Knowing the Ropes in Open Innovation:
Understanding Tensions through a Paradox Lens

Ioana Stefan
Abstract

The fundamental paradox of disclosure suggested by Kenneth Arrow represents a challenge in contemporary open innovation settings. Potential negative outcomes of this paradox – e.g. misappropriation of ideas – are still not fully avertable. Researchers, practitioners and policy makers strive to untangle tensions related to this paradox, because failure to manage such tensions might entail lost jobs and hampered economic and technological growth.

The purpose of this thesis is to provide a deeper understanding of this paradox by combining three perspectives on tensions in open innovation and applying a paradox lens. The overarching perspective is of value co-creation–value capture. The thesis comprises of five papers that are based on quantitative, qualitative and conceptual studies. The findings reveal: 1) characteristics of tensions; 2) factors that create tensions; and 3) possible solutions and pitfalls to managing said tensions. Findings show that tensions may be managed as paradoxical, dilemmatic or dialectical, depending e.g. on the need to be open or on the overlap between a product’s solution and its characteristics. Moreover, tensions could be spurred by a variety of factors, which may be categorized as: plurality of views, scarcity of resources, change, and combinations thereof (compound factors).

Possible solutions to managing tensions include e.g. increasing staff awareness about intellectual property issues or improving collaboration contracts. Possible pitfalls are linked to over-focusing on either co-creating or on capturing value, and also to subsequent tensions. Findings also reveal a category of factors with dual role, which depending on their intensity, may lead to either solutions or to pitfalls. This hints towards additional layers of complexity concerning the paradox of disclosure. The findings contribute to theory on open innovation, appropriability and organizational paradox, and have important implications for practitioners and policy makers.

Keywords: tensions, open innovation, paradox of disclosure, value co-creation, value capture, openness, appropriability, intellectual property rights, misappropriation, paradox lens.
Sammanfattning

En aktuell utmaning i samband med öppen innovation kan hänföras till den grundläggande paradox om avslöjande av idéer som föreslogs av Kenneth Arrow. Det är oklart hur potentiella negativa konsekvenser av denna paradox - till exempel otillåten användning av idéer – ska hanteras. Forskare, praktiker och beslutsfattare strävar efter att eliminera de spänningar som följer av paradoxen eftersom de kan hindra ekonomisk och teknologisk tillväxt.


Nyckelord: spänningar, öppen innovation, paradox om avslöjande, samskapande av värde, värdefångst, öppenhets, immateriella rättigheter, idé missbruk, paradoxteori lins.
Acknowledgements

During the past four and a half years I have learned a lot and been inspired by many great people. Some of them have been by my side throughout the years, others have been gatekeepers to the academic world and yet others I have met along my PhD journey. Although I do not have space to name all who have contributed in different ways to my development as a researcher, I will try to at least mention those that have had more meaningful contributions.

First of all I want to thank my supervisors for providing support, encouragement and constructive criticism throughout this journey. I am very grateful to have been affiliated with both KTH and University of Gävle and to have benefited from supervision from both institutions. I therefore wish to thank Lars Bengtsson, my main supervisor, for introducing me to the academic world, for enabling the affiliation with the two afore-mentioned universities, for allowing me to pursue the topic that I was passionate about, and for constantly providing wise observations and guidance. I am also grateful to Camilla Niss, my co-supervisor from University of Gävle, for the great attention to detail, for support and good advice, and for always having the door open for me. I also wish to thank Mats Engwall, my co-supervisor from KTH, for always being a cheerful presence at the supervision meetings, for providing sharp comments, and for often bringing different perspectives to our discussions.

Aside from the official supervision team, I have additionally benefited from support, guidance and mentorship from external co-authors and colleagues who have shaped my way of thinking and from whom I have learned a great deal. I would like to thank Wim Vanhaverbeke for taking an active interest in the topic of my dissertation, for opening up a network of contacts for my qualitative studies, and for being a sharp and constructive critic of my work. I also wish to thank Pia Hurmelinna-Laukkanen for being positive and enthusiastic about my early qualitative studies, and helping me to develop these further, as well as for providing constructive feedback. I am grateful to Eva Niesten for sharing the ‘burden’ of the systematic literature review with me and for the nice research visits we exchanged in Gävle and in Manchester. I would further like to thank Paavo Ritala for insightful discussions about paradoxes, disclosure and appropriation and for providing sharp feedback and support. I also wish to thank William Bird for valuable guidance and new perspectives related to my thesis topic.

My work has further been shaped by insightful comments from journal editors and anonymous reviewers. Here I wish to give particular thanks to editors: Francesco Appio, Antonella Martini and Antonio Petruzzelli. Earlier versions of my thesis have also benefited from constructive criticism and valuable comments at formal seminars during my doctoral studies. I would particularly
like to thank **Nicolette Lakemond** for challenging my ideas and providing useful suggestions as opponent for my final seminar. I also wish to thank **Johan Frishammar** for giving valuable feedback and recommendations for future research as opponent at my licentiate seminar. I am further grateful to **Sofia Ritzén** for helpful feedback on my thesis proposal at the KTH Candidate Day during my first year as PhD student. I am also thankful to the quality reviewer of my PhD thesis, **Mats Magnusson**, for valuable insights about paradoxes. Further, I wish to thank the quality reviewer of my licentiate thesis, **Terrence Brown**.

