



**Technische Universität München**  
Fakultät für Wirtschaftswissenschaften  
Lehrstuhl für Strategie und Organisation

# **Organization and Innovation: Essays on the Effects of Ambidexterity and Open Innovation on Innovation Performance**

**Sebastian Otto Paul Kobarg**

Vollständiger Abdruck der von der Fakultät für Wirtschaftswissenschaften der Technischen Universität München zur Erlangung des akademischen Grades eines Doktors der Wirtschaftswissenschaften (Dr. rer. pol.) genehmigten Dissertation.

Vorsitzender: Univ.-Prof. Dr. Dr. Holger Patzelt  
Prüfende der Dissertation: 1. Univ.-Prof. Dr. Isabell M. Welpel  
2. Univ.-Prof. Dr. Claudia Peus

Die Dissertation wurde am 16.10.2017 bei der Technischen Universität München eingereicht und durch die Fakultät für Wirtschaftswissenschaften am 15.01.2018 angenommen.

## **Acknowledgements**

In writing this dissertation, I have received exceptional academic and personal support from many individuals. I wish to extend my sincere gratitude to Prof. Dr. Isabell M. Welpe, who supervised my dissertation at the Technical University of Munich. Her challenging advice continuously stimulated me to strongly focus on academic relevance while bearing in mind the bigger picture. Thank you for the opportunities you provided and the outright support throughout this dissertation. Furthermore, I wish to express my deepest gratitude to Prof. Dr. Jutta Stumpf-Wollersheim, who supervised me in the course of this dissertation. The research contained in this dissertation and my personal development profoundly benefitted from her structured approach and exceptional attention to detail. Her encouragement and advice in writing this dissertation were invaluable. Thank you for your guidance and untiring support.

Further, I want to thank Prof. Dr. Matthias Spörrle for his excellent methodological advice, and all colleagues at the Chair for Strategy and Organization for providing constructive feedback and practical advice countless times. Moreover, I am grateful to the faculty of the TUM School of Management for the knowledge and insights they provided in multiple courses I had the pleasure to attend as part of the qualification program of the TUM Graduate School. I want to especially thank Prof. Dr. Claudia Peus for acting as the second examiner, and Prof. Dr. Dr. Holger Patzelt for chairing the examination board for this dissertation.

Finally, I want to wholeheartedly thank my family and friends, especially my parents Christine and Bernd, for the ongoing and unconditional understanding, support, and encouragement which I have received while writing this dissertation. I could not have done it without you.

## **Abstract**

This dissertation investigates the role of ambidexterity and open innovation for innovation performance, adopting a contingency view. Although both concepts have received considerable scholarly interest and found wide application in practice, important moderating effects and contingency factors have not been the subject of a thorough examination. The essays contained in this dissertation build on the conceptual findings from the ambidexterity and open innovation literature and draw from the knowledge- and resource-based views of the firm as well as organizational learning theory. The essays employ econometric study designs to provide an empirical investigation of the phenomena with a focus on relevant contingencies and moderators. First, regarding ambidexterity, one study finds first evidence for the existence of a positive effect of individual ambidexterity on innovation performance and identifies organizational moderators of this relationship. Specifically, being set in the academic context, Essay I finds a negative moderating effect of the supervisory ratio on the individual ambidexterity–performance relationship. Second, a study investigating university–industry collaboration identifies a dichotomous role of the absorptive capacity in this context. While employee absorptive capacity positively moderates the emergence of radical innovation in such collaborations, absorptive capacity negatively moderates the emergence of incremental innovation performance. Absorptive capacity can hence be regarded as having either a beneficial or substituting effect in collaborative innovation settings, contingent on the type of innovation in focus. Third, another study investigates the effect of innovation collaboration with different types of partners on the emergence of ecological innovation within firms. Building on the considerations of the open eco-innovation mode and the general open innovation literature, this study finds that, while collaboration with end users is beneficial to the emergence of ecological process and ecological product innovation, collaboration with business customers and competitors is associated with lower levels of ecological process

innovation. Collaboration with universities and research institutions as well as with suppliers is associated with higher ecological process, but not product innovation. Fourth, a further study examines the relationship between the extent of collaboration (breadth and depth) in innovation projects and project innovation performance. The results suggest that this relationship follows an inverted U-shape, that it is highly sensitive to excessive collaboration, and that it differs considerably in shape and magnitude from those relationships detected by previous studies at the firm or business unit level.

The individual studies contribute to specific areas of interest within the ambidexterity and open innovation literature, and provide meaningful guidance to practitioners concerned with the generation of innovation. Above all, the results of this dissertation are supportive of a contingency view of ambidexterity and open innovation in the context of innovation performance. While both concepts have the potential to further the emergence of innovation, they are subject to considerable moderating effects and contingency factors residing within the type of pursued innovation, innovation partner type, organizational level, and organizational prerequisites. Based on the individual findings and this general conjecture, this dissertation derives implications for literature and practice and provides recommendations for future research.

## Deutsche Kurzfassung (German Abstract)

Die vorliegende Dissertation untersucht den Einfluss von „*Ambidexterity*“ und „*Open Innovation*“ auf die Innovationsperformance von Organisationen unter Einnahme einer Kontingenzzperspektive, in welcher der Einfluss situativer und kontextueller Moderatoren und Bedingtheiten auf die Beziehung zwischen den Konzepten und der Innovationsperformance Berücksichtigung findet. Obwohl beide Konzepte große Aufmerksamkeit in der Literatur und eine weitreichende Implementierung in der Praxis erfahren haben, wurden wichtige Moderationseffekte und situative Bedingtheiten in diesem Zusammenhang bisher nicht tiefgreifend untersucht. Aufbauend auf dem aktuellen Stand der *Ambidexterity*- und *Open Innovation* Literatur, und unter Verwendung von Erklärungsansätzen aus der wissensbasierten Unternehmenssicht, aus der Ressourcentheorie, und aus der Theorie zu organisationalem Lernen verwenden die Studien dieser Dissertation ökonomische Ansätze um eine empirische Untersuchung beider Konzepte unter Berücksichtigung relevanter Moderatoren und Bedingtheiten durchzuführen. Die Ergebnisse dieser Dissertation unterstützen einerseits das große Potential beider Konzepte zur Steigerung der Innovationsperformance, unterstreichen andererseits aber auch die Wichtigkeit der Berücksichtigung dieser Bedingtheiten in der Erforschung und praktischen Implementierung beider Konzepte. Die Ergebnisse sprechen daher für eine Abkehr von der vorherrschenden, übermäßig positiven Beurteilung beider Konzepte in diesem Zusammenhang.

Die einzelnen Studien dieser Dissertation kamen im Detail zu den folgenden Ergebnissen: Erstens, in Bezug auf *Ambidexterity*, zeigt Studie I in einem universitären Kontext einen positiven Zusammenhang zwischen individueller Ambidextrie und individueller Performance und identifiziert gleichzeitig das Betreuungsverhältnis als einen wichtigen, negativen Moderator dieser Beziehung. Zweitens, und in Bezug auf *Open Innovation*, zeigt Studie II einen zweiseitigen Effekt von *Absorptive Capacity* und

Innovationskompetenzen auf die Fähigkeit von Unternehmen im Rahmen von Innovationskollaborationen mit Universitäten und Forschungseinrichtungen ihre Innovationsperformance zu steigern. Während *Absorptive Capacity* der Mitarbeiter einen positiven Moderationseffekt auf die Schaffung von radikaler Innovation hat, zeigt die Studie einen negativen Moderationseffekt von *Absorptive Capacity* auf die Schaffung inkrementeller Innovation. Dementsprechend kann *Absorptive Capacity* im Kontext von *Open Innovation*, abhängig der zugrundeliegenden Innovationstypologie, entweder einen positiven Effekt oder einen negativen Substitutionseffekt ausüben. Drittens untersucht eine weitere Studie den Effekt von Innovationskollaborationen mit verschiedenen Partnertypen auf die Generierung ökologischer Innovationen. Diese Studie zeigt, dass Kollaboration mit Produktnutzern förderlich für ökologische Prozess- und Produktinnovation ist, wohingegen die Kollaboration mit Geschäftskunden und Wettbewerbern mit einer geringeren ökologischen Prozessinnovation assoziiert ist. Kollaboration mit Hochschulen und öffentlichen Forschungseinrichtungen ist mit größerer ökologischer Prozess-, aber nicht Produktinnovation assoziiert. Viertens zeigt eine weitere Studie, dass die Beziehung zwischen Kollaborationsumfang (Breite und Tiefe) auf Projektebene und der Innovationsperformance des Projekts konkav verläuft, und dabei hochsensitiv gegenüber einem zu großen Kollaborationsumfang ist. Die Beziehung unterscheidet sich daher deutlich in Form und Größenordnung von den auf der Ebene von Gesamtunternehmen in früheren Studien identifizierten Beziehungen. Als wahrscheinliche Ursache für diese Sensitivität erarbeitet die Studie das Vorhandensein von vergleichsweise weniger Ressourcen sowie eines vergleichsweise stärkeren technologischen Fokus auf Projektebene.

Die einzelnen Studien dieser Dissertation tragen zum Verständnis auf spezifischen Interessengebieten der Ambidextrie- und Open Innovation Forschung bei, und geben wertvolle Hinweise für Praktiker, insbesondere Innovationsmanager. Insgesamt unterstützen die Ergebnisse die Einnahmen einer Kontingenzzperspektive gegenüber beiden Konzepten.

Während beide Konzepte einen substantiellen Beitrag zur Steigerung der Innovationsperformance von Organisationen beitragen können, unterliegen die Beziehungen zwischen beiden Konzepten und der Innovationsperformance kontextuellen und organisationalen Bedingtheiten, die deren Effektivität deutlich beeinflussen. Basierend auf diesen Erkenntnissen erarbeitet diese Dissertation Implikationen für Theorie und Praxis sowie Empfehlungen für zukünftige Forschung.

