which primarily serve to immobilize painful or swollen extremities in emergency care, could use this knowledge to design a novel basketball shoe (Hargadon, 2002). Here, the connection between the function and the need to establish better ankle support in basketball shoes occurs with an analogical transfer (Kalogerakis et al., 2010).

As the existing literature supports analogical thinking as a driver of both incremental and radical product innovations (Boden, 1994; Dahl and Moreau, 2002; Kalogerakis et al., 2010), this study presents the use of analogical thinking as a promising instrument to achieve cognitive ambidexterity in NPC.

Achieving ambidexterity is positively influenced by individual creative problem-solving skills (Tempelaar, 2010), which, in turn, can be enhanced by applying analogical thinking. Making use of analogical thinking in NPC means that creative problem-solvers search through stored knowledge in their memory to access helpful information that is (potentially) relevant for the creation of a

It is evident that there are differences between the analogies used in terms of their cognitive distance and relatedness to the source knowledge domain. Kalogerakis et al. (2010) show that the implementation of analogical thinking in NPC processes helps in both incremental and radical innovation, which relates to the “conceptual distance” between the source and the target of an analogy (near or far analogy). According to Dahl and Moreau (2002), an analogy can be perceived as near if the source domain is located in the same-use context as the target problem. By contrast, a far analogy means that the transferred problem’s solution (source) is situated in another context than the target. For instance, if the aim is to invent an innovation that enables individuals to eat while driving, an analogy could be classified as near if the base knowledge arises from the field of car accessories (e.g. a cup holder). An example for a far analogy would be if individuals engaged in the previously mentioned NPC task access knowledge from a non-vehicle field (e.g. dentist’s lamp) (Dahl and Moreau, 2002).

The cognitive distance between domains in NPC can be operationalized with product categories. Bonnardel and Marmèche (2004) let a designer consider a novel chair for a café. They distinguished between knowledge about products in the same category as near or intra-domain knowledge (e.g. a rocking chair) and knowledge from non-related categories as far or inter-domain knowledge (e.g. climbing). In addition to distinguishing between near and far analogies, in line with Dunbar (1997), this study pinpoints the importance of a third category: medium-far analogies. A medium-far analogy occurs when the source knowledge used to create the novel target arises from another product category. Therefore, a medium-far analogy in this study corresponds to the definition of a far analogy by Bonnardel and Marmèche (2004) and Dahl and Moreau (2002). By contrast, an analogy is classified as far if the source knowledge is accessed from a non-product category, for instance, if inventors develop a new tent by making use of their base knowledge on how woodchucks build their caves.

Figure 2 summarizes this theoretical framework. Integration of knowledge between source and target knowledge domains through mapping stage is achieved by the use of different types of analogies. Depending on the cognitive distance (x-axis in the figure), the used analogies can be classified as near, medium-far, or far analogies. The more distant the analogy, the more the process of exploration is pronounced, while in more near analogies, exploitative knowledge processes are more prominent. Deliberate choices in promoting cognitive ambidexterity in NPC can be achieved by using analogies aligned with NPC targets.
METHODOLOGY

Research design

In order to examine the applicability of the theoretical framework, NPC processes leading to incrementally and radically new products are scrutinized by conducting qualitative semi-structured interviews with managers or engineers highly involved in the companies’ NPC processes in the globally dispersed sports industry. The sports equipment industry was chosen for the study because of its rather short lead times (in comparison with pharmacy, for instance), technology intensity, and the assumption that companies’ competitive advantage leans on their innovation capability. Furthermore, this industry was chosen because these companies can recognize and distinguish the difference of their incremental and radical innovations more explicitly as opposed to service-intensive sectors such as banking or finance.

Data collection

The data was collected during 2011–2012 using semi-structured interviews conducted via telephone or Skype. The companies included in the research were found in the Amadeus European company database and by a manual online search. Altogether, 60 suitable sports equipment companies were shortlisted after the search process. The selected companies were a crosscut of the representatives in the global sports equipment industry, including companies developing gear and equipment for winter sports such as skiing and snowboarding, as well as other sports like running, surfing, and climbing. The companies providing sufficient contact information on their websites were approached via email and/or telephone. The companies were promised anonymity, and the incentive to participate was the study results, which were sent to the participants as per their desire. Those who agreed to participate in the study were sent the central interview questions prior to the interview via email. This permitted the interviewees to familiarize themselves with the questions and the study, and it possibly strengthened the focus of the semi-structured interviews. It also allowed the interviewees to acquire the needed information before the interview and provided the opportunity to choose a more knowledgeable company representative for the interview if needed. After the first interview, minor fine-tuning to the interview questions was made in order to receive richer information on the innovation processes in the further interviews.