I am grateful to the team of researchers that have developed the Open Innovation Survey (OIS 1.0) – primarily to **Valentina Lazzarotti, Raffaella Manzini** and **Luisa Pellegrini** who coordinated the research group - for providing me access to this survey in the early stages of my doctoral studies. I have also enjoyed our more recent collaboration in designing the OIS 2.0 together. Special thanks here to the Swedish team: **Lars Bengtsson, Mohammad Eslami** and **Nicolette Lakemond**.

Throughout the past years I have further received valuable inputs at PhD workshops and seminars, particularly ones on the topics of open innovation or innovation management. Here I would like to thank **Henry Chesbrough, Patricia Wolf** and **Harry Boer**. During my time as a PhD student I also had the opportunity to participate in research projects outside the topic of my thesis. I am grateful to **Christian Berggren, Filiz Karabag** and **Weihong Wang** for the interesting and fun collaboration in the Rapid Innovators in Emerging Markets project financed by Vinnova. I also wish to thank **Henry Lopez-Vega, Nicolette Lakemond** and **Fredrik Tell** for nice times while collaborating in the research project on Knowledge Integration in Open Innovation.

Although research activities count for the most part of one’s doctoral studies, teaching is also a valuable part of these. My teaching experience has been enhanced by opportunities to teach as guest lecturer abroad. Here I wish to thank colleagues at Lappeenranta University of Technology for inviting me to teach about appropriability issues in open innovation. Thank you for a warm welcome: **Antero Kutvonen, Daria Podmetina, Katja Albats** and **Justyna Dabrowska**. I am also grateful for the opportunity to participate as co-host for the ISPIM Junior Researcher Lab. Thank you **Jane Webb** for making this possible and for being a wonderful organizer, and thank you **Hardik Bhimani** for the teamwork to co-moderate the panel debate.

I am further grateful to all colleagues in CLIP/Indek at University of Gävle for research meetings, workshops and for a nice work environment. I am particularly thankful to **Rodrigo Lozano** for the workshops and seminars on grounded theory and article writing and for putting me in touch with **Eva**.
During the preparations for my licentiate seminar and PhD defense I received a lot of help and support in administrative matters from Elisabeth Lampén and Gülten Baysal at KTH – thank you both for helping me navigate the ‘maze’. I also wish to thank Malin Ekeberg from University of Gävle for being a great help in matters of funding and invoices throughout my doctoral studies. My PhD studies would not have been possible without funding from: Region Gävleborg and Tillväxtverket for research projects in CLIP 3.0 and CLIP 4.0 at University of Gävle, Vinnova for a joint research project between University of Gävle and Linköping University, Danielsson and Styffe foundations at KTH for travel funds.

The time as PhD student would not have been as fun without PhD student colleagues and friends at KTH and University of Gävle. I would like to thank colleagues at KTH for fun times during PhD courses and for help and support – special thanks to Nidal, Serdar, and Yury. I also wish to thank Abid, Abo, Alan, Amer, Ann-Sofie, Arash, Daniel, Hadi, Hanna, Hossein, Ida, Jamila, Lea, Marita, Martin, Mohammad, Pontus, Robert, Sandra, Zheng, Åsa (and others) from University of Gävle for nice fika talks, PhD lunch seminars, after-work outings and much more.

Throughout my PhD journey I also enjoyed the company, advice and support of colleagues and friends from different parts of the world. Thank you Clemens and Astrid for your friendship over the years, for making my visits to Germany so enjoyable and not the least for sharing an interest in the topic of my thesis. Thank you Oana-Maria for countless discussions and support and for the nice visits to Belgium and the Netherlands. Thank you also Karla for wise advice during PhD courses and conferences, and for our sightseeing tours.

Finally, I would like to thank my family members, without whom none of this would have been possible. I wish to thank my grandparents Ion (rest in peace) and Victoria for believing in me and for your support and care. I wish you both could have enjoyed seeing my PhD thesis in print. I further want to thank my parents Aurelia and Gheorghe for teaching me so many things, and for always listening and supporting me, no matter what. I would especially like to thank my dad for being my incentive to pursue this research topic and for awakening my interest in issues related to intellectual property. Last but definitely not least, I wish to thank my husband Vlad for constantly being there for me, for providing support and advice whenever I needed it, as well as for giving feedback to prior drafts of my work.

Ioana Stefan,
Stockholm, 26 October, 2018
List of appended papers

This thesis is based on five appended papers.

Paper 1

A previous version was presented at the Continuous Innovation Network Conference (CINet), September 7–9, 2014, Budapest, Hungary.

Paper 2

A previous version was presented at the World Open Innovation Conference (WOIC), December 4-5, 2014, Napa, California, USA.

Paper 3

A previous version was presented at the Academy of Management Conference, August 10-14, 2018, Chicago, Illinois, USA.

Paper 4

Previous versions were presented at the ISPIM Conference, June 18-21, 2017, Vienna, Austria, and at the R&D Management Conference, July 1-5, 2017, Leuven, Belgium.
Paper 5

Stefan, I. (2018). Disentangling the nature of tensions in Arrow’s paradox of disclosure (manuscript to be submitted for publication).