## Table of Contents

Acknowledgements .....	I
Abstract .....	II
Deutsche Kurzfassung (German Abstract).....	IV
Table of Contents .....	VII
List of Abbreviations.....	VIII
1 Introduction.....	1
1.1 Motivation and Research Questions .....	1
1.2 Theoretical Background .....	9
1.2.1 Ambidexterity.....	9
1.2.2 The Open Innovation Paradigm .....	11
1.3 Methodology and Data Sources.....	13
1.4 Structure, Contribution, and Main Results .....	16
2 Individual Ambidexterity and Performance in the Public Sector: A Multilevel Analysis	19
3 University-Industry Collaborations and Product Innovation Performance: The Moderating Effects of Absorptive Capacity and Innovation Competencies.....	20
4 Green Together? The Effects of Companies' Innovation Collaboration with Different Partner Types on Ecological Process and Product Innovation.....	21
5 More Is Not Always Better: Effects of Collaboration Breadth and Depth on Radical and Incremental Innovation Performance at the Project Level.....	22
6 Conclusion and Discussion .....	23
6.1 Discussion of Main Findings and Contributions .....	23
6.2 Implications for Practice.....	26
6.3 Limitations and Directions for Future Research.....	27
7 References.....	30
Appendix .....	45



## List of Abbreviations

$\beta$  – beta, regression coefficient

cf. – confer

doi – digital object identifier

CFA – confirmatory factor analysis

CHE – Centrum für Hochschulentwicklung

CIS – Community Innovation Survey

CI – confidence interval

d.f. – degrees of freedom

Ed. – editor

e.g. – exempli gratia

EI – ecological innovation

et al. – et alii

HLM – hierarchical linear modelling

ICC – intra-class correlation coefficient

i.e. – id est

IT – information technology

LLCI – lower-level confidence interval

$M$  – mean

MIN – minimum of variable

MIP – Mannheimer Innovationspanel

MAX – maximum of variable

$N$  – number of participants or observations in sample

ns – not significant

OI – open innovation

---

p. – page

$r$  – correlation coefficient

R&D – research and development

$SD$  – standard deviation

$SE$  – standard error

UIC – university-industry collaboration

VIF – variance inflation factor

$\chi^2$  – Chi-Square statistic

ZEW – Zentrum für Europäische Wirtschaftsforschung

# 1 Introduction<sup>1</sup>

## 1.1 Motivation and Research Questions

Innovation is a central constituent of organizations' performance, competitive advantage, and longevity (Ahlstrom, 2010; Baumol, 2002; Christensen, 1997; Schumpeter, 1934). Increasing market dynamism, the rising economic importance of knowledge, and the growing prevalence of knowledge-intensive organizations further emphasize the paramount importance of innovation (Alvesson, 2004; Anand et al., 2007; Grant, 1996). Given this preeminent importance of innovation, it is not surprising that the management and organization literature has long been concerned with answering the question of how to facilitate and further the emergence of innovation and, consequently, how to improve innovation performance (e.g., Abernathy and Clark, 1985; Benner and Tushman, 2003; Tushman and Nadler, 1986). In the search for organizational measures that further the ability of organizations to innovate, two concepts have received particular scientific and practical attention: organizational ambidexterity (Benner and Tushman, 2015; Gibson and Birkinshaw, 2004; Raisch et al., 2009) and open innovation (Chesbrough, 2003). The conceptual and practical salience of ambidexterity and open innovation is founded on the substantial assumption that "*fundamental mechanisms and locus of innovation have shifted over the past decade*" (Benner and Tushman, 2015, p. 6). This fundamental change is primarily engendered by (1) the increasing need for organizations to generate complex, radical innovations while at the same time leveraging efficiency of existing products and processes (Benner and Tushman, 2003; Christensen, 1997) and (2) by the loci of innovation shifting from being rooted strictly within organizational boundaries to being dispersed between a wide set of actors and organizations, both within and outside the boundaries of the firm (Chesbrough et al., 2006a;

---

<sup>1</sup> This section is partially based on Kobarg, Wollersheim, Welpel (2015), Kobarg, Stumpf-Wollersheim, Welpel (2017, forthcoming), Kobarg, Stumpf-Wollersheim, Welpel (under review), and Kobarg, Stumpf-Wollersheim, Welpel (under review)

Chesbrough, 2003; Von Hippel, 1994). Following these fundamental changes, the past decade saw a paradigm shift in the way we think about organizational processes related to innovation (Baldwin and Hippel, 2011; Benner and Tushman, 2015), giving rise to the importance of concepts such as ambidexterity and open innovation.

Ambidexterity, the ability of organizations to be “*aligned and efficient in their management of today’s business demands, while also adaptive enough to changes in the environment*” (Gibson and Birkinshaw, 2004, p. 209), requires organizations to simultaneously pursue exploitative and explorative activities (Duncan, 1976; March, 1991; Tushman and O Reilly, 1996). The joint pursuit of both types of activities has long been regarded as contradictory and unachievable (Miller and Friesen, 1986; Raisch and Birkinshaw, 2008). Following the notion of paradoxical thinking (Eisenhardt, 2000), research showed that structural segmentation between exploitative and explorative organizational units (Adler et al., 1999; Duncan, 1976) and contextual sequencing within the same unit or individual (Gibson and Birkinshaw, 2004) can enable ambidexterity. Research in the last decade investigated the performance effects of ambidexterity and found that ambidexterity is positively associated with various measures of firm performance (Birkinshaw and Gibson, 2004; He and Wong, 2004; Lubatkin et al., 2006; Raisch and Birkinshaw, 2008). Moreover, exploitation, exploration, and their balancing through ambidexterity are directly linked with the emergence of innovation and firms’ ability to innovate (Adler et al., 1999; Ancona et al., 2001; Atuahene-Gima, 2005; Benner and Tushman, 2003; Rothaermel and Alexandre, 2009; Smith and Tushman, 2005). As a consequence, ambidexterity has become “*a hot topic in research on organizations*” (Birkinshaw and Gupta, 2013, p. 287) that continues to attract considerable attention from scholars and practitioners concerned with innovation (Benner and Tushman, 2015).

Open innovation was recently re-defined as “*a distributed innovation process based on purposively managed knowledge flows across organizational boundaries*” (Chesbrough

and Bogers, 2014, p. 17). Under the open innovation paradigm, the locus of innovation with relation to an organization's boundaries becomes increasingly indistinct, and firms are argued to enable an increase in their innovative capability by actively identifying and managing these boundary-spanning innovation activities through the use of externally acquired knowledge, processes, and resources (Chesbrough et al., 2006a; Chesbrough, 2003). Based on this general conjecture, research has focused on the advantageous aspects of open innovation for a long time and reached the general consensus of there being a positive association between open innovation activities and measures of innovation performance (Almirall and Casadesus-Masanell, 2010; Belderbos et al., 2004; Ghisetti et al., 2015; Laursen and Salter, 2006; Leiponen and Helfat, 2010). As a consequence of the scientific inquiry and resulting implications, the managerial paradigm of open innovation is widely established in industrial practice (Bogers et al., 2017; Vanhaverbeke et al., 2014a; West et al., 2014) and open innovation *"has become one of the hottest topics in innovation management"* (Huizingh, 2011, p. 2)

In over a decade of extensive research, the literature has engendered a profound conceptual and empirical understanding of the fundamental performance effects of ambidexterity and open innovation. Both concepts are widely regarded as being beneficial to innovation performance, and these implications caused their widespread awareness and implementation in practice (cf. O'Reilly and Tushman, 2013; Vanhaverbeke et al., 2014a; West et al., 2014). However, despite extensive research and high practical relevance, our knowledge of the performance effects of both concepts is still limited in several important ways. Specifically, our knowledge is severely limited with regard to the moderating and mediating contingency factors and contextual boundary conditions of both concepts' effects on innovation performance (Bogers et al., 2017; Huizingh, 2011; O'Reilly and Tushman, 2013; Raisch et al., 2009; West et al., 2014).

Our understanding of the performance effects of ambidexterity suffers from the limitation of previous studies to analyses at the level of firms, business units, and teams in a corporate context. First, this limitation restricts our understanding of ambidexterity on the smallest organizational level, namely, the individual level. The ability of individuals to exhibit ambidexterity is subject to considerable dissent in the literature (e.g. Gibson and Birkinshaw, 2004; Gupta et al., 2006), and there is no empirical evidence of a potential impact of individual ambidexterity on individual performance. This research gap is regrettable, as knowledge on the presence and size of such effects could be highly beneficial because of the importance of individuals in knowledge-intensive organizations. Creating such knowledge would extend our understanding of ambidexterity to the important individual level and enable us to provide recommendations to practice regarding the effects of individual ambidexterity and how organizations could enhance and use the ambidexterity of its members as well as how environmental factors influence this relationship. Second, and closely related to the need for an improved understanding of individual ambidexterity, is the necessity to develop a multilevel understanding of organizational ambidexterity (O'Reilly and Tushman, 2013; Raisch et al., 2009; Simsek, 2009). Ambidexterity is argued to likely permeate through an organization, and its antecedents are also likely rooted within the broader organizational context (Birkinshaw and Gupta, 2013; Jansen et al., 2012). These findings sparked the conjecture that the organizational context is an enabler of ambidexterity and that *“organizational mechanisms may be required to enable ambidexterity at the individual level”* (Raisch et al., 2009, p. 686)—a conjecture that, however, remains untested in the literature. Gupta et al. (2006) and Simsek (2009) propose that this gap in our knowledge could be mitigated by *“integrative models spanning multiple levels of analysis”* (Simsek, 2009, p. 598). Third, ambidexterity research has been widely limited to the corporate realm, and knowledge on its effects in other areas, such as the public realm, is scarce, even though

*“ambidexterity research has the opportunity to provide novel insights to research problems in other areas”* (Birkinshaw and Gupta, 2013, p. 9). Against this background, the goal of this dissertation is to address these research gaps in the ambidexterity literature by answering the following research questions:

- (1) What are the performance effects of individual ambidexterity? How do organizational factors moderate the relationship between individual ambidexterity and individual performance? What are the effects of ambidexterity in the public domain?

Since the publication of the seminal work of Chesbrough (2003), open innovation, recently defined as *“a distributed innovation process based on purposively managed knowledge flows across organizational boundaries”* (Chesbrough and Bogers, 2014, p. 17), has had a tremendous impact on innovation research, practice, and policy (Bogers et al., 2017; West et al., 2014). Open innovation research established a broad consensus on the general relevance of open innovation for firms’ present-day innovation activities. However, while being primarily concerned with the benefits of open innovation, research continues to produce inconsistent results with regard to the performance effect of open innovation activities (Tsai, 2009; Vanhaverbeke et al., 2014a; Vanhaverbeke et al., 2014b). At the same time, relatively little is known about the boundary conditions, contextual contingencies, and moderators of open innovation activities (Bogers et al., 2017; Enkel et al., 2009; West and Bogers, 2014; West et al., 2014). In consequence, one can argue that our lack of understanding of contingencies and moderators serves as a potential explanation for inconsistent results (Chesbrough and Bogers, 2014; Vanhaverbeke et al., 2014b). As one *“would expect that the mechanisms and outcomes of open innovation models would also be sensitive to the context in which they are analyzed”* (Vanhaverbeke et al., 2014a, p. 282) and *“research that identifies moderators of the benefits of external innovation is scarce”* (West and Bogers, 2014, p. 827), the research community recently and repeatedly voiced the need *“to shift from a debate [...]*

*about the benefits of open innovation towards an analysis that identifies the mediators and moderators of such benefits*” (Vanhaverbeke et al., 2014a, p. 282) and the “*need for a contingency perspective*” (Bogers et al., 2017, p. 6) in future open innovation research.