The final set of interviewees represents a heterogeneous group of eight companies engaging in development of different sports equipment (e.g., skis, skiing, accessories, clothing). The operation history of the companies varied from 3 years to over 100 years, and they employed from 2 to over 500 employees. All the interviewees were male and highly involved in the NPC process. Their positions were commonly CEO or Company Founder, Innovation and Technology Manager, Industrial Designer, or Product Manager. Five out of the eight companies that participated in the study were headquartered in Austria or Switzerland and had a strong international presence in several different sports fields. They also made use of seasonal changes and thus developed both winter and summer sports equipment. Two of the companies interviewed were located in the USA and one in Sweden/Canada. Each company was highly specialized in a certain sport’s equipment rather than offering a broader product range.

The interviewees were asked to think back on the NPC processes that they were personally involved in. Interviewees described their NPC processes and explained whether they considered the product as a truly new (radical) or incrementally new innovation. They selected an example of a development process for each innovation type. The interviewees assessed the role of innovations in their company, clarified their motivation to seek new product ideas and the routines carried out in idea generation, and revealed the sources of ideas for incrementally and radically new products. The interviewees discussed their NPC team’s composition, hierarchy level, and decision-making processes, as well as the number of annual product launches and the lead time of the products when possible. Lastly, interviewees were asked to evaluate the success or market position of the company in comparison with their competitors. Secondary data was also collected from company websites in order to gather more information about the complex innovation interviewees described. Table 1 summarizes the key details of the interviews.

Data analysis

The interviews were recorded, and the duration was 277 min total. In order to simplify the initial analysis of the results, rough transcripts of the interviews were prepared. To scrutinize the collected qualitative data, this study followed a deductive, pattern-matching approach (Hyde, 2000) to interpret the results and to mirror them against the theoretical framework of analogies, cognitive distance, and cognitive ambidexterity. The data interpretations were verified using triangulation, which means that any claim was supported with a variety of evidence (Yin, 1994). In particular, data and investigator triangulation was used (refer to Denzin, 1989). The primary data sources were the empirical semi-structured interviews, yet the data set was
strengthened with the information collected on the company websites; those together constituted the final data set. The initial analysis of the results was carried out in collaboration within the author team in order to minimize investigator biases. First, this study investigated whether companies used analogies for idea creation in truly new and incrementally new product development. Second, the study categorized the idea generation styles based on the type of analogy and the knowledge transfer distance. Furthermore, the configuration of the NPC teams involved was analyzed. The results of this analysis are presented in the following section, which first discusses the findings regarding analogies and the companies’ knowledge transfer processes. Then, the evidence of knowledge transfer patterns are discussed.

RESULTS AND ANALYSIS

The interviewees described their NPC teams and the processes they engage in when taking steps toward launching a new innovation or improving an existing product in their product range. The NPC teams varied in size from 2 to 15 employees (40 in one case), typically having five people per team. The teams were supervised by a team lead or manager who held responsibility for the project’s success and had the final authority and decision-making power. The teams were cross-functional, composed of members from different substance fields or departments (such as engineering, marketing, finance, production, and design), and they often worked jointly on both radical and incremental product development projects. They were engaged with a close collaboration of students, amateur and professional athletes, and some external business partners such as manufacturers, suppliers, or service providers. Two interviewees mentioned that the core team that developed the incremental and radical product ideas consisted of the same people, but for the radical product innovations, the team was extended by externals; the team sizes for radical innovations were 15 and 40, and they had five members in their incremental innovation teams. Many employees/managers turned out to be former or active amateur sportsmen with an enormous passion for the sport. Companies had very close ties to the industry and were active in sponsoring activities and testing the products with athletes. The NPC teams were characterized as rather heterogeneous and diverse; often different nationalities and age groups were represented. The internal relations within the teams were described as collaborative and decision-making collective; the power structures were rather non-hierarchical, and the knowledge exchange was informal. The lateral communication in the NPC teams was pronounced as informal and frequent. As the Innovation and Technology Manager of a large alpine sports company expressed:

<table>
<thead>
<tr>
<th>Country</th>
<th>Interviewee</th>
<th>Company description</th>
<th>Interview length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switzerland</td>
<td>Innovation and Technology Manager</td>
<td>Specializes in alpine sports/outdoor sports (e.g. climbing) and outdoor equipment/clothes. Well-known brand in their core market of Austria, Germany, and Switzerland. The company is a sponsor for several athletes.</td>
<td>35 min</td>
</tr>
<tr>
<td>USA</td>
<td>Owner/Industrial Designer</td>
<td>Specialized design and marketing agency for action sports, especially ocean sports (surfing, windsurfing, kiteboarding, stand-up paddling, canoe paddling).</td>
<td>50 min</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Product Manager for Skis and Ski Accessories</td>
<td>Specializes in different action sports, winter sports, motorsports, bikes, and running. Supports athletes and is highly involved in sponsoring events.</td>
<td>65 min</td>
</tr>
<tr>
<td>Austria</td>
<td>Product Developer/ Product Manager</td>
<td>Producer of premium sportswear for summer and winter (e.g. hiking, biking, ski touring), as well as functional apparel and accessories.</td>
<td>25 min</td>
</tr>
<tr>
<td>Sweden/Canada</td>
<td>One of the founders of the company CEO</td>
<td>Small start-up company; producer of innovative gloves for skiing, snowboarding, and oudoors, pioneers in creating radical innovations in the ski industry. Producer of skis, bicycles, tennis rackets, and golf equipment. Operating also in hotel business and gastronomy.</td>
<td>13 min</td>
</tr>
<tr>
<td>Austria</td>
<td>CEO/Founder/Engineer</td>
<td>A small producer of winter sports equipment for disabled athletes.</td>
<td>28 min</td>
</tr>
<tr>
<td>USA</td>
<td>Project Assistant/ Junior employee</td>
<td>A big brand worldwide; producer of bicycles and motorcycles.</td>
<td>34 min</td>
</tr>
</tbody>
</table>

Table 1 Description of the interviews
The strength of flat hierarchies within small project groups is that you can quickly assume responsibility. If trainees or someone who has even not been in the business for five years can contribute something, it is very much appreciated.”—Innovation and Technology Manager

One interviewee, a surfboard producer, provided an example of their typical NPC process steps. First, they gather feedback on their current products; the competitors’ products are benchmarked or the market demand assessed. Thereafter, they build a prototype or multiple prototypes, which are followed by a concept formulation, which is given to the manufacturer who produces the first product. Then, the testing phase is carried out, and, based on that, the decision is made based on whether the product meets the quality criteria and could be marketed. After acceptance, the initial product is then given to the distributors for evaluation, who can then further assess the product’s fit to the market needs. The product is then produced and kept in the market until its life span comes to an end and it is replaced by another product.

The product ideas were instigated because of an envisioned market opportunity or pressure from the external stakeholders, customers, athletes, or suppliers. Two interviewees explained that their operations in the industry started with a radical innovation because of recognizing a market gap they wanted to fill. The possible cost reductions were mentioned as the driving factor, as well as the possibility to make more durable products. The companies explained that they either want to produce the same product at a cheaper price or make something nicer at the same price.

Parallel creation of incremental and radically new products

These results suggest that companies consider ambidextrous style to innovation important. Many companies realize the importance of having a stable, steady flow of incremental innovations, which ensure the improvements of the core products. Most businesses also recognize the danger of getting overtaken by competition when trapped to their core knowledgebase. Hence, interviewees in this study felt the necessity to challenge their current knowledge and explore new business opportunities while fine-tuning their core products in order to ensure a sustainable competitive advantage.

The incremental innovations in the sports equipment field were commonly described as rather logical improvements in the technology, existing material, design, comfort, or functionality. The radical innovations—the new products—created exceptional value for the customer, and the products were often unique or remarkably better, thus even superseding the competitors’ offerings. In order to create such products, NPC teams thought of a need or gap in the market and possible ways to fulfill it, often using combined functions or technology that they had seen used in another context.

The optimal balance of incremental and radical innovations is achieved with an emphasis on exploitation activities (incremental product innovations) and continuously challenging the core competences when necessary or possible. Radical innovations require more resources, longer testing phases, and may simply be difficult for the company to obtain. Thus, it is not a sustainable strategy to launch only radical innovations. Realization of this showed in the interviewees’ comments on parallel creation of incrementally and radically new products:

“Our collection is divided… At the moment, I would say 40% basics and 60% new developments where the new products are not necessarily very innovative but rather for instance new design or material changes in the product and from these new products maybe 15–20% are highly innovative.”—Product Developer/Product Manager

The owner of the company specializing in ocean sports explained how finding new material, combining ideas from another context, or creating a new technology would be something radical for them but is happening because of the ongoing parallel incremental innovation process. Incremental innovations are the “daily R&D work” for the company, which means that every day, the company tries to improve some aspect either of the boards, the manufacturing technology, or their marketing activities. The company is always seeking radical innovations, but it develops them through incremental innovation processes.