A previous version was presented at the World Open Innovation Conference (WOIC), December 15-16, 2016, Barcelona, Spain.

Authorship

Papers 1, 2, 4  The thesis author is the main author.

The co-authors of these papers provided valuable contributions to: data collection, research design, drafting and critically revising the manuscripts.

Paper 3  The thesis author and the co-author contributed equally.

Paper 5  The thesis author is the sole author.
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“How wonderful that we have met this paradox.
Now we have some hope of making progress.”

Niels Bohr
1. Introduction

1.1. Introducing a fundamental paradox

It is widely acknowledged by researchers, practitioners and policy makers that organizations seldom innovate in isolation anymore (Chesbrough, 2003; Chesbrough, 2017; Dyer & Singh, 1998; Organisation for Economic Co-operation and Development, 2008; Rigby & Zook, 2002; West & Bogers, 2017). The benefits of collaborating with external partners in innovation include sharing risks and costs, tapping into partners’ complementary resources, reducing time to market and much more (Bengtsson et al., 2015; Chesbrough & Vanhaverbeke, 2018; Faems et al., 2005; Hagedoorn, 1993; Huang & Rice, 2009; Lakemond et al., 2016; Lazzarotti & Manzini, 2009; Teece, 1986). At the same time, researchers, practitioners and policy makers acknowledge critical challenges that may occur in interorganizational innovation collaboration (Ollila & Elmquist, 2011; Salter et al., 2014; Van de Vrande et al., 2009; West & Gallagher, 2006; Westerlund & Leminen, 2011). One such challenge relates to tensions between opening up the innovation process to external stakeholders and appropriating benefits from that endeavour.

Arrow (1962) illustrated this as a “fundamental paradox” (p. 615) in settings of arm’s-length transactions, where an inventor selling an idea is challenged by the need to disclose information about the idea to make a potential buyer interested and, at the same time, by the need to appropriate benefits from the sale. Some subsequent studies refer to this as the paradox of disclosure; this thesis will use the paradox of disclosure designation henceforth. Scholars have recently pointed out the increasingly complex tensions related to the paradox of disclosure in contemporary interorganizational innovation collaboration settings (see Buss & Peukert, 2015; Laursen & Salter, 2014). Such tensions related to the paradox of disclosure have been investigated from different perspectives in various streams of literature. For instance, some prior studies emphasize the perspective of tensions between value co-creation and value capture (e.g. Cassiman et al., 2009), others the perspective of openness-appropriability (e.g. Laursen & Salter, 2014) and still others emphasize tensions of disclosure and appropriation (e.g. Gans et al., 2017). These dyads
represent slightly different yet overlapping viewpoints on the paradox of disclosure. All three above-mentioned perspectives are considered in this thesis, but the overarching perspective is that of tensions between value co-creation and value capture. If not effectively managed, tensions related to the paradox of disclosure might have severe negative outcomes. Despite the relevance of understanding such tensions and how to manage them, previous research has not reconciled these (Giarratana & Mariani 2014; Lorenz & Veer, 2017).

In practice such tensions are sometimes also difficult to reconcile. One example is the case of Infoflows (a start-up) and Corbis (a large digital library). According to Lohr (2010), Infoflows had developed a technology to track digital objects, and Corbis, who was its one big customer, signed a collaboration agreement with the start-up. The two parties agreed that the technology would not be patented until later on in the collaboration, when they would have developed it further. A few months into the collaboration, after Infoflows had revealed more about the new technology, Corbis suddenly announced the cancellation of the collaboration agreement. Several months later, when Infoflows launched a new website, presenting the previously developed technology, Corbis sued, claiming Infoflows was infringing on Corbis proprietary technology. Infoflows sued back and, after approximately three years of lawsuits, a US court found Corbis guilty of having infringed upon Infoflows’ trade secret. However, such verdicts involving misappropriation of trade secrets are rare, because it is a matter that is very difficult to prove in court (Lohr, 2010). Similar examples of such tense asymmetric partnerships can be found in the media, for instance the case of a Swedish start-up and Swedish banks (see Björk, 2018).

As illustrated in the above example of Infoflows and Corbis, in the event of misappropriation of intellectual property (IP) in a partnership, one of the partners could be left with little or no profits. For smaller organizations, such as start-ups, not profiting from an idea might mean that they simply do not survive. Nevertheless, misappropriation is also a challenge beyond the realm of start-ups. For instance, a report from a European Commission conference (EC, 2012) draws attention to the potential repercussions of misappropriation for companies in general. Representatives of several large companies, such as
Alstom, DuPont and Michelin, participating at this European Comission conference provided examples of misappropriation of trade secrets that their companies had experienced. Misappropriation could have negative impacts on organizations’ revenues as well as on overall innovation and economy growth. The following refers to a statement by Patrick Ozoux, Head of the EU Representation Office at Michelin:

Mr Ozoux (Michelin) recalled that trade secrets have a jobs and growth dimension. A company whose trade secrets are misappropriated will lose competitiveness, will lose growth and jobs. (EC, 2012, p. 24)

Moreover, misappropriation is a matter that not only concerns trade secrets, but also patented knowledge and IP in general (e.g. Autio & Acs, 2010; Besen & Raskind, 1991; Robinson, 2012). Even when misappropriation does not occur, challenges related to fear of misappropriation may create a lack of incentives to innovate. For instance, a recent study by Lorenz and Veer (2017) shows that firms that have experienced misappropriation while not relying on formal appropriation mechanisms, i.e. not using patents, were less likely to engage in future R&D collaboration. This might lead to unwanted outcomes: for instance, failing to co-create value between partners. Finally, misappropriation or risks thereof also raise issues of ethics and fairness.