Our current lack of such an understanding manifests itself in three salient research gaps. First, while there are considerable “*ties between open innovation and research on absorptive capacity*” (West et al., 2014, p. 808), it is unclear whether absorptive capacity amplifies the potential positive effects of inbound open innovation (Fabrizio, 2009; Rothaermel and Alexandre, 2009; Spithoven et al., 2011; Zahra and George, 2002) or whether it engenders a substitution effect (Leonard-Barton, 1992; Ritala and Hurmelinna-Laukkanen, 2013; West and Bogers, 2014). Absorptive capacity arguably plays a pronounced role in the context of university–industry collaboration, a common form of open innovation (Perkmann et al., 2013; Perkmann and Walsh, 2007). In this context, the differences in culture between innovation partners (Agrawal, 2001; Estrada et al., 2016), the complexity of the knowledge to be transferred (Perkmann et al., 2011), and the resulting low ease of learning (Bruneel et al., 2010; Lane et al., 2006) provide a strong indication that the absorptive capacity of the focal firm contributes to explaining the variance of the performance effect of open innovation. However, no study so far has adapted such a contingency perspective and investigated if and how absorptive capacity and innovation competencies moderate the relationship between university–industry collaboration and innovation performance. This omission gives rise to a further research question to be addressed in this dissertation:

- (2) How does absorptive capacity moderate the relationship between university–industry collaboration and incremental and radical innovation performance?

Second, investigations of the performance effects of open innovation were mostly conducted at the level of entire organizations, firms, and business units (Belderbos et al., 2004; Laursen and Salter, 2006; van Beers and Zand, 2014). However, “*neither the practice of nor research on open innovation are limited to the level of the firm*” and “*the subfirm level*



*of analysis is particularly salient in understanding the sources of innovation*” (Chesbrough et al., 2006b, p. 287). Despite this early call for open innovation research below the firm level of analysis, the literature has widely neglected these levels of analysis (Bogers et al., 2017; Vanhaverbeke et al., 2014b; West et al., 2014). As innovation projects are increasingly regarded as the locus of innovation strategy implementation and innovation performance (Dodgson et al., 2008; Kim et al., 2015; Shenhar and Dvir, 2013; Sydow et al., 2004), it is plausible to assume that an aggregation of measurement at the firm level—treating innovation projects as a black box—can lead to a loss of information and has the potential to mask variance in an investigation of the performance effects of open innovation (cf. Du et al., 2014; Vanhaverbeke et al., 2014b). As such, the project level appears as to be a highly pertinent level of analysis for an investigation of the performance effects of open innovation activity. At the same time, because of the resource constraints and narrow technological focus of innovation projects (Du et al., 2014; Pinto and Prescott, 1988), open innovation research at the project level arguably necessitates the adoption of a contingency perspective of open innovation that takes into account potentially diminishing returns from high levels of openness (cf. Dyer and Singh, 1998; Hottenrott and Lopes-Bento, 2016; Katila and Ahuja, 2002; Salge et al., 2013). Such a contingency perspective is conducive to observing open innovation through the lens of a portfolio approach (Faems et al., 2005), in which the breadth and depth of open innovation activities are the primary constituents of openness and open innovation activities (Katila and Ahuja, 2002; Laursen and Salter, 2006). Against this background, a further research question to be answered by this dissertation arises:

- (3) What are the performance effects of the breadth and depth of open innovation on innovation performance at the project level?

Last, innovation research is often characterized by a differentiation between different typologies of innovation, e.g., incremental, radical, and architectural innovation (cf. Ettlie et

al., 1984; Garcia and Calantone, 2002; McDermott and O'Connor, 2002). This differentiation has been valuable in research on open innovation, as the performance effects of open innovation have been shown to be contingent on the extent of radicalness of the underlying innovations (cf. Laursen and Salter, 2006; Tsai, 2009; van Beers and Zand, 2014). While existing open innovation research differentiates between different typologies of technological product innovation, other types of innovation, such as ecological innovation, have been less prominently investigated. As ecological innovation, i.e., “*new or modified processes, techniques, practices, systems, and products to avoid or reduce environmental harms*” (Beise and Rennings, 2005, p. 6), garners increasing importance for organizations as a source of competitive advantage (Ambec et al., 2013; Ghisetti and Rennings, 2014; Porter and Van der Linde, 1995) while being primarily driven by incentives and technological trajectories outside the core competencies of firms (Horbach et al., 2013; Rennings and Rammer, 2009), an investigation of the effects of open innovation on the emergence of ecological innovation appears to be highly relevant and promising. The literature recently identified open innovation as a driver of ecological innovation (De Marchi, 2012; Horbach et al., 2013) and established the “*open eco-innovation mode*” (Ghisetti et al., 2015). While these findings emphasize the importance of innovation collaboration for the creation of ecological innovation and its impact on firms’ ecological innovation performance, they do not enable us to draw conclusions regarding a highly plausible, differential effect (Belderbos et al., 2006; Tsai and Hsieh, 2009) and thus to answer the central question of what impact innovation collaboration with different partner types has on the emergence of specific forms of ecological innovation. This research gap gives rise to the following research question, which this dissertation seeks to answer:

- (4) How do open innovation activities with different types of partners influence the emergence of different types of ecological innovation?

## 1.2 Theoretical Background

Ambidexterity and open innovation are widely regarded as paradigms or managerial concepts. As such, they draw from theoretical and conceptual frameworks in the fields of organization studies, management theory, and innovation research rather than representing a fully encapsulated theoretical framework. Both concepts draw their conceptual foundation from the knowledge-based view of the firm (Grant and Baden-Fuller, 1995), resource-based view of the firm (Mowery et al., 1998; Penrose, 1959), and organizational learning (Argote and Miron-Spektor, 2011; Cohen and Levinthal, 1990; Dewar and Dutton, 1986; Levinthal and March, 1993). The following sections provide an overview of the theoretical and conceptual foundation of the essays in this dissertation.

### 1.2.1 Ambidexterity

The concept of ambidexterity is founded on the insight of organizational studies that, for long-term survival and success, organizations need to constantly re-align themselves to changing technological and socio-economical environments (Burns and Stalker, 1961; Schumpeter, 1934) and at the same time be aligned and efficient in their ongoing operations (Adler et al., 1999; Thompson, 1967). Closely linking this trade-off to organizational learning, in his seminal work, March (1991) condensed this challenge to “*the basic problem confronting an organization is to engage in sufficient exploitation to ensure its current viability and, at the same time, devote enough energy to exploration to ensure its future viability*” (March, 1991, p. 105). Exploitation and exploration have long been regarded as discrete and contradictory, and their mutual pursuit is assumed to be associated with insurmountable challenges for organizations, thus requiring organizations to focus on either one or the other (Burns and Stalker, 1961; Denison et al., 1995; Miller and Friesen, 1986), and described as a core “*paradox of administration*” (Thompson, 1967, p. 15). Following the work of March (1991) and Levinthal and March (1993) and the adoption of paradoxical thinking in management research (e.g., Andriopoulos and Lewis, 2009; Eisenhardt, 2000),

management research shifted towards investigating how organizations could be enabled to balance the conflicting requirements of exploitation and exploration (Adler et al., 1999; Katila and Ahuja, 2002). These efforts included further theoretical development and the first empirical tests of the ambidexterity concept (Benner and Tushman, 2003; He and Wong, 2004; Tushman and O Reilly, 1996) and shared the conjecture that ambidexterity is conducive to firm longevity and performance. Manifold empirical tests largely confirm this hypothesis with regard to various dimensions of performance, including but not limited to innovation performance (Burgers et al., 2009; Gibson and Birkinshaw, 2004; He and Wong, 2004; Rothaermel and Alexandre, 2009; Uotila et al., 2009).

In principle, the simultaneous pursuit of exploitation and exploration by organizations can be enabled by two primary means: First, from the standpoint of organizational design, by sequentially ordering both activities or the creation of dual structures within organizations (Duncan, 1976; Tushman and O Reilly, 1996), ensuring that both types of tasks are carried out by dedicated organizational units. Second, and more recently, the literature proposed that exploitation and exploration could be contextually balanced (Gibson and Birkinshaw, 2004). Such contextual balancing is enabled by the organizational context within individual units that allows individuals or sub-groups to independently determine how to divide their attention between exploitation and exploration (Gibson and Birkinshaw, 2004; Lubatkin et al., 2006). Thus, contextual ambidexterity builds on the conjecture of the paradoxical thinking of individuals and emphasizes the importance of environmental contexts and leadership behavior conducive to ambidexterity (Andriopoulos and Lewis, 2009; Jansen et al., 2008; Lubatkin et al., 2006; Raisch et al., 2009; Smith and Tushman, 2005). However, the ability of individuals to be ambidextrous has been questioned because of the fundamentally different cognitive patterns that are associated with exploitation and exploration (Amabile, 1996; Audia et al., 2000; Gupta et al., 2006) and limited (cognitive) resources available at this level. In line with this reasoning, there are indications that the performance effects of ambidexterity diminish as

the unit of observation becomes smaller (Junni et al., 2013). Conversely, other research affirms the existence and positive performance effects of individual ambidexterity (Mom et al., 2007; Mom et al., 2009; Raisch et al., 2009), while not testing the ambidexterity–performance relationship empirically at the individual level. As such, a central pillar within the concept of contextual ambidexterity, namely, the ambidexterity of individuals, remains relatively under-researched.

### 1.2.2 The Open Innovation Paradigm

The literature considers open innovation primarily as a paradigm, managerial practice, and field of research rather than an independent theory. The shift from a closed, hierarchical, and control-oriented innovation paradigm (Chandler, 1977; Thompson, 1967) to the open innovation paradigm (Chesbrough et al., 2006a; Chesbrough, 2003) is founded on the notion that *“the assets necessary for creating innovation will not necessarily be collocated with those for commercializing them”* and seeks *“to explain why firms should commercialize external sources of innovation”* (West and Bogers, 2014, p. 815). Following the seminal work of Chesbrough (2003), open innovation was regarded as the use of purposive in- and outflows of knowledge and spillovers. After a decade of research and the development of a more active understanding of open innovation, it was recently redefined as *“a distributed innovation process based on purposively managed knowledge flows across organizational boundaries”* (Chesbrough and Bogers, 2014, p. 17).