Despite the dynamic nature of sports and frequent product launches, some interviewees characterize the ski equipment development as a traditional and established arena where radically new product innovations have not taken place in decades. Incremental innovation, however, takes place yearly—mostly for the sake of marketing and the pressure from the distributors, not because of technological enhancements. Another product category that had not overcome any “reinventions of the wheel” was bicycles. The CEO of a large sports equipment producer remarked that the ski market has declined substantially; thus, the costs and risks associated in creation of radical innovations do not exceed the benefits at the moment. Rather, the radical innovations in the ski sector took place in the 1950s when they started using plastic material instead of wood, in the 1990s when they changed the ski size and shape, and with the launch of the [Name] model shortly followed by carving skis. Currently, skis are subject to rather incremental changes.
The analogies used

Following the definitions by Dunbar (1997), Dahl and Moreau (2002), and Kalogerakis et al. (2010), near analogy is situated cognitively within the same product category, medium-far analogy within another product category, and far analogy from a non-product category (e.g. something completely unrelated to sports equipment). This study found empirical evidence that companies embark on near, medium-far, and far analogies when generating ideas for incrementally and radically new products.

This chapter discusses the real-world examples of analogies the companies used and whether usage of those analogies resulted in the development of incremental or radical innovations. The practical means of emitting product ideas with analogical thinking were individual and collective brainstorming and ideation sessions or by observing something interesting in the nature or the usage of the product in a different field and context.

Near analogies

Near analogies typically resulted in making incremental product changes. An incremental change was described as an improvement to the existing products, enhancement of the production process, technology, material, comfort, or functionality of the product.

When a large company producing equipment, clothing, and gear for winter and summer sports wanted to revise their whole backpack collection to include an adjustable mesh back, they described their idea generation as an intended process with contributions from external partners:

“There were creative workshops that we organized and there were external service providers involved in looking for innovation potential of the backpacks. The idea, it is a bit hard to say, but it was with the output of the external service provider. [Company name], a creative agency, they do research, they look for innovation potential. And they came up with the idea that we could make the “netback” ourselves. We took in the internal workshop as the theme, the focus points, the ventilation, and the stability of the weight on the body. And that’s how we came up with the idea. We think about the usage (situation) itself, we observe the customers and how they use it and the competitors as orientation assistance.”—Innovation and Technology Manager

The company combined the idea from the creative agency and looked at the existing backpacks for ways to improve the functionality, comfort, and design:

“Then in the backpack area, we shifted the hip belt, therefore hip movement can be transferred and load control straps reduce movement of the backpack to have better control. There is “net fabric”, which is also used with the other backpacks, but with an on-top open “closing”… so a mesh-back which is open, has air circulation, and includes control straps. […] Normally you need to move your belly backwards so that it is parallel to and along your back. Creating an S-curve so the backpack can take the power of the whole body, and there is better control, stability, and ventilation… so functionality of the backpack model was improved.”—Innovation and Technology Manager

One sports clothing manufacturer supported the creation of incremental innovations by having their own in-house seamstress. This way, they can experiment with the new possible knitting combinations and test its realization shortly after the birth of the idea:

“We have actually an in-house seamstress, so we make a lot of the material ourselves and thereby always try to find out new innovations, materials, and knitting combinations and include new materials to improve the functionality and comfort continuously.”—Product Developer/Product Manager

As an example of an incremental innovation, the Product Developer/Product Manager at the company manufacturing sports clothing completed a material change in touring pants. They got the idea at a fabric fair where the company searches for various vendors. The material seemed decent for the touring pants, and it had received positive feedback:

“We had internal dissatisfaction with the old material, on the one hand in terms of price and on the other hand regarding the performance. In the test processes we noticed that the previous material was not ideal.”—Product Developer/Product Manager

In the ocean sports sector, incremental innovations can relate to technology enhancements, improvements in the manufacturing process, changes in the physical dimensions and shape, or raw material changes. Surfboards generally come with one to five fins. The company provided surfboards with three fins but changed the configuration of the product to have four fins instead. Four fins were considered too specialized or too “fringe” for mass market, but they became popular because of high performance. Thereafter, the company came up with an idea of a surfboard with optional fins—the customer could choose to use the surfboard with three or four fins. The idea came when an in-house member of the NPC team was “thinking out of the box.”

Near analogies aid in improving, fine-tuning, and altering the existing products but do not generate completely new innovations. Incremental innovations are vital in ensuring companies’ sustainable competitive advantage together with more radical innovations.
Medium-far analogies
The empirical results on medium-far analogies are in line with the suggested framework of this study: Companies used mostly medium-far analogies, ideas from a different product category, in order to generate ideas for truly new products. Companies were actively including external informants to extend their knowledge base.