From the above examples, it seems that neither researchers nor practitioners nor policy makers have found a clear way of managing tensions between co-creating and capturing value to avoid misappropriation and allow for technological progress and economic growth. In research, particularly, there is also somewhat of a conceptual ambiguity surrounding the paradox of disclosure and related tensions, partly due to the different labels and constructs used in analyses in various literature streams. For instance, the fundamental paradox signalled by Arrow (1962) has been dubbed as a disclosure problem (e.g. Shane, 2002), paradox of disclosure (e.g. Dushnitsky & Shaver, 2009), information paradox (e.g. Lemley, 2012) and several other labels. Additionally, some studies call it a paradox (e.g. Gans & Stern, 2003; Laursen & Salter, 2014), others a dilemma (e.g. Anton & Yao, 2002) and still others use both terms interchangeably (e.g. Bogers, 2011). And although dilemmatic and
paradoxical tensions might be overlapping, they are also slightly different from one another (see, e.g., Lüscher & Lewis, 2008; Smith & Lewis, 2011). Moreover, the notion of paradox is often used metaphorically in analyses related to the paradox of disclosure. Nevertheless, studies on organizational paradox theory pinpoint that paradox is an increasingly used but insufficiently defined concept (see Handy, 1994; Lewis, 2000; Schad et al., 2016; Smith & Lewis, 2011). Paradox theorists suggest that we do not fully grasp complex phenomena such as paradoxes because we do not investigate them through a paradox lens (Poole & Van de Ven, 1989; Schad et al., 2016; Smith & Lewis, 2011). It should be noted here that the paradox of disclosure is primarily a metaphorical label, among other labels (as described above) used for dubbing a complex phenomenon. This is investigated by applying a paradox theory lens in order to better capture its intricacies and depths.

Although researchers call tensions between co-creating and capturing value paradoxical (see, e.g., Ritala & Hurmelinna-Laukkanen, 2009; Wadhwa et al., 2017), and the related paradox of disclosure was designated as a “fundamental paradox” by Arrow (1962; p. 615), studies that investigate the paradox of disclosure through paradox theory lens are scant. Thus, extant research is missing a deeper understanding of this paradox and tensions associated with it.

1.2. Purpose and research questions

As showed in the previous section, the knowledge gaps concerning the paradox of disclosure relate to a lack of reconciliation of tensions between co-creating and capturing value, conceptual ambiguity and an overall lack of a deeper understanding of the phenomenon.

To narrow the above-mentioned gaps, this study applies a paradox theory lens to investigate the paradox of disclosure and related tensions to co-create and capture value. The structure of the research questions is inspired by concepts highlighted in the seminal study of Smith and Lewis (2011). Paradox theory is thus used as a tool for providing a more comprehensive analysis of this topic.
The overall purpose of this thesis is to gain a deeper understanding of the paradox of disclosure and related tensions between value co-creation and capture in open innovation settings, by using a paradox lens. This is achieved by exploring the underlying contradictions in the paradox of disclosure, identifying factors that lead to value co-creation and capture tensions, and pinpointing potential solutions and pitfalls to managing such tensions.

Qualitative and quantitative data analyses, as well as a systematic literature review and a discussion paper, combine to fulfil the purpose.

The purpose is further specified in the following research questions:

Q1: What characterizes the tensions between co-creating and capturing value?

Q2: What factors create tensions between value co-creation and value capture?

Q3: What are possible solutions and pitfalls to managing tensions between value co-creation and value capture?

The three research questions are answered by five studies, henceforth referred to as P1–P5.

1.3. Focus and limitations

Next the boundaries of each of the five appended studies are specified, in order to provide better insight into their theoretical and empirical focus and limitations. Three of the five studies appended to this thesis are empirical (P1, P2 and P4), and two conceptual (P3 and P5). The empirical studies are anchored in open innovation settings, and therefore a major part of the theory in these studies also draws from open innovation literature. Figure 1 summarizes the perspectives taken by each study, the type of methods used and the settings.
The quantitative papers P1 and P2 focus on tensions related to openness and appropriability (following Laursen & Salter, 2014), and are limited to inbound open innovation settings, for respondents from three European countries (Finland, Italy and Sweden) in the manufacturing sector. Inbound open innovation refers to searching and absorbing external knowledge into the innovation process (Bengtsson et al., 2015; Chesbrough, 2003).

The qualitative study P4 takes the perspective of tensions between value co-creation and value capture, i.e. going beyond the constructs used for openness and appropriability in the quantitative studies. Moreover, the qualitative study analyses bidirectional coupled or interactive coupled open innovation processes (Piller & West, 2014). Bidirectional entails combined inbound and outbound open innovation (Gassmann & Enkel, 2004; Piller & West, 2014), while interactive translates into creative interorganizational collaboration.
processes pertaining to the joint development of new products, services or processes (Piller & West, 2014). The interviewed informants are based in the EU and the USA.