The relevance of and increasing dependency on external sources for innovation is primarily caused by increasing market dynamism and globalization, higher modularization of products and services, and ever-decreasing communication and computation cost (Altman et al., 2014; Baldwin and Hippel, 2011; Baldwin and Clark, 2000; Benner and Tushman, 2015; Teece, 2014). Hence, open innovation can be regarded as a paradigm that is induced by changing market and technological environment conditions. Consequently, open innovation was, at its onset, not built upon a strong theoretical foundation and did not immediately

contribute to theory building. However, as the concept developed, several works viewed open innovation through the lens of established theoretical concepts from the organization and management sciences. Three conceptual channels were particularly salient in these efforts: First, from the knowledge-based view, open innovation is associated with the acquisition of knowledge and information not present within the firm (Chesbrough, 2003; Grant and Baden-Fuller, 1995). External knowledge ranges from information about customer demands and market needs to specialized technological knowledge and competencies (Belderbos et al., 2006; Tödtling et al., 2009; Von Hippel, 1994). Such external knowledge, made available through collaboration, extends the knowledge base that is available for knowledge recombination, which is a central driver of innovation (Conner and Prahalad, 1996; Sood and Tellis, 2005). Second, from an organizational learning perspective (Argote and Miron-Spektor, 2011; Cohen and Levinthal, 1990), collaboration allows firms to learn skills related to technology and the innovation process itself (van Beers and Zand, 2014). Acquired skills can be explicit or tacit (Ahuja, 2000), and learning can be direct or indirect, through an increase in absorptive capacity (Cohen and Levinthal, 1990). Third, from the stance of the resource-based view of the firm (Penrose, 1959; Wernerfelt, 1984), innovation collaboration allows firms to pool resources between the partners (Miotti and Sachwald, 2003; Mowery et al., 1998), share risk in uncertain technological environments (Belderbos et al., 2004; Das and Teng, 2000), and access complementary assets (Faems et al., 2005; Teece, 1986).

While there is a clear theoretical and practical distinction between open innovation and the mere outsourcing of innovation and R&D activities for cost reductions (Chesbrough and Crowther, 2006), the activities subsumed under the open innovation paradigm are manifold and less clearly differentiated. Generally, open innovation activities can be classified along two dimensions: (1) the degree of formalization and (2) directionality of the knowledge transfer. With regard to the former, open innovation activities can range from informal verbal exchange of information between members of the organization to highly formalized

contractual relationships (Laursen and Salter, 2014; Mina et al., 2014). More formal relationships in this context are associated with a greater transfer of knowledge and thus a greater potential for risk and reward from open innovation activities (West et al., 2014). With regard to the latter, the synthesis of Enkel et al. (2009) allows for the differentiation between three directionalities: first, the outside-in process, in which the company's internal knowledge is enhanced by the knowledge of external sources, such as suppliers, customers, competitors, and research organizations; second, the inside-out process, in which internal knowledge is commercialized by transferring and multiplying it in the external environment through licensing, spin-offs, and joint ventures; and third, the coupled process, which is characterized by a bi- or multilateral knowledge transfer and represents a combination of the outside-in and the inside-out processes (Enkel et al., 2009; Piller and West, 2014). Given this wide range of conceptualizations of open innovation, the need for a consistent understanding and definition of the concept, and the relationship between the potential from open innovation and its degree of formalization, this dissertation adopts an understanding of open innovation as *innovation collaboration*. Innovation collaboration is considered by this dissertation as a coupled process, i.e., “*co-creation with (mainly) complementary partners through alliances, cooperation, and joint ventures during which give and take are crucial for success*” (Enkel et al., 2009, p. 313). This understanding is consistent with multilateral innovation activities, a relatively high degree of formalization, and active participation of all partners in the innovation process.

### **1.3 Methodology and Data Sources**

The essays contained in this dissertation follow a methodological approach that can be described as empirically quantitative, econometric, and survey-based.

Data collection by means of field research in the form of surveys offers the primary advantage of a comparably high external validity. Findings derived from primarily large-scale, cross-organizational, and cross-sectoral populations allow for large comparability, generalizability, and transferability. In the context of this dissertation, the advantages of this

approach are especially pronounced: An overarching goal of all essays is the investigation of contextual moderators and factors pertaining to organizational and environmental influences. Thus, the ability to analyze the influence of environmental and organizational (control) variables as enabled by data gathered by means of large-scale surveys is crucial to answer the research questions addressed by this dissertation. This would not be possible in other study designs, such as experimental research. However, a considerable disadvantage of a survey-based study design is the reduced internal validity, which reduces the ability to draw inferences regarding the causality of observed effects. Despite employing several econometric tools that increase the validity of causal inferences, this factor remains a primary caveat when interpreting the results of this dissertation.

The data used in this dissertation were collected through two different types of surveys. Essay I contains a unique data set of 2,225 doctoral and post-doctoral students at German business and economics faculties collected in 2012. This dataset is complemented with secondary data for the organizational level available from the *Center for Higher Education*. Essays II through IV use data collected from several editions of the *Mannheimer Innovationspanel* (MIP), which represents the German contribution to the Community Innovation Survey (CIS). The MIP is commissioned by the *German Federal Ministry of Education and Research*, and the data are available from the *Zentrum für Europäische Wirtschaftsforschung*. CIS data are collected as a panel survey in a homogenized, European effort coordinated by Eurostat, which allows for the consistent measurements of central indicators of innovation across European countries. The data are sampled in accordance with the guidelines for measuring innovation and innovation activities established by the OECD (OECD and Eurostat, 2005). The subsets of data used in Essays II through IV were gathered in the 2008, 2009, 2011, and 2012 waves of the CIS, and the sample sizes of the raw data available for this dissertation ranged from 6.684 to 7.657 German companies for each wave. The high degree of standardization, homogenization, and resulting comparability across



countries, sectors, and time have led to the establishment of CIS data as a standard for econometric inquiries of innovation and related topics, and the data are used in countless studies concerned with this topic (cf. Cricelli et al., 2016; West et al., 2014). The ability to panelize data across several waves of data collection also allows for the consideration of the time lag between (open) innovation activities and the emergence of innovation in organizations' product portfolios and processes. This technique is applied in Essays II and III of this dissertation and has the potential to increase the internal validity, reduce problems associated with endogeneity and common method bias, and hence increase the validity of causal inferences drawn from the analyses (cf. Belderbos et al., 2004; van Beers and Zand, 2014).

The specific econometric methods used in the individual essays of this dissertation vary depending on the nature of the respective independent and dependent variables. First, to investigate the moderating effect of organizational variables on the relationship between individual ambidexterity and individual performance, Essay I uses moderated hierarchical linear modelling (HLM) to approach this multilevel research question. Multilevel methods are increasingly applied in the social sciences (Raudenbush and Bryk, 2010; Snijders, 2011; Snijders and Bosker, 1999). HLM, one method from the multilevel toolkit, is a regular OLS regression that considers the hierarchically clustered structure of the underlying data and is hence able to identify variance induced by higher-level predictors (Raudenbush and Bryk, 2010; Snijders, 2011). In the case of Essay I, individual researchers are clustered within their organizational units (faculties), and variables enter the models at both levels of analysis. Second, as the moderating effects of absorptive capacity and innovation competencies on the relationship between university–industry collaboration and innovation performance are located on the same organizational level, Essay II relies on moderated OLS regression. Third, to conform with the count nature of the innovation performance measure employed in Essay III, this essay uses Zero-Inflated Poisson Regression as the primary empirical method. Fourth,

Essay IV employs TOBIT-Regression because of the strictly censored nature of the project innovation performance measure of interest in this essay.

### **1.4 Structure, Contribution, and Main Results**

Following this introductory chapter (Chapter 1) are four essays that constitute the main part of this dissertation. Each essay is contained in a separate chapter of this dissertation (Chapters 2 through 5). Chapter 6 discusses the findings, contribution, and limitations of this dissertation and provides implications for practice and future research. The remainder of this chapter provides a short overview of the findings and contribution of the essays contained in this dissertation as well as of the dissertation as a whole. Essay I builds the theoretical foundation of contextual ambidexterity to investigate the influence of individual ambidexterity on individual innovation performance in an academic setting and the potential organizational moderators of this relationship. It finds that there is a relationship between individual ambidexterity and individual performance, thus confirming the ambidexterity hypothesis (He and Wong, 2004) for individual performance. Moreover, it finds that factors residing within the organizational framework, specifically the advisory ration, exert a considerable moderating influence on this relationship. Hence, Essay I contributes to the organization literature by providing the first empirical evidence for the disputed performance effect of individual ambidexterity and by offering a frequently called for multilevel investigation of ambidexterity (Birkinshaw and Gupta, 2013; Raisch et al., 2009; Simsek, 2009) by analyzing how factors from higher organizational levels moderate the ambidexterity–performance relationship. It furthermore sheds light on the ambidexterity–performance relationship in previously overseen realms other than the corporate context. Essay II investigates how absorptive capacity and innovation competencies influence firms’ ability to leverage innovation collaboration with universities and research organizations (UIC) into innovation performance, i.e., it investigates the moderating effect of firms’ absorptive capacity and innovation competencies on the relationship between UIC involvement and

innovation performance. It finds that while absorptive capacity and innovation competencies have the potential to foster this relationship, their beneficial effect is highly contingent on the type of innovation in focus. Essay II, hence, contributes to the contingency perspective of open innovation by investigating the moderating effects of a highly important organizational prerequisite (cf. Bogers et al., 2017; Ritala and Hurmelinna-Laukkanen, 2013; West and Bogers, 2014). Essay II shows that the effect of absorptive capacity in open innovation settings should be regarded as dichotomously contingent on the innovation type, as the results show that the absorptive capacity has either a positive or negative moderation effect on innovation performance in UIC settings. Essay II thus also contributes to the recent discussion on the potential substitution effect of absorptive capacity (cf. West and Bogers, 2014). Essay III finds that while collaboration with certain partner types is beneficial to the emergence of ecological innovation of firms, this relationship does not hold true for all collaboration partners and is furthermore highly contingent on the subtype of ecological innovation in focus. As such, Essay III further contributes to the understanding of the recently established open eco innovation mode (De Marchi, 2012; Ghisetti et al., 2015) and contributes to the management literature by strengthening the links between two research areas of great interest, namely, open innovation and ecological innovation (De Marchi and Grandinetti, 2013; Horbach, 2008; Marzucchi and Montresor, 2017). Essay IV investigates open innovation at the level of innovation projects and shows that the relationship between the breadth and depth of firms' collaboration activities within innovation projects and the innovation performance follows an inverted U-shape. These relationships differ from those found at the firm level by previous studies (Laursen and Salter, 2006; van Beers and Zand, 2014). Specifically, the collaboration–performance relationship at the project level is highly sensitive to an excessive degree of collaboration, likely because of the comparatively narrow focus and lower resource endowment of innovation projects. Hence, and again in line with the contingency perspective of open innovation, the effects of open innovation not only depend on the organizational level

at which innovation activities are carried out and analyzed but are also negatively influenced by too large a degree of collaboration. Consequently, this essay contributes to an emerging stream of open innovation literature that is concerned with understanding open innovation across different levels of analysis and understanding the limits of open innovation (Bogers et al., 2017; Hottenrott and Lopes-Bento, 2016).