One of the top five alpine clothing brands in the German-speaking market used medium-far analogies for radical innovations. Depending on the project needs, the company also involves additional contributors (e.g. trainees or external service providers) in the product development process for both incremental and radical innovations in order to generate new ideas. Furthermore, the company organizes special creative workshops in order to generate product ideas. One product manager explained how they were searching for ideas for climbing pants with an integrated harness by looking at kite-surfing gear and firefighter pants:

“Kite-surfing, you know? [Company name] and [Company name] were offering pants with integrated lap belts [...]. In principle the same function of the products we were investigating [...]. There are many others, firefighters’ pants, special working pants with some safety functions, and those had already integrated security belts. And also competitors [Competitor’s name] and [Competitor’s name] had similar concepts, low weight belts, which can be inserted flexibly to the pants but no fixed integrated belt.”—Innovation and Technology Manager

Another company provided sports equipment for summer sports such as mountain and road bikes and trekking equipment and for winter sports such as mountain and road bikes. For example, we implement at the moment on the surfboards the printing on the surfboards became more realistic, and the plastic skin with graphics for the surfboard design was initially the monoslide that could turn in such a way was not expected outcome and benefit for the company. Hence, the plastic film added an additional layer of puncture resistance. The interviewee described this as an unexpected outcome and benefit for the company.

Medium analogies help in creating new product ideas by combining an existing product with a new technology, design, or functionality with another context. The companies may find it easier to draw new product ideas from other product categories as the ideas are already sophisticated or detailed enough to be translated into products that are not coming up with a product idea “out of the blue.” The medium-far analogies lead to product ideas with more tangibility as the implementation method or idea used in another context are the key features that are being borrowed.

Far analogies
When far analogies are utilized, the ideas in the NPC process stem from a non-product category (Dunbar, 1997; Dahl and Moreau, 2002; Kalogerakis et al., 2010). This study discovered some indication of their application. The far analogies, as the name indicates, are the most challenging because of the far distance of the knowledge transfer: The idea generator is required to disregard all conventional linkages to new ideas, be open to unorthodox solutions, and able to think entirely outside the box. R&D teams or manufacturers may be confronted by certain complications in the realization of an idea because of the distant analogies’ abstract nature.

The CEO/Founder/Engineer of a company manufacturing skiing equipment for disabled athletes detected the underdevelopment of the business when observing a handicapped acquaintance skiing with a monoski available in the market in the 1980s. The discovery of the market gap led the mechanical engineer to start his own business with the aim of providing more affordable, more functional monoskis for disabled athletes. The product idea was generated by emulating the anatomy and shock absorption capacity of the human knee. Other companies had been designing monoskis, but such a monoslide that could turn in such a way was not available at that time.

“You have to be able to duplicate knee action as close as you can, but at the same time minimize the change of your center of gravity. […] this gives you more like the actual knee, ankle, and hip action of your body.”—CEO/Founder/Engineer

In a similar vein, the invention of the [Name] ski changed the skiing market, later igniting the spark that led to the invention of carving skis, the most popular ski today. Our interviewee, the CEO for a traditional sports equipment company, had not been involved in the truly radical innovations in the ski industry but was knowledgeable...
To translate the ideas to practical, favorable business opportunities, companies need to recognize and implement them with the highest possible consumer and market benefit.”—Innovation and Technology Manager

Recognizing that the ideas need stimuli, the idea generation process often takes place offsite. “Getting outside the four walls” is considered a more fruitful atmosphere for generating new ideas than brainstorming in the office. The ideas for new products were actively searched for by exposing the team to external stimulation and encouraging them to think out of the box.

“You always get inspired. Maybe you ride your bike and you feel something: a cushioning effect for example, or you hold something in your hands like the handle of a vacuum cleaner and you think this is great. […] in our company the components will be then put together.”—Product Manager for Skis and Ski Accessories

The far analogies seem to be the igniting spark for creating a new product and may even lead to entrepreneurship. Far analogies offer potential for new product ideas when there is a need to significantly stand out from the existing products in the market. Two companies in this study were founded because of business ideas originating from a distant analogy, and one using far analogies caused a radical change in the industry leaving the competitors no choice but to follow.

Summary of the analysis toward cognitive ambidexterity in NPC

This study supports the premise that businesses access cognitively distant knowledge in order to generate ideas for truly new products. Companies that were seeking ideas for line extensions or the next generation of an existing product were acquiring the needed ideas from a knowledge base within close proximity.

Incremental innovations are improvements in the manufacturing process, technology, functionality, design, or material and oftentimes were generated as a response to a need after gathering feedback about the product or due to dissatisfaction with the current state of the product. Thus, incremental innovations were a result or an outcome of an external push or a need. Companies were actively doing market research or testing in order to gather feedback on their products and thus were searching for the “push” to change something. Incremental innovations were generated by near analogies—benchmarking being one practical solution used by the companies participating in the study. Benchmarking proves to be effective in routine and redesign tasks but may hinder the creative process of designing radically new and innovative products (Marsh et al., 1999; Ward, 1994; Dahl and Moreau, 2002, Kalogerakis et al., 2010). Thus, it is
suitable only when trying to generate INPs with near analogies.