The systematic literature review P3 takes a broader view of tensions between value co-creation and value capture, surveying literature from the fields of management, economics and marketing. Although many of the studies surveyed in P3 pertain to co-creation of innovation, the definitions used here refer to value in a broader sense, in order to also encompass the studies that do not refer to interorganizational innovation collaboration (definitions can be found in the theory section of the appended P3). The majority of studies assessed in P3 analyse dyadic interorganizational relationships (IORs), yet few of the studies concern multi-partner IORs.

The conceptual study P5 takes the perspective of tensions between disclosure and appropriation, particularly concerning technological innovation. The propositions suggested by P5 could be tested in open innovation settings but also in other kinds of interorganizational innovation partnerships.

1.4. Thesis outline

As previously mentioned, this thesis combines three perspectives on the paradox of disclosure and related tensions. These three perspectives overlap yet differ from one another; thus, they complement each other. The overarching perspective is that of tensions between co-creating and capturing value, as this is the broadest of the three.

The remainder of this thesis is structured as follows. Chapter 2 contains the theoretical framework for this thesis. In this chapter, paradox is defined and illustrated first in logic and philosophy, and then in management studies, particularly focusing on the model suggested in the seminal study by Smith and Lewis (2011). Chapter 2 further describes the three perspectives on the paradox of disclosure emphasized in this thesis. Chapter 2 further provides a brief overview of such tensions in open innovation literature, since the empirical part, and the theoretical part for some of the appended papers pertain to open innovation. Chapter 3 describes the methods used for the quantitative, qualitative and conceptual studies and provides some insights
into the overall quality of the methods. Chapter 4 summarizes the purpose, research questions and results of each of the five appended studies. Chapter 5, the Discussion, is structured around the three research questions of the thesis. Chapter 6 provides a summary of conclusions, as well as specific contributions and implications for theory and practice.
2. Theoretical framework

2.1. Using paradox theory as a lens

2.1.1. Paradox in logic and philosophy

Paradoxes could be viewed as atoms of philosophy or, more simply, as riddles. The former considers paradox to be the point where investigation begins (Sorensen, 2003). Quine (1966) defines paradox as follows:

A paradox is just any conclusion that at first sounds absurd but that has an argument to sustain it (…) the argument that sustains a paradox may expose the absurdity of the buried premise or of some preconception previously reckoned as central to physical theory, to mathematics, or to the thinking process. (p. 1)

The concept of paradox is rooted in Eastern as well as Western philosophies; while in the former it is best represented by the yin-yang symbol, emphasizing antipodes and their underlying completeness, the latter highlight contradictory and interdependent elements, favoring rhetorical paradoxes that appear absurd (Schad et al., 2016). Modern philosophers have often combined Eastern and Western interpretations of paradox (Schad et al., 2016). Among the more well-known folk paradoxes is the paradox formulated as question: which came first, the chicken or the egg? Since every chicken comes from an egg, and each egg from a chicken, this seems a puzzling riddle. Scholars partial to Aristotle might argue that neither chicken nor egg came first – Aristotle favored the perspective that there was an infinite connection between finite elements. Darwinian theory of evolution might suggest a different answer to this riddle, hinting that either egg or chicken must have come first.

A different example of paradox emphasizes the irrational result \(2 = 1\). Specifically: if \(x = 1\), therefore one could argue that \(x^2 = x\) and that by subtracting 1 the result would be \(x^2-1 = x-1\), also represented as \((x+1)(x-1) = x-1\). Furthermore, dividing by \((x-1)\) the answer would be \(x+1 = 1\), resulting in the paradoxical \(2 = 1\). The answer to this is easier to identify, since if \(x = 1\) one couldn’t divide by \((x-1)\) as it equals 0 (Quine, 1966).
Certain phenomena or theories were regarded as paradoxes also because they seemed impossible to grasp at the time they were introduced. Dell (1986) highlights that:

“[...] for years afterward, even the scientists who believed Copernicus referred to his heliocentric model as "The Copernican Paradox." To see the earth revolving around the sun as being "natural" rather than "paradoxical" was just too much to achieve quickly. (p. 2, italics in the original)

Based on the above example, the notion of time appears to be highly relevant for paradoxes in logic and philosophy. The discussion about time will continue in the next section and in chapter 5 of this thesis. The following section presents paradox in organizational studies.