Beyond the findings and contributions of the individual essays, this dissertation as a whole makes the following, broader contribution to the management and organization science literature and practice. First, this dissertation supports the high relevance and almost pivotal role of ambidexterity and open innovation on innovation performance in the 21st century. As this dissertation finds a positive effect of ambidexterity and open innovation across multiple levels, for different types of innovation partners, and with regard to the qualitatively different types of innovation, this dissertation supports the widespread notion of their furtherance of innovation activities established in the early stages of their conceptual development (Benner and Tushman, 2003; Chesbrough, 2003; Tushman and O Reilly, 1996).

Second, this dissertation contributes to—and emphasizes the need for—a contingency perspective of ambidexterity and open innovation (Benner and Tushman, 2015; Bogers et al., 2017). Their positive effects have to be regarded as highly sensitive to the organizational environment that they are carried out in, types of partners that they are carried out with, and specific innovation goals that they are carried out for. This emphasis is orthogonal to the long-standing notion of ambidexterity and open innovation as a panacea, strictly and ubiquitously positively related to multiple measures of performance (cf. Huizingh, 2011). This knowledge of a contingency perspective is not only important for the further theoretical development of an innovation framework of ambidexterity and open innovation but is also highly valuable for the application of these concepts in practice.

## 2 Individual Ambidexterity and Performance in the Public Sector: A Multilevel Analysis

### Abstract

In this study, we examine individual ambidexterity (i.e., individuals' balanced pursuit of exploitative and explorative activities) in a public management context. In particular, we combine survey data from junior scholars and secondary data from the Center for Higher Education to investigate the role of individual ambidexterity in an academic context. We conduct multilevel analyses and find that individual ambidexterity is positively related to research performance, indicating that individual ambidexterity positively influences individual performance in the public sector. In addition, we observe a negative relationship between the supervisory ratio and research performance, indicating that having a lower number of employees supervised by a single person leads to lower performance in the public sector.

### Current Status (see also Appendix A):

#### Published as:

Kobarg, S.\*, Wollersheim, J.\*, Welpe, I. M., & Spörrle, M. (2017). Individual ambidexterity and performance in the public sector: A multilevel analysis. *International Public Management Journal*, 20(2): 226-260. [\*equal contribution]

#### Presented at:

2014 Academy of Management Annual Meeting, Philadelphia, USA.

Symposium Governance, Performance & Leadership of Research and Public Organizations, Munich, Germany, 15-16 July 2015.

### **3 University-Industry Collaborations and Product Innovation**

#### **Performance: The Moderating Effects of Absorptive Capacity and Innovation Competencies**

##### **Abstract**

We investigate the potential influence of absorptive capacity and innovation competencies on the relationship between UIC and product innovation performance. Based on a panelized sample of 2,061 German companies from the German Community Innovation Survey and using moderated multiple regression, we find that (1) absorptive capacity in terms of internal R&D negatively moderates the relationship between UIC and incremental innovation performance and has no effect on the relationship between UIC and radical innovation performance; (2) absorptive capacity related to employee know-how has no moderating effect on the relationship between UIC and incremental innovation performance, but positively moderates the relationship between UIC and radical innovation performance; and (3) innovation competencies exert no moderating effect on the relationship between UIC and incremental innovation performance, but have a predominantly positive moderating effect on the relationship between UIC and radical innovation performance. We discuss implications for both theory and practice.

##### **Current Status (see also Appendix B):**

###### Published as:

Kobarg, S., Stumpf-Wollersheim, J., & Welp, I. M. (2017). University-industry collaboration and product innovation performance: The moderating effects of absorptive capacity and innovation competencies. *The Journal of Technology Transfer*. Advance online publication. doi: 10.1007/s10961-017-9583-y.

## **4 Green Together? The Effects of Companies' Innovation Collaboration with Different Partner Types on Ecological Process and Product Innovation**

### **Abstract**

This paper investigates the effect of companies' innovation collaboration with different partner types on the emergence of different typologies of ecological innovation (EI), specifically Process- and Product-EI. We develop hypotheses against the background of the open innovation and EI literature. Using econometric estimates based on a panelized sample of 546 German manufacturing companies collected as part of the Community Innovation Survey, we find a differential effect of collaboration with individual partner types. Specifically, we find that collaboration with end users is associated positively with both Process- and Product-EI, whereas collaboration with universities and research organizations as well as with suppliers is associated positively only with Process-EI. Collaboration with enterprise customers and with competitors is associated negatively with Process-EI, and not associated with Product-EI. Our results shed light on the mechanisms within the recently established open eco-innovation mode and emphasize the importance for theory and practice of distinguishing among collaboration partners, contingent on the underlying typology of EI. We discuss important implications for theory and practice, specifically for innovation managers and policy makers.

### **Current Status (see also Appendix C):**

Working Paper.

Presented at:

*2017 Academy of Management Annual Meeting, Atlanta, USA.*

## **5 More Is Not Always Better: Effects of Collaboration Breadth and Depth on Radical and Incremental Innovation Performance at the Project Level**

### **Abstract**

This study investigates the effect of project-level collaboration breadth (i.e., the number of collaboration partner types) and collaboration depth (i.e., intensity of interactions with these collaboration partners) on the incremental and radical innovation performance of innovation projects. We argue that because of the trade-offs between the beneficial and detrimental effects of innovation collaboration, aggravated by narrow technological foci and resource limitations on the project level, the relationships between collaboration breadth and depth and innovation performance are highly curvilinear. Moreover, we expect a differential effect of collaboration breadth and depth on incremental and radical innovation performance. The econometric analyses, based on a Community Innovation Study sample of 218 innovation projects conducted in German manufacturing companies, largely confirm these assumptions. Specifically, the study reveals an inverted U-shaped relationship between collaboration breadth and radical innovation performance and between collaboration depth and incremental innovation performance. These curvilinear effects speak to the high sensitivity of innovation projects to the extent of collaborative activity, which thus also implies that practitioners should exert caution in managing collaborative innovation projects. This study contributes to the understanding of project-level open innovation and to the overall understanding of the performance effects of innovation collaboration, which, following recent assertions in the literature, could be flawed by analyses conducted on the organizational level.

**Current Status (see also Appendix D):**

Working Paper.



## **6 Conclusion and Discussion**

This dissertation set out to contribute to the management and organization science literature by offering an in-depth analysis of two central concepts that are of great interest in the context of innovation, while specifically considering emergent topics in the respective fields of research. A common theme of these emergent topics across both concepts is the adoption of a contingency perspective that seeks to further explain the variance of results in previous empirical investigations of the primary relationship between the two constructs and innovation performance (cf. Tsai, 2009; Vanhaverbeke et al., 2014b).

### **6.1 Discussion of Main Findings and Contributions**

The essays in this dissertation contain several findings that directly pertain to the individual research questions and to the overall goal of this dissertation. Specifically, Essay I provides evidence for a positive relationship between individual ambidexterity and performance in public-sector and academic contexts and for relevant organizational moderators of this relationship. Consequently, Essay I contributes to the ambidexterity literature by providing a first empirical investigation of the performance effects of individual ambidexterity. By specifically examining moderating effects of the organizational framework, this essay further contributes to the development towards a multilevel perspective of ambidexterity (Birkinshaw and Gupta, 2013; Raisch et al., 2009; Simsek, 2009). Essay II indicates that firms' absorptive capacity and innovation competencies exert a considerable and in some cases surprisingly negative moderating effect on the ability of firms to leverage collaboration with universities into innovation performance. Essay II thus contributes to the literature concerned with the efficacy of university–industry technology transfer (Bishop et al., 2011; Hewitt-Dundas, 2013; Perkmann et al., 2013; Perkmann and Walsh, 2007) and to the recent scholarly discussion on the substitution effect of absorptive capacity (Ritala and Hurmelinna-Laukkanen, 2013; West and Bogers, 2014). Essay III shows that while

collaboration with certain partner types is beneficial to the emergence of ecological innovation of firms, this relationship does not hold true for all collaboration partners and is furthermore highly contingent on the subtype of ecological innovation in focus. As such, Essay III contributes to our knowledge of the recently established open eco innovation mode (De Marchi, 2012; Ghisetti et al., 2015) and provides further links between two research areas of great interest, namely, open innovation and ecological innovation (De Marchi and Grandinetti, 2013; Horbach, 2008; Marzucchi and Montresor, 2017). Essay IV shows that the relationship between the breadth and depth of firms' collaboration activities within innovation projects and the innovation performance follows an inverted U-shape relationship and is furthermore contingent on the novelty and radicalness of the innovation goals of the project. In doing so, this essay contributes to an emerging stream of open innovation literature that is concerned with understanding open innovation across different levels of analysis and understanding the limits of open innovation (Bogers et al., 2017; Hottenrott and Lopes-Bento, 2016).

While these “micro-level” findings and the individual contributions of the underlying essays are discussed in detail in the individual essays, this dissertation draws further conclusions on an overarching “meta-level” in the context of ambidexterity, open innovation, and innovation performance. First, this dissertation lends support to the high relevance and potential of ambidexterity and open innovation in the context of innovation performance. At their conception, it was argued that both concepts would be not only beneficial but almost imperative to the emergence of innovation, sustained performance, and organizational longevity in light of drastically changing markets, environments, and challenges (Benner and Tushman, 2003; Chesbrough, 2003; Tushman and O Reilly, 1996). Empirical research following these seminal contributions set out to confirm this general conjecture and found initial evidence supporting these positive relationships (Belderbos et al., 2004; Faems et al., 2005; He and Wong, 2004; Laursen and Salter, 2006). The results of this dissertation lend

further support to the relevance and positive effect of the concepts on innovation performance, as it finds several positive relationships between the concepts and various dimensions of innovation performance. As these positive relationships are found across contexts, industries, and performance dimensions, they provide strong support for the generally positive effects of ambidexterity and open innovation on innovation performance and emphasize the theoretical and practical relevance of these concepts in modern economies.