When there is an urge for companies to create radically new products, they find it easier to draw product ideas from other product categories as the ideas are already sophisticated or detailed enough to be translated to products opposite to far analogies. The medium-far analogies lead to product ideas with more tangibility, as the implementation method or a practical solution has been seen in use in another context. When using medium-far analogies, companies seem to stay within “optimal” cognitive distance (Nooteboom et al., 2007), where the new integrated knowledge is not too distant but not too close either in order to generate some novelty. In our study, the product ideas with medium-far analogies were new functional or technical solutions, but the truly new product ideas with great market impact were generated through far analogies.

Similarly to the findings by Kalogerakis et al. (2010), analogies are frequently applied without formal methods, procedures, techniques, or tools. In our study, this holds true particularly in case of far analogies. Near analogies were often generated using benchmarking technique or observing as the initial tool. Due to their tangibility and use of existing knowledge in another context, also medium-far analogies could clearly be enhanced by having collective brainstorming sessions or creative workshops with experts. In turn, far analogies are more difficult to generate and control as they can emerge from anywhere at any time in a non-structured or non-monitored process. In this study, far analogies were generated through individuals’ experiences; they were not manufactured by the NPC team in-house. In the endeavor to become a market leader, far analogies appear to play a significant role and companies should discover practical steps to make use of them.

Based on prior ambidexterity research, socialization, recognition, team-building practices (Ghoshal and Bartlett, 1997), behavioral integration (Lubatkin et al., 2006), and informal social integration (Jansen et al., 2008) would be of additional help in achieving ambidexterity. In their article, Hülsheger et al. (2009) reviewed three decades of studies regarding team characteristics and team processes and innovation using meta-analysis. Key team process variables, external and internal communication, vision, support for innovation, task orientation, and cohesion were found to be favorable in generating innovations. This aligns with this study’s findings on near and medium-far analogies, which, according to the study results, can be fostered by compiling a heterogeneous team, facilitating frequent communication and brainstorming workshops, maintaining the sense of flat hierarchy, and having permission to speak up. Some companies extended the teams for radical innovations increasing heterogeneity, creativity, and ability for the team members to build on each other’s ideas.

Interviewees described the market especially for skis as challenging with regards to any new radical innovations. In our study, many interviewees were former or active amateur sportsmen with an enormous passion for the sport. Having such expertise is a benefit for knowing the market and having the feel for technology, functionality, and design. Such knowledge may however hinder the creative process and hold back from thinking openly to make use of far or medium-far analogies. Some interviewees were also hesitant or careful to name their innovations as radical (i.e. new to the firm or to the market), even though their products seemed to have the status of a radical innovation based on what was visible on the company websites. Some interviewees described the innovations in the sport industry as “marketing innovations.” This shows that engineers and marketers do not always speak the same language.

In order to facilitate creation of far analogies, companies should generate the conditions or an atmosphere for the NPC team where they are allowed to express their ideas and find ways to transfer those into products. The challenge lies in the fact that the process is difficult to capture; thus, internal conditions play a big role in ensuring that the NPC team does not feel restricted or “locked in” when generating ideas.

In their study of design and engineering companies, Kalogerakis et al. (2010) divided the analogy types, transfers of technological solutions or functional principles as well as transfers of shapes and design arrangements. The ideas for technological solutions or functional principles were mostly drawn using medium-far analogies, whereas the ideas for the shapes and design came through medium-far or far analogies. The interviewees participating in this study operate in sports equipment industry, generally imagined as a technical field where new products are being launched to the market on a seasonal basis. With regards to analogies, the emphasis was on near and medium-far analogies; however, evidence also on far analogies was found. Similarly to Kalogerakis et al. (2010), we found that new product ideas using analogies were technical, functional, design, or shape solutions. However, the technical solutions were mostly generated through near analogies, functional solutions through medium-far, and design and shape solutions through far analogies. For near analogies, the image (marketing), cost savings, or external push for improvements were the main drivers; medium-far analogies aimed at improvements in comfort and durability, and for far analogies, the opportunity to fill a market gap served as the main reasons for using analogical thinking for NPC.