2.1.2. Paradox and tensions in organizational management

Paradox in the organizational sciences is regarded from a slightly different viewpoint than that of paradox in logic and philosophy. Specifically, paradox in logic consists of two opposite premises that are supported by arguments that appear to be logical (Poole & Van de Ven, 1989, citing Heigenoort, 1972). Paradox in organizational studies highlights contradictory yet interrelated elements that need to be balanced simultaneously (Lewis, 2000; Schad et al., 2016; Smith & Lewis, 2011). Paradox theory emerged as a subfield of organizational management studies approximately three decades ago (Schad et al., 2016). Paradox scholars point out that paradox could be a useful lens for understanding complex phenomena (Cameron & Quinn, 1988; Lewis & Smith, 2014; Poole & Van de Ven, 1989; Schad et al., 2016):

[Paradox] offers a powerful lens for management science, providing deeper understandings of constructs, relationships, and dynamics surrounding organizational tensions, while also enriching extant theories and processes of theorizing. (Schad et al., 2016, p. 3)

Among the first seminal studies that tackled paradox in management were Smith and Berg (1987), Quinn and Cameron (1988) and Poole and Van de
Ven (1989). The latter, for instance, advocate an interest in paradox “in the lay sense – in the interesting tensions, oppositions, and contradictions between theories which create conceptual difficulties” (Poole & Van de Ven, 1989, p. 564). Poole and Van de Ven (1989) further emphasize that using paradox as a lens would enable the studying of complex realities rooted in contrasting elements. Over time, paradox definitions have developed; more recent definitions seem to converge (in a broader sense) towards the concept of contradictory yet interdependent elements (see Putnam et al., 2016; Smith & Lewis, 2011; Schad et al., 2016). Some of these definitions also emphasize a persistence over time (e.g. Putnam et al., 2016). However, in the present thesis paradox is viewed as two contradictory yet interdependent elements (or poles), excluding time. A main reason for this is that paradox scholars such as Poole and Van de Ven (1989) suggest time as one of four alternatives to manage paradox. In this they assume that one pole of the paradox occurs in one period of time, and the other pole in a different time period – even though clear temporal delineation is difficult to reach (Poole & Van de Ven, 1989). This example could indicate that time is rather a tool for managing paradoxical tensions than an aspect that helps delineate paradox. An implicit part of paradoxes appears to be tensions. According to Poole and Van de Ven (1989), tensions emerge from contradictions between interdependent elements. The recent review by Putnam et al. (2016) defines tensions as:

\[
\text{Stress, anxiety, discomfort, or tightness in making choices, responding to, and moving forward in organizational situations (p. 68)}
\]

This definition of tensions is also used in this thesis and appended studies. According to Smith and Lewis (2011), paradoxical tensions emerge between contradictory yet interlinked elements, but such tensions remain latent (dormant) unless triggered to render salient, i.e. experienced by actors (Smith & Lewis, 2011). Salient tensions are spurred by contextual factors related to plurality, scarcity, change and increased globalization and competition (Smith & Lewis, 2011). In the following subsection these categories of factors are described within the dynamic equilibrium model proposed by Smith and Lewis (2011).
2.1.3. A dynamic equilibrium model for managing paradox

The dynamic equilibrium model suggested by Smith and Lewis (2011) describes a cycle. At the start of the cycle there are latent tensions, i.e. tensions that are not perceived by actors; however, in the presence of contextual factors that exacerbate latent tensions, such as factors related to plurality, scarcity, change, and increased globalization and competition, latent tensions may turn into salient ones (Smith & Lewis, 2011). They define salient tensions as tensions that are perceived by actors. Plurality-related factors pinpoint distinct goals that different actors may have (Smith & Lewis, 2011), which may lead to misaligned goals, potential conflicts and uncertainty. Change-related factors emphasize friction between short- and long-term views or current and future demands (Lüscher & Lewis 2008; Smith & Lewis, 2011). Scarcity-related factors pinpoint the finite quantity of resources, which can create tensions between competing needs (Smith & Lewis, 2011). Contemporary settings are increasingly global and fast paced, relying on frontline technologies, all of which exacerbate competition (Smith & Lewis, 2011). These types of factors create pressure due to their emphasis on competing demands, conflicting goals, etc. (Smith & Lewis, 2011). When salient tensions are spurred by such factors, managing said tensions may turn out to be a difficult task.

Salient tensions occur between the two poles of a paradox. Hence, when attempting to manage tensions it may appear as an easier fix to favour one of the poles instead of balancing both simultaneously (Smith & Lewis, 2011; also see Lüscher & Smith, 2008). The latter would lead to so-called virtuous cycles; the former, however, is likely to result in so-called vicious cycles (Smith & Lewis, 2011). The virtuous cycles imply embracing paradox and attempting to achieve balance between its poles. This comes from regarding tensions as favourable circumstances, enabling creativity (Beech et al., 2004; Smith & Lewis, 2011). Vicious cycles entail overemphasizing one pole of the paradox while overlooking the other. In this case there would be imbalance between the poles and hence the tensions would not be effectively managed.
2.2. Different perspectives on the paradox of disclosure

2.2.1. From arm’s-length transactions to open innovation

In 1962 Kenneth Arrow suggested a paradox that occurs when a so-called seller wishes to sell an invention to a potential buyer:

[T]here is a fundamental paradox in the determination of demand for information; its value for the purchaser is not known until he has the information, but then he has in effect acquired it without cost. Of course, if the seller can retain property rights in the use of the information, this would be no problem, but given incomplete appropriability, the potential buyer will base his decision to purchase information on less than optimal criteria. (Arrow, 1962, p. 615)

The fundamental paradox as Arrow (1962) introduced it appears to stress simultaneous needs to disclose enough information about the invention to interest the potential buyer yet to conceal information, so that the buyer does not acquire the (idea for the) invention for free. The paradox of disclosure has been investigated since then under various labels, in different settings and different fields of study (e.g. economics, law, management). A more detailed list of examples of such labels and fields of study may be found in P5, Table 1. Because of this variety of interpretations, the paradox of disclosure may be viewed from different perspectives. When introducing the perspectives that are investigated in this thesis, it may also be relevant to establish what has changed from Arrow’s (1962) seminal study to contemporary times.