Second, this dissertation shows that these positive effects should be regarded as highly sensitive to organizational and environmental moderators and strongly dependent on contextual contingency factors. While both concepts have long been regarded almost as imperative, as a panacea uniformly positively related to multiple measures of performance (cf. Huizingh, 2011) despite a certain lack of consistency of results and larger portions of unexplained variance (cf. Tsai, 2009; Vanhaverbeke et al., 2014b), this dissertation shows that this notion is not unopposed. Specifically, this dissertation identified moderators and contingencies to reside within the nature of the innovation partner, the innovation typology in focus, the prerequisites and capacity residing within the broader framework of the organization, and the organizational level of analysis. Furthermore, these contingency factors and moderators are interrelated. For example, while conducting open innovation activities with one type of partner can be beneficial for the emergence of incremental innovation under certain circumstances, collaboration with the same partner type can have no effect or even negative effects on other types of innovation or under different organizational circumstances. As such, this dissertation follows and contributes to the relatively recent notion of the “*need for a contingency perspective*” (Bogers et al., 2017, p. 6) that was previously widely disregarded (Benner and Tushman, 2015; Bogers et al., 2017; Huizingh, 2011; Vanhaverbeke et al., 2014a). Knowledge of these contingencies is valuable for the ambidexterity and open innovation literature, for it reveals linkages between actors, antecedents, and external and internal context characteristics (Huizingh, 2011) that contribute to a thorough understanding

of open innovation as a framework within the broader innovation ecosystem (Bogers et al., 2017). This finding thus provides a contribution to the further enhancement of a framework for (open) innovation and emphasizes the necessity for research on ambidexterity and open innovation to explicitly consider contextual contingencies in future research.

### **6.2 Implications for Practice**

Ambidexterity and open innovation found wide consideration and implementation in practice, and particularly open innovation practices have become to be the norm rather than the exception in modern economies (Benner and Tushman, 2015; Huizingh, 2011; West et al., 2014). Given this wide implementation and high practical relevance of both constructs, paired with a perhaps overly optimistic “heal-all” expectation of their effects, a thorough understanding of relevant moderators and contextual contingencies is crucial for practitioners concerned with the emergence of innovation. With open innovation initiatives often receiving considerable policy interest and public funding (Bishop et al., 2011; Borghesi et al., 2013; Bozeman et al., 2013; Cunningham and Link, 2015), these implications also extend to policy makers concerned with local, regional, or national innovation initiatives. The essays in this dissertation provide guidance for practitioners in several contexts: Essay I illustrates the importance of individual ambidexterity for individual performance, argues that the emergence of such ambidexterity is desirable for organizations and provides initial evidence on how parameters in the immediate organizational environment of individuals moderate the relationship between individual ambidexterity and performance. Essay II provides guidance to managers concerned with university–industry collaboration and shows how absorptive capacity and innovation competencies moderate the ability of firms to leverage UIC into innovation performance. The results, partially counterintuitive and lending support to the existence of a substitution effect of absorptive capacity, provide insights potentially useful for practitioners when selecting the appropriate open innovation strategy contingent on their organizations’ prerequisites and the targeted innovation typology. Essay III provides

implications for innovation managers and policy makers that are concerned with the creation of ecological innovation. The essay analyzes the potential contribution of specific types of innovation partners on the emergence of subtypes of ecological innovation. It hence provides recommendations as to which partners could potentially be valuable for the achievement of specific ecological innovation goals. Essay IV has the potential to provide guidance to innovation managers at the project level. It illustrates how two central variables of open innovation activities that can be shaped by innovation managers, namely, collaboration breadth and depth, relate to the emergence of incremental and radical innovation at the project level. Essay IV further demonstrates the presence of highly diminishing returns on increased open innovation activity at this level of analysis, thus cautioning managers against overly extensive openness within innovation projects.

Analogous to the theoretical contribution, the implications this dissertation can offer to practice on a more general level should be understood as a cautionary support of ambidexterity and open innovation: This dissertation demonstrates that while both concepts have the potential to benefit organizations in their innovation activities under the conditions of the 21<sup>st</sup> century, they are highly dependent on internal and external moderators and contextual contingencies. Hence, this dissertation demonstrates that practitioners need to be diligent and careful in choosing and using these concepts appropriately. Moreover, practitioners should seek to design the appropriate organizational preconditions for ambidexterity and open innovation to have the desired effect on innovation performance.

### **6.3 Limitations and Directions for Future Research**

This dissertation is subject to limitations that should be considered when interpreting its results. Based in part on these limitations, this dissertation provides directions for future research. On a methodological level, several limitations are discussed within the respective essays. Several common limitations can be identified as a synopsis of the essays contained in this dissertation: First, all of the empirical investigations in this dissertation are conducted on

the basis of survey data. While econometric tools were applied to reduce endogeneity and increase internal validity with regard to causal inference, to the best of the authors knowledge, the limited ability for causal inferences remains a caveat of this dissertation. Second, the measurement of central constructs such as ambidexterity, open innovation, and innovation performance is subject to a great deal of discussion in the management literature. While the measures applied in all analyses were selected against the background of the current state of this discourse and with the goal of maintaining comparability to other studies, no one measure can be regarded as a definitive measurement of the constructs under investigation. Third, and closely related, the CIS data used in Essay II through IV potentially suffer from a relatively broad definition of the constructs used (cf. Cricelli et al., 2016; Hashi and Stojčić, 2013). While this dissertation specifically opted for a definition of open innovation that is in line with the items provided by the CIS, a potential masking of variance could be caused by broadly defined survey items. Fourth, this dissertation adopted a predominantly multilateral, formalized, and coupled view of open innovation. The results of this dissertation thus have to be transferred with caution to other modes of open innovation, such as the informal exchange of information between entities.

While this dissertation achieved its primary goal in offering a contingency view of ambidexterity and open innovation in the context of innovation performance by investigating some of the most relevant moderators and contextual contingency factors, three important avenues for future research appear to be necessary and promising: First, with regard to ambidexterity, this dissertation offered a frequently called for multilevel investigation. However, ambidexterity was only measured and analyzed at the individual level under consideration of organizational moderators. Future research should measure ambidexterity at multiple levels in an effort to examine how ambidexterity permeates through organizations and to answer the questions of whether ambidextrous individuals create contextually ambidextrous organizations—or the other way around. Second, in the field of open

innovation, this dissertation is the first to investigate a set of moderators and contextual contingencies. While it offers valuable insights regarding the effect of these factors, it fails to build a conceptual framework of such contingencies. Future research should design and test such a framework along various dimensions, such as internal and environmental contingencies, innovation typologies, and innovation partners (cf. Bogers et al., 2017). Moreover, it is unlikely that the moderators and contingencies identified by this dissertation are exhaustive in this context. Future research should thus continue to identify further factors and examine their role. Third, this dissertation treats ambidexterity and open innovation independently from each other. However, previous conceptual work allows the notion of a shared link between ambidexterity and open innovation through the lens of knowledge-based view and organizational learning (Katila and Ahuja, 2002; cf. Vanhaverbeke et al., 2008). In this link, the use of internal knowledge and resources for innovation could be equated with exploitation, whereas external sources acquired through open innovation could be equated with exploration. Against this background, it could be highly promising to examine ambidexterity as an antecedent or moderator of open innovation activities.

## 7 References

- Abernathy, W. J., & Clark, K. B. (1985). Innovation: Mapping the winds of creative destruction. *Research Policy*, 14, 3-22.
- Adler, P. S., Goldoftas, B., & Levine, D. I. (1999). Flexibility versus efficiency? A case study of model changeovers in the toyota production system. *Organization Science*, 10, 43-68.
- Agrawal, A. K. (2001). University-to-industry knowledge transfer: Literature review and unanswered questions. *International Journal of Management Reviews*, 3, 285-302.
- Ahlstrom, D. (2010). Innovation and growth: How business contributes to society. *The Academy of Management Perspectives*, 24, 11-24.
- Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: A longitudinal study. *Administrative Science Quarterly*, 45, 425-455.
- Almirall, E., & Casadesus-Masanell, R. (2010). Open versus closed innovation: A model of discovery and divergence. *Academy of Management Review*, 35, 27-47.
- Altman, E. J., Nagle, F., & Tushman, M. (2014). Innovating without information constraints: Organizations, communities, and innovation when information costs approach zero. *Harvard Business School Organizational Behavior Unit Working Paper*, 14-043.
- Alvesson, M. (2004). *Knowledge work and knowledge-intensive firms*. Oxford: Oxford University Press.
- Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity*. Boulder, CO: Westview Press.



- Ambec, S., Cohen, M. A., Elgie, S., & Lanoie, P. (2013). The porter hypothesis at 20: Can environmental regulation enhance innovation and competitiveness? *Review of Environmental Economics and Policy*, 7, 2-22.
- Anand, N., Gardner, H. K., & Morris, T. (2007). Knowledge-based innovation: Emergence and embedding of new practice areas in management consulting firms. *Academy of Management Journal*, 50, 406-428.
- Ancona, D. G., Goodman, P. S., Lawrence, B. S., & Tushman, M. L. (2001). Time: A new research lens. *Academy of Management Review*, 26, 645-663.
- Andriopoulos, C., & Lewis, M. W. (2009). Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation. *Organization Science*, 20, 696-717.
- Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science*, 22, 1123-1137.
- Atuahene-Gima, K. (2005). Resolving the capability—rigidity paradox in new product innovation. *Journal of Marketing*, 69, 61-83.
- Audia, P. G., Locke, E. A., & Smith, K. G. (2000). The paradox of success: An archival and a laboratory study of strategic persistence following radical environmental change. *Academy of Management Journal*, 43, 837-853.
- Baldwin, C., & Hippel, E. V. (2011). Modeling a paradigm shift: From producer innovation to user and open collaborative innovation. *Organization Science*, 22, 1399-1417.
- Baldwin, C. Y., & Clark, K. B. (2000). *Design rules: The power of modularity*. Cambridge, MA: MIT Press.
- Baumol, W. J. (2002). *The free-market innovation machine: Analyzing the growth miracle of capitalism*. Princeton, NJ: Princeton University Press.