The table in the succeeding texts shows some selected examples of near, medium-far, and far analogies that were discovered in the interviews. The far analogies in our study were not generated by
DISCUSSION AND IMPLICATIONS

Based on a theoretical framework and a qualitative empirical study, the results suggest that analogical thinking is a promising strategy to achieve ambidexterity in NPC. The results show that some companies use both far and medium-far analogies to create truly new or radically new products and near analogies for incrementally new product ideas. The results also provide understanding of the processes and the composition of product development teams that allow for cognitive ambidexterity, the ability to engage in parallel mental processes that are paradoxical or in contradiction.

Concerning analogies, the study finds that near, medium-far, and far analogies are used for different purposes in NPC. Therefore, taking into account that the target of the analogical transfer in this study is always a novel product solution, the base can arise from the same broad product category (near analogy), a different product category (medium-far analogy), or even a non-product category (far analogy). An increasing distance between the source and the target leads to a higher degree of novelty for a new product, that is, the use of far and medium-far analogies assists in the generation of radical product innovations whereas the use of near analogies facilitates the creation of incremental product innovations (Kalogerakis et al., 2010).

From an organizational perspective, being able to create both incremental and radical product ideas and innovations results in a desirable state of ambidexterity in NPC. Therefore, this paper presents analogical thinking as an idea-generating tool in the NPC process resulting in the achievement of ambidexterity. An ambidextrous NPC team focuses on near analogies when the desired outcome of idea generation is incremental. In contrast, the focus lies on medium-far or far analogies if the purpose is to invent radically new products.

From a team perspective, this study found that both intra- and extra-organizational diversity matters for near and medium-far analogies. While stored knowledge in the memory of the design members is accessed when processing an analogy, the set of knowledge is limited, and therefore, the possibility for a creative reassembling by analogies is constrained. Consequently, diversity of knowledge in design teams should be enhanced. This can be carried out by enlarging the specialization

The next chapters explain the implications of the discovered near, medium-far, and far analogies and the limitations of the study and highlight the future research avenues of NPC and analogies.

### Table 2 Selected examples of analogies

<table>
<thead>
<tr>
<th>Near analogy</th>
<th>Medium-far analogy</th>
<th>Far analogy</th>
<th>Realized innovation</th>
</tr>
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<tbody>
<tr>
<td>Backpacks in the market</td>
<td>Backpack with more ergonomic design and functionality</td>
<td>Firefighting pants or kite-surfing pants</td>
<td>Climbing pants with integrated harness</td>
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<tr>
<td>Biking sector</td>
<td>New material for touring pants</td>
<td>Motor race jackets</td>
<td>Lightweight Gore-Tex jackets</td>
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<tr>
<td>Surfboards with different number of fins</td>
<td>Surfboard with optional fins</td>
<td>Plastic film from household goods</td>
<td>Surfboards with better puncture resistance</td>
</tr>
<tr>
<td>Benchmarking biking sector</td>
<td>Transportation bike, better handlebars, tandem mountain bikes, and better driving mechanism for e-bikes</td>
<td>Technology in other industries</td>
<td>Mass production of surfboards through molding process</td>
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of the design team members, for example, by hiring new members according to their potential to contribute knowledge that is missing in the current team (Hargadon and Sutton, 1997; Kalogerakis et al., 2010) or by involving external service providers in the NPC process. The results of this study suggest that the more diverse the NPC team is, the better it can master analogical thinking using near and medium-far analogies in NPC and thus achieve ambidexterity. In addition to benefits of a heterogeneous team, we found that facilitating frequent communication, maintaining the sense of flat hierarchy, and the allowance to speak up and express ideas no matter what position the employee has in the team are important in creating the atmosphere and conditions that positively effect on the birth of analogical linkages.

Also, prior studies have highlighted the importance of diverse teams in creating analogies. According to our results, team diversity is beneficial for far analogies as well but rather at the later stage of the new product development process when the ideas are being translated to concrete products. Idea generation through far analogies seems to be a lengthy process as a whole—also Kalogerakis et al. (2010) found that distance of the analogy is negatively associated with the duration—hence it is not necessarily because of an extensive idea generation period but rather because of necessary extended prototype building and testing phase. Interestingly, the results in this study show not only that the utilization of far analogies is an informal and unstructured process but also that it is not directed to a particular product, is not conscious, and may happen accidentally. Thereby, using them in NPC as a tool to solve practical problems under a certain time pressure may turn out challenging. In the light of the study results, monetary incentives or strict deadlines may not be of help in generating far analogies. Therefore, usage of far analogies requires first the opportunity to appear, not forced or necessarily in the office environment as the results show, and thereafter the knowledge-processing abilities of the company to translate the far analogies into business opportunities within a reasonable timeframe. According to our results, far analogies were not used collectively in the team but alone, despite the company size. Acknowledging that the ideas need stimulus, the idea generation process often takes place offsite. For example, being in the nature is considered a more fruitful atmosphere for generating new ideas than brainstorming in the office. The ideas for new products were actively searched through external stimulation and with the courage to think out of the box. Another method access far analogies was to observe, feel, and see openly. Given the fact that incremental innovations are improvements to the existing products, it is important that the company not only provides (financial and time) resources to facilitate the processes near analogies but also the sufficient means and facilities to practically test the ideas and discover what works best. Incremental ideas generated through near analogies were described as an outcome of a test process and an end result of building sometimes several prototypes. In the interviews, it came out that some companies were, in their minds, targeting solely to radical innovations. Despite this endeavor, they mostly ended up with ideas for incremental improvements. Thus, it is not evident for the companies what kind of analogies they should search for when generating incremental, new, or radical product ideas. Our research shares some new insights on the favorable conditions that assist in knowledge mapping process so that companies know how to find the optimal cognitive distance for different types of product ideas.