In the more than 55 years following Arrow’s (1962) seminal study, numerous streams of literature in different fields of study have investigated the paradox of disclosure from slightly distinct perspectives. During this time, innovation management has evolved and several new trends have emerged, one of these being open innovation (Frishammar et al., 2018). Such trends as open innovation add a series of mechanisms and possibilities that are crucial for an improved understanding of innovation and innovation management, particularly in manufacturing firms (Frishammar et al., 2018). Specifically, the trend to open up the innovation process highlights risks of unintended
knowledge spillovers (Frishammar, Ericsson, & Patel, 2015; Frishammar et al., 2018). From the settings of an arms’-length transaction (Arrow, 1962), the paradox of disclosure has during the past 50 or so years transposed into a richer variety of tensions (see also Laursen & Salter, 2014). Specifically:

This paradox of disclosure applies also to a range of external interactions between the innovating firm and the external environment, beyond the commercial transaction of selling the idea. (Laursen & Salter, 2014, p. 869)

This section has implicitly hinted at different perspectives on the paradox of disclosure. The initial one, implied in Arrow’s (1962) fundamental paradox, concerns tensions between disclosing information (about an intangible asset such as an idea) and appropriating benefits from that intangible asset. Contemporary research in open innovation emphasizes a new perspective related to tensions between openness and appropriability. However, this perspective appears to be included in a broader perspective highlighted by open innovation literature, alliance literature and other such literature streams – that of value co-creation and value capture. These three perspectives are combined in this thesis. In the following two sections, tensions in open innovation are emphasized, due to the three empirical studies’ focus on open innovation, and afterwards the three perspectives on tensions related to the paradox of disclosure are presented.

### 2.2.2. An open innovation perspective on tensions

The term *open innovation*, coined by Henry Chesbrough (2003), refers to purposive flows of knowledge across the boundaries of organizations (Chesbrough & Bogers, 2014). Open innovation has become a popular topic in both academic circles (see, e.g., Bogers et al., 2017; Dahlander & Gann, 2010) and in practice (Chesborough & Bogers, 2014), though not without critique (e.g. Groen & Linton, 2010; Trott & Hartmann, 2009). In spite of the growing attention paid to open innovation, scholars point out that the concept of openness is not stringently defined (e.g. Dahlander & Gann, 2010). In their review of open innovation, Dahlander and Gann (2010) emphasize that capturing openness has been achieved via different measures:
The extant literature presents the concept of openness in quite different ways; Laursen and Salter (2006a) equate openness with the number of external sources of innovation, whereas Henkel (2006) focuses on openness as revealing ideas previously hidden inside organizations. (p. 700)

Prior studies tend to focus on the advantages of openness while overlooking possible downsides. To this end, Dahlander and Gann (2010) propose a model of inbound and outbound open innovation, where each of the two can be either pecuniary or non-pecuniary. The outbound non-pecuniary openness is linked with the disclosure of ideas and secrets, and defined as follows: “firms reveal internal resources without immediate financial rewards, seeking indirect benefits to the focal firm” (Dahlander & Gann, 2010, p. 703). The outbound non-pecuniary openness may present difficulties when appropriating benefits sourced from the disclosure of information about internal assets (Dahlander & Gann, 2010). Moreover, being overprotective with internal resources might also represent a challenge in commercializing ideas. The pecuniary type of openness concerns the way “firms commercialize their inventions and technologies through selling or licensing out resources developed in other organizations” (Dahlander & Gann, 2010, p. 704). While selling ideas has upsides in the case of “Rembrandts in the attic” (also see Rivette & Kline, 2000), Dahlander and Gann (2010) also signal potential downsides, exemplifying the “fundamental paradox” proposed by Arrow (1962).

Inbound non-pecuniary openness relates to the use of knowledge sources from outside the focal firm/organization, while pecuniary openness links to purchasing external knowledge (Dahlander & Gann, 2010). Advantages of non-pecuniary openness include combining internal and external knowledge assets (Dahlander & Gann, 2010), yet prior studies also emphasize downsides related to e.g. over-search (see Katila and Ahuja, 2002; Laursen & Salter, 2006). While pecuniary inbound openness has similar benefits to the non-pecuniary variety, buying external knowledge imposes the need to further integrate such knowledge (Dahlander & Gann, 2010). Theoretical concepts such as absorptive capacity (Cohen & Levinthal, 1990) or knowledge integration (Berggren et al., 2011; Lakemond et al., 2016) include internal
mechanisms and capabilities required to assimilate and integrate externally sourced knowledge (Dahlander & Gann, 2010). The four types of openness in Dahlander and Gann’s (2010) taxonomy are not necessarily mutually exclusive. Although both pecuniary and non-pecuniary outbound openness resemble the perspective of the seller in Arrow’s (1962) paradox, if considering such open innovation as the so-called coupled process coined by Gassman and Enkel (2004), it becomes apparent that risks related to disclosing knowledge and selling it may not be exclusive to one party in the collaboration. Moreover, recent studies investigate tensions related to the paradox of disclosure in inbound open innovation (e.g. Laursen & Salter, 2014), thus supporting the idea that this paradox may be present in several types of openness: inbound, outbound, and even coupled. Such recent studies emphasize tensions between openness and appropriability.

Teece (1986) defined the appropriability regime as: “the environmental factors […] that govern an innovator’s ability to capture the profits generated by an innovation” (p. 287). Essential dimensions of the appropriability regime are the “nature of technology” and “the efficacy of the legal mechanisms of protection” (Teece, 1986, p. 287). Appropriability refers to the ability to capture rents from a commodity (e.g. a product or invention), and some scholars regard it as having monopoly over an idea, invention, etc. (see Levin et al., 1987). To this end, previous studies suggest various so-called appropriability mechanisms such as patents and trade secrets that would ensure the capture of benefits (see Cohen, Nelson, & Walsh, 2000; Hertzfeld, Link, & Vonortas, 2006; Laursen & Salter, 2014; Levin et al., 1987). These mechanisms are also called intellectual property protection mechanisms (IPPMs).

Prior studies use various constructs to measure appropriability, usually focusing on IPPMs (e.g. Laursen & Salter, 2014), yet few have attempted to develop the appropriability constructs by adding items related to labour legislation in employment contracts, human resource management, tacitness of knowledge and complexity of the product or process (e.g. Hurmelinna-Laukkanen, 2011).
The commonly investigated appropriability mechanisms, i.e. IPPMs, are often categorized as formal and informal ones. The former include patents, designs, trademarks and copyrights, while the latter cover trade secrets, lead times and product complexity (see Hall et al., 2014). However, there are also other ways of classifying IPPMs. Particularly the categorization of informal IPPMs leaves some room for discussion: while some prior studies regard trade secrets as informal IPPMs (see, e.g., Hall et al., 2014), according to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), confidentiality agreements (or similar) are necessary so that a trade secret can be considered valid from a legal perspective. This could imply that nondisclosure agreements and trade secrets constitute a separate category of IPPMs. IPPMs may also have different roles, besides that of protecting intellectual property (IP). For instance, prior studies point out that patents may also take roles of signalling, coordinating (Penin, 2005) or being codes for knowledge (Burk, 2008). The use of IPPMs may vary across industries and firm sizes (see Neuhäusler, 2012).

Effectively managing IP is essential in order to sustain competitive advantage (Appio et al., 2014; Di Minin & Faems, 2013). Yet this is often a challenging task, particularly so when it comes to appropriability in innovation partnerships (Eppinger & Vladova, 2013; Frishammar et al., 2015; Granstrand & Holgersson, 2014; Veer, Lorenz, & Blind, 2016; Zobel, Lokshin, & Hagedoorn, 2017). Moreover, tensions related to opening up the innovation process and appropriating value from this endeavour are yet to be reconciled (Laursen & Salter, 2014; Lorenz & Veer, 2017).

2.2.3. Combining three perspectives on the paradox of disclosure

As explained previously in Chapter 1, the three perspectives combined in this thesis concern tensions between three dyads (or pairs) of elements: value co-creation and value capture, openness and appropriability, and disclosure and appropriation. The former is considered to be the overarching perspective. The overarching perspective entails broader concepts than the other two perspectives. It should also be noted here that there are other related perspectives in prior studies. For instance, a recent study by Lauritzen and Karafyllia (2018) emphasizes the perspective on tensions between openness and control. However, due to the emphasis on appropriability and value
capture, this thesis only combines the three above-mentioned perspectives. The elements in such pairs of dyads as the three investigated in this thesis could be regarded as being contradictory yet interdependent. Therefore, each of these dyads of interrelated and contradictory elements might be viewed as a pair of poles, in line with paradox theory studies (e.g. Smith & Lewis, 2011; Schad et al., 2016). Between the potential poles of a paradox there are tensions. Although such tensions are not yet fully defined or categorized in extant literature, nor is it the scope of this thesis to do so, prior studies do provide some examples of how such tensions may unfold in relation to the paradox of disclosure.

For instance, some scholars argue that conflicting mechanisms and strategies may be required for value co-creation and value capture. Khalid and Larimo (2012) emphasize that value creation is linked to sharing mechanisms, while Veer et al. (2016) suggest that value appropriation calls for appropriation mechanisms. Moreover, it may be necessary to attribute finite resources between the two poles (Capaldo & Petruzzelli, 2011; Mizik & Jacobson, 2003). Another source of tensions might be that value co-creation and appropriation are likely to occur at different levels; value co-creation may at times happen at an interorganizational level, whereas value capture is most often situated at the organizational level (Capaldo & Petruzzelli, 2011; Ritala et al., 2013). A further example of tensions could be the division of resources shared between partners in an interorganizational innovation collaboration: appropriating value is meant to divide only those resources pooled between partners, yet there is the potential risk that non-pooled resources are drawn in (Lavie, 2006). These examples of tensions between creating and capturing value