- Beise, M., & Rennings, K. (2005). Lead markets and regulation: A framework for analyzing the international diffusion of environmental innovations. *Ecological Economics*, 52, 5-17.
- Belderbos, R., Carree, M., & Lokshin, B. (2004). Cooperative R&D and firm performance. *Research Policy*, 33, 1477-1492.
- Belderbos, R., Carree, M., & Lokshin, B. (2006). Complementarity in R&D cooperation strategies. *Review of Industrial Organization*, 28, 401-426.
- Benner, M. J., & Tushman, M. L. (2003). Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review*, 28, 238-256.
- Benner, M. J., & Tushman, M. L. (2015). Reflections on the 2013 decade award—“exploitation, exploration, and process management: The productivity dilemma revisited” ten years later. *Academy of Management Review*, 40, 497-514.
- Birkinshaw, J., & Gibson, C. (2004). Building ambidexterity into an organization. *MIT Sloan Management Review*, 45, 47-55.
- Birkinshaw, J., & Gupta, K. (2013). Clarifying the distinctive contribution of ambidexterity to the field of organization studies. *Academy of Management Perspectives*, 27, 287-298.
- Bishop, K., D’este, P., & Neely, A. (2011). Gaining from interactions with universities: Multiple methods for nurturing absorptive capacity. *Research Policy*, 40, 30-40.
- Bogers, M., et al. (2017). The open innovation research landscape: Established perspectives and emerging themes across different levels of analysis. *Industry and Innovation*, 24, 8-40.
- Borghesi, S., Costantini, V., Crespi, F., & Mazzanti, M. (2013). Environmental innovation and socio-economic dynamics in institutional and policy contexts. *Journal of Evolutionary Economics*, 23, 241-245.

- Bozeman, B., Fay, D., & Slade, C. P. (2013). Research collaboration in universities and academic entrepreneurship: The-state-of-the-art. *The Journal of Technology Transfer*, 38, 1-67.
- Bruneel, J., D'este, P., & Salter, A. (2010). Investigating the factors that diminish the barriers to university–industry collaboration. *Research Policy*, 39, 858-868.
- Burgers, J. H., Jansen, J. J., Van Den Bosch, F. A., & Volberda, H. W. (2009). Structural differentiation and corporate venturing: The moderating role of formal and informal integration mechanisms. *Journal of Business Venturing*, 24, 206-220.
- Burns, T. E., & Stalker, G. M. (1961). *The management of innovation*. Oxford: Oxford University Press.
- Chandler, A. D. J. (1977). *The visible hand. The managerial revolution in american business*. Cambridge, MA: Harvard University Press.
- Chesbrough, H., & Bogers, M. (2014). Explicating open innovation: Clarifying an emerging paradigm for understanding innovation. In H. Chesbrough, J. West and W. Vanhaverbeke (Eds.), *New frontiers in open innovation* (pp. 3-28). Oxford: Oxford University Press.
- Chesbrough, H., & Crowther, A. K. (2006). Beyond high tech: Early adopters of open innovation in other industries. *R&D Management*, 36, 229-236.
- Chesbrough, H., Vanhaverbeke, W., & West, J. (2006a). *Open innovation: A new paradigm for understanding industrial innovation*. Oxford: Oxford University Press.
- Chesbrough, H., Vanhaverbeke, W., & West, J. (2006b). Open innovation: A research agenda. In H. Chesbrough, W. Vanhaverbeke and J. West (Eds.), *Open innovation: Researching a new paradigm* (pp. 285-307). Oxford: Oxford University Press.

- Chesbrough, H. W. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Cambridge, MA: Harvard Business Review Press.
- Christensen, C. M. (1997). *The innovator's dilemma: When new technologies cause great firms to fail*. Cambridge, MA: Harvard Business School Press.
- Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly*, 35, 128-152.
- Conner, K. R., & Prahalad, C. K. (1996). A resource-based theory of the firm: Knowledge versus opportunism. *Organization Science*, 7, 477-501.
- Cricelli, L., Greco, M., & Grimaldi, M. (2016). Assessing the open innovation trends by means of the eurostat community innovation survey. *International Journal of Innovation Management*, 20, 1650039.
- Cunningham, J. A., & Link, A. N. (2015). Fostering university-industry R&D collaborations in european union countries. *International Entrepreneurship and Management Journal*, 11, 849-860.
- Das, T. K., & Teng, B.-S. (2000). A resource-based theory of strategic alliances. *Journal of Management*, 26, 31-61.
- De Marchi, V. (2012). Environmental innovation and R&D cooperation: Empirical evidence from spanish manufacturing firms. *Research Policy*, 41, 614-623.
- De Marchi, V., & Grandinetti, R. (2013). Knowledge strategies for environmental innovations: The case of italian manufacturing firms. *Journal of Knowledge Management*, 17, 569-582.
- Denison, D. R., Hooijberg, R., & Quinn, R. E. (1995). Paradox and performance: Toward a theory of behavioral complexity in managerial leadership. *Organization Science*, 6, 524-540.

- Dewar, R. D., & Dutton, J. E. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management Science*, 32, 1422-1433.
- Dodgson, M., Gann, D. M., & Salter, A. (2008). *The management of technological innovation: Strategy and practice*. Oxford: Oxford University Press.
- Du, J., Leten, B., & Vanhaverbeke, W. (2014). Managing open innovation projects with science-based and market-based partners. *Research Policy*, 43, 828-840.
- Duncan, R. B. (1976). The ambidextrous organization: Designing dual structures for innovation. In R. H. Killman, L. R. Pondy and D. P. Slevin (Eds.), *The management of organization design: Strategies and implementation* (pp. 167-188). New York, NY: North Holland.
- Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy of Management Review*, 23, 660-679.
- Eisenhardt, K. M. (2000). Paradox, spirals, ambivalence: The new language of change and pluralism. *The Academy of Management Review*, 25, 703-705.
- Enkel, E., Gassmann, O., & Chesbrough, H. (2009). Open R&D and open innovation: Exploring the phenomenon. *R&D Management*, 39, 311-316.
- Estrada, I., Faems, D., Martin Cruz, N., & Perez Santana, P. (2016). The role of interpartner dissimilarities in industry-university alliances: Insights from a comparative case study. *Research Policy*, 45, 2008-2022.
- Ettlie, J. E., Bridges, W. P., & O'keefe, R. D. (1984). Organization strategy and structural differences for radical versus incremental innovation. *Management Science*, 30, 682-695.

- Fabrizio, K. R. (2009). Absorptive capacity and the search for innovation. *Research Policy*, 38, 255-267.
- Faems, D., Van Looy, B., & Debackere, K. (2005). Interorganizational collaboration and innovation: Toward a portfolio approach. *Journal of Product Innovation Management*, 22, 238-250.
- Garcia, R., & Calantone, R. (2002). A critical look at technological innovation typology and innovativeness terminology: A literature review. *Journal of Product Innovation Management*, 19, 110-132.
- Ghisetti, C., Marzucchi, A., & Montresor, S. (2015). The open eco-innovation mode. An empirical investigation of eleven european countries. *Research Policy*, 44, 1080-1093.
- Ghisetti, C., & Rennings, K. (2014). Environmental innovations and profitability: How does it pay to be green? An empirical analysis on the german innovation survey. *Journal of Cleaner Production*, 75, 106-117.
- Gibson, C. B., & Birkinshaw, J. (2004). The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of Management Journal*, 47, 209-226.
- Grant, R. M. (1996). Prospering in dynamically-competitive environments: Organizational capability as knowledge integration. *Organization Science*, 7, 375-387.
- Grant, R. M., & Baden-Fuller, C. (1995). A knowledge-based theory of inter-firm collaboration. *Academy of Management Best Paper Proceedings*, 17-21.
- Gupta, A. K., Smith, K. G., & Shalley, C. E. (2006). The interplay between exploration and exploitation. *Academy of Management Journal*, 49, 693-706.
- Hashi, I., & Stojčić, N. (2013). The impact of innovation activities on firm performance using a multi-stage model: Evidence from the community innovation survey 4. *Research Policy*, 42, 353-366.

- He, Z.-L., & Wong, P.-K. (2004). Exploration vs. Exploitation: An empirical test of the ambidexterity hypothesis. *Organization Science*, 15, 481-494.
- Hewitt-Dundas, N. (2013). The role of proximity in university-business cooperation for innovation. *The Journal of Technology Transfer*, 38, 93-115.
- Horbach, J. (2008). Determinants of environmental innovation—new evidence from german panel data sources. *Research Policy*, 37, 163-173.
- Horbach, J., Oltra, V., & Belin, J. (2013). Determinants and specificities of eco-innovations compared to other innovations—an econometric analysis for the french and german industry based on the community innovation survey. *Industry and Innovation*, 20, 523-543.
- Hottenrott, H., & Lopes-Bento, C. (2016). R&D partnerships and innovation performance: Can there be too much of a good thing? *Journal of Product Innovation Management*, 33, 773-794.
- Huizingh, E. K. R. E. (2011). Open innovation: State of the art and future perspectives. *Technovation*, 31, 2-9.
- Jansen, J. J. P., George, G., Van Den Bosch, F. a. J., & Volberda, H. W. (2008). Senior team attributes and organizational ambidexterity: The moderating role of transformational leadership. *Journal of Management Studies*, 45, 982-1007.
- Jansen, J. J. P., Simsek, Z., & Cao, Q. (2012). Ambidexterity and performance in multiunit contexts: Cross-level moderating effects of structural and resource attributes. *Strategic Management Journal*, 33, 1286-1303.
- Junni, P., Sarala, R., Taras, V., & Tarba, S. (2013). Organizational ambidexterity and performance: A meta-analysis. *Academy of Management Perspectives*, 27, 299-312.

- Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal*, 45, 1183-1194.
- Kim, N., Kim, D.-J., & Lee, S. (2015). Antecedents of open innovation at the project level: Empirical analysis of Korean firms. *R&D Management*, 45, 411-439.
- Lane, P. J., Koka, B. R., & Pathak, S. (2006). The reification of absorptive capacity: A critical review and rejuvenation of the construct. *Academy of Management Review*, 31, 833-863.
- Laursen, K., & Salter, A. (2006). Open for innovation: The role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, 27, 131-150.
- Laursen, K., & Salter, A. J. (2014). The paradox of openness: Appropriability, external search and collaboration. *Research Policy*, 43, 867-878.
- Leiponen, A., & Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, 31, 224-236.
- Leonard-Barton, D. (1992). Core capabilities and core rigidities: A paradox in managing new product development. *Strategic Management Journal*, 13, 111-125.
- Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, 14, 95-112.
- Lubatkin, M. H., Simsek, Z., Ling, Y., & Veiga, J. F. (2006). Ambidexterity and performance in small-to medium-sized firms: The pivotal role of top management team behavioral integration. *Journal of Management*, 32, 646-672.
- March, J. G. (1991). Exploration and exploitation in organizational learning. *Organization Science*, 2, 71-87.



- Marzucchi, A., & Montresor, S. (2017). Forms of knowledge and eco-innovation modes: Evidence from spanish manufacturing firms. *Ecological Economics*, 131, 208-221.
- Mcdermott, C. M., & O'connor, G. C. (2002). Managing radical innovation: An overview of emergent strategy issues. *Journal of Product Innovation Management*, 19, 424-438.
- Miller, D., & Friesen, P. H. (1986). Generic strategies and performance: An empirical examination with american data. *Organization Studies*, 7, 37-55.
- Mina, A., Bascavusoglu-Moreau, E., & Hughes, A. (2014). Open service innovation and the firm's search for external knowledge. *Research Policy*, 43, 853-866.
- Miotti, L., & Sachwald, F. (2003). Co-operative R&D: Why and with whom?: An integrated framework of analysis. *Research Policy*, 32, 1481-1499.
- Mom, T. J. M., Van Den Bosch, F. a. J., & Volberda, H. W. (2007). Investigating managers' exploration and exploitation activities: The influence of top-down, bottom-up, and horizontal knowledge inflows. *Journal of Management Studies*, 44, 910-931.
- Mom, T. J. M., Van Den Bosch, F. a. J., & Volberda, H. W. (2009). Understanding variation in managers' ambidexterity : Investigating direct and interaction effects of formal structural and personal coordination mechanisms. *Organization Science*, 20, 812-828.
- Mowery, D. C., Oxley, J. E., & Silverman, B. S. (1998). Technological overlap and interfirm cooperation: Implications for the resource-based view of the firm. *Research Policy*, 27, 507-523.
- O'reilly, C., & Tushman, M. (2013). Organizational ambidexterity: Past, present and future. *The Academy of Management Perspectives*, 27, 324-338.
- OECD, & Eurostat (2005). *Oslo manual: Guidelines for collecting and interpreting innovation data*. Paris: Organisation for Economic Co-operation and Development.

- Penrose, E. T. (1959). *The theory of the growth of the firm*. New York, NY: Wiley.
- Perkmann, M., King, Z., & Pavelin, S. (2011). Engaging excellence? Effects of faculty quality on university engagement with industry. *Research Policy*, 40, 539-552.
- Perkmann, M., et al. (2013). Academic engagement and commercialisation: A review of the literature on university–industry relations. *Research Policy*, 42, 423-442.
- Perkmann, M., & Walsh, K. (2007). University–industry relationships and open innovation: Towards a research agenda. *International Journal of Management Reviews*, 9, 259-280.
- Piller, F., & West, J. (2014). Firms, users, and innovation: An interactive model of coupled open innovation. In H. Chesbrough, W. Vanhaverbeke and J. West (Eds.), *New frontiers in open innovation* (pp. 29-49). Oxford: Oxford University Press.
- Pinto, J. K., & Prescott, J. E. (1988). Variations in critical success factors over the stages in the project life cycle. *Journal of Management*, 14, 5-18.
- Porter, M. E., & Van der Linde, C. (1995). Toward a new conception of the environment-competitiveness relationship. *The journal of economic perspectives*, 9, 97-118.
- Raisch, S., & Birkinshaw, J. (2008). Organizational ambidexterity: Antecedents, outcomes, and moderators. *Journal of Management*, 34, 375-409.
- Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M. L. (2009). Organizational ambidexterity: Balancing exploitation and exploration for sustained performance. *Organization Science*, 20, 685-695.
- Raudenbush, S. W., & Bryk, A. S. (2010). *Hierarchical linear models: Applications and data analysis methods*. Thousand Oaks, CA: Sage Publications.

- Rennings, K., & Rammer, C. (2009). Increasing energy and resource efficiency through innovation: An explorative analysis using innovation survey data. *Czech Journal of Economics and Finance*, 59, 442-459.
- Ritala, P., & Hurmelinna-Laukkanen, P. (2013). Incremental and radical innovation in coopetition - the role of absorptive capacity and appropriability. *Journal of Product Innovation Management*, 30, 154-169.
- Rothaermel, F. T., & Alexandre, M. T. (2009). Ambidexterity in technology sourcing: The moderating role of absorptive capacity. *Organization Science*, 20, 759-780.
- Salge, T. O., Farchi, T., Barrett, M. I., & Dopson, S. (2013). When does search openness really matter? A contingency study of health-care innovation projects. *Journal of Product Innovation Management*, 30, 659-676.
- Schumpeter, J. A. (1934). *The theory of economic development: An inquiry into profits, capital, credit, interest, and the business cycle*. Piscataway, NJ: Transaction Publishers.
- Shenhar, A. J., & Dvir, D. (2013). *Reinventing project management: The diamond approach to successful growth and innovation*. Boston, MA: Harvard Business Review Press.
- Simsek, Z. (2009). Organizational ambidexterity: Towards a multilevel understanding. *Journal of Management Studies*, 46, 597-624.
- Smith, W. K., & Tushman, M. L. (2005). Managing strategic contradictions: A top management model for managing innovation streams. *Organization Science*, 16, 522-536.
- Snijders, T. (2011). Multilevel analysis. In M. Lovric (Eds.), *International encyclopedia of statistical science* (pp. 879-882). Berlin: Springer.

- Snijders, T., & Bosker, R. (1999). *Multilevel modeling: An introduction to basic and advanced multilevel modeling*. London: Sage Publications.
- Sood, A., & Tellis, G. J. (2005). Technological evolution and radical innovation. *Journal of Marketing*, 69, 152-168.
- Spithoven, A., Clarysse, B., & Knockaert, M. (2011). Building absorptive capacity to organise inbound open innovation in traditional industries. *Technovation*, 31, 10-21.
- Sydow, J., Lindkvist, L., & DeFillippi, R. (2004). Project-based organizations, embeddedness and repositories of knowledge: Editorial. *Organization Studies*, 25, 1475-1489.
- Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15, 285-305.
- Teece, D. J. (2014). The foundations of enterprise performance: Dynamic and ordinary capabilities in an (economic) theory of firms. *The Academy of Management Perspectives*, 28, 328-352.
- Thompson, J. D. (1967). *Organizations in action: Social science bases of administrative theory*. Piscataway, NJ: Transaction Publishers.
- Tödting, F., Lehner, P., & Kaufmann, A. (2009). Do different types of innovation rely on specific kinds of knowledge interactions? *Technovation*, 29, 59-71.
- Tsai, K.-H. (2009). Collaborative networks and product innovation performance: Toward a contingency perspective. *Research Policy*, 38, 765-778.
- Tsai, K.-H., & Hsieh, M.-H. (2009). How different types of partners influence innovative product sales: Does technological capacity matter? *Journal of Business Research*, 62, 1321-1328.

- Tushman, M., & Nadler, D. (1986). Organizing for innovation. *California Management Review*, 28, 74-92.
- Tushman, M. L., & O Reilly, C. A. (1996). Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, 38, 8-29.
- Uotila, J., Maula, M., Keil, T., & Zahra, S. A. (2009). Exploration, exploitation, and financial performance : Analysis of s&p 500 corporations. *Strategic Management Journal*, 30, 221-231.
- Van Beers, C., & Zand, F. (2014). R&D cooperation, partner diversity, and innovation performance: An empirical analysis. *Journal of Product Innovation Management*, 31, 292-312.
- Vanhaverbeke, W., Chesbrough, H., & West, J. (2014a). Surfing the new wave of open innovation research. In H. Chesbrough, W. Vanhaverbeke and J. West (Eds.), *New frontiers in open innovation* (pp. 281). Oxford: Oxford University Press.
- Vanhaverbeke, W., Du, J., Leten, B., & Aalders, F. (2014b). Exploring open innovation at the level of R&D projects. In H. Chesbrough, W. Vanhaverbeke and J. West (Eds.), *New frontiers in open innovation* (pp. 115-131). Oxford: Oxford University Press.
- Vanhaverbeke, W., Van De Vrande, V., & Chesbrough, H. (2008). Understanding the advantages of open innovation practices in corporate venturing in terms of real options. *Creativity and Innovation Management*, 17, 251-258.
- Von Hippel, E. (1994). "Sticky information" and the locus of problem solving: Implications for innovation. *Management Science*, 40, 429-439.
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5, 171-180.

- West, J., & Bogers, M. (2014). Leveraging external sources of innovation: A review of research on open innovation. *Journal of Product Innovation Management*, 31, 814-831.
- West, J., Salter, A., Vanhaverbeke, W., & Chesbrough, H. (2014). Open innovation: The next decade. *Research Policy*, 43, 805-811.
- Zahra, S. A., & George, G. (2002). Absorptive capacity: A review, reconceptualization, and extension. *Academy of Management Review*, 27, 185-203.

## **Appendix**

### **Appendix A: Reference for Essay I (Chapter 2)**

Kobarg, S. \*, Wollersheim, J. \*, Welppe, I. M., & Spörrle, M. (2017). Individual ambidexterity and performance in the public sector: A multilevel analysis. *International Public Management Journal*, 20(2): 226-260. [\*equal contribution]

### **Appendix B: Reference for Essay II (Chapter 3)**

Kobarg, S., Stumpf-Wollersheim, J., & Welppe, I. M. (2017). University-industry collaboration and product innovation performance: The moderating effects of absorptive capacity and innovation competencies. *The Journal of Technology Transfer*. Advance online publication. doi: 10.1007/s10961-017-9583-y.

### **Appendix C: Reference for Essay III (Chapter 4)**

Kobarg, S., Stumpf-Wollersheim, J., & Welppe, I. M. (2017). Green Together? The Effects of Companies' Innovation Collaboration with Different Partner Types on Ecological Process and Product Innovation. Working paper.

### **Appendix D: Reference for Essay IV (Chapter 5)**

Kobarg, S., Stumpf-Wollersheim, J., & Welppe, I. M. (2017). More Is Not Always Better: Effects of Collaboration Breadth and Depth on Radical and Incremental Innovation Performance at the Project Level. Working paper.