Research implications

This study contributes to the literature on organizational ambidexterity by focusing on the phenomenon of cognitive ambidexterity in NPC teams. While organizational ambidexterity literature has suggested that the top management team could be the point of integrating exploitation and exploration logics (Smith and Tushman, 2005), this study provides insights on a team level in an NPC context. In doing this, the study follows a dialectical perspective on innovation management in suggesting the adoption of ambidextrous logic for knowledge processes in NPC at the team level. This follows a suggestion that more research is needed to understand lower levels of analysis for the exploitation-exploration dilemma in organizing innovation (Bledow et al., 2009). In particular, the results of this study support the emerging stream of studies on analogies (Ward, 2004; Kalogerakis et al., 2010; Dahl and Moreau, 2002) or other contextually separated development settings (Elmquist, 2007) in showing how cognitive ambidexterity can be conducted in practice.

These results also contribute to the discussion of cognitive distance (Nooteboom et al., 2007). The study shows that medium-far analogies are more frequent and easily applicable than far analogies, while contributing to more radical product innovation than near analogies. This supports the notions of “optimal” cognitive distance, where the new integrated knowledge is not too distant but not too close either.

The results of this study also propose broader implications for organizing knowledge processes in innovation and new product development activities. It shows the utility of analogies from familiar and from very unfamiliar and unrelated product categories. This finding is in line with suggestions for unfamiliar knowledge searches for
organizational renewal and non-routine change (Tripsas and Gavetti, 2000; Ritala, 2013). Making deliberate usage choices of unfamiliar knowledge in NPC might help organizations break the typically implicit path dependencies and limitations.

Practical implications
The results of this study can provide some support for practitioners on how to achieve ambidexterity in NPC processes. Following the findings of this study, ambidexterity in NPC can be achieved by encouraging the team to implement intensive analogical thinking while generating innovative (product) ideas. Thereby, companies with a rather inexperienced design team should specify the desired outcome (incremental or radical) and act based on whether near, medium-far, or far analogies should be employed to create new products so that an ambidextrous (i.e. sustainable) NPC strategy is accomplished. When companies possess the necessary resources and an efficient mindset to move these innovations to the market, more new products can be created and launched by utilizing analogical thinking in comparison with companies that overemphasize exploitation or exploration (Katila and Ahuja, 2002). The results of this study support these notions for the near and medium-far analogies. The findings from the literature may assist in compiling the optimal NPC team capable of achieving the desired state, ambidexterity. However, when the companies seek for really new product ideas and are ready to challenge their core competences, attempt to reach far analogies in NPC is recommendable. Creating favorable conditions for far analogies may be difficult in a company setting. Far analogies can be utilized by individuals with the capability of accessing cognitively distance knowledge and convert it into a new product idea. In order to capitalize the idea, it needs to be translated to the technical team in a way that they can build the first prototype. This study provides findings that may ignite a spark to conduct further empirical research around these yet unexplored processes.

Limitations and future research
This study can be considered an explorative, qualitative study of a phenomenon that is not very well known. Therefore, it is subject to several limitations that relate to the research design and generalizability, and thus, the results should be interpreted with caution. In particular, the study of the use of analogies in the sports equipment industry and the number of cases/interviewees was limited. Therefore, it might be that the analogies could provide different benefits in other industries or contexts. Also, while this study examined analogies as a tool to facilitate cognitive ambidexterity, there are many feasible methods that NPC teams could use. These include various types of brainstorming and cognitive mapping tools, exposure to external interventions, and separated concept projects (Elmquist, 2007), among others. Future research could go deeper into the variety of cognitive tools and approaches that help exploit and explore knowledge in the NPC context. Further studies on the different characteristics of the individuals who have frequently been able to utilize far analogies in NPC would make a contribution to this emerging research stream.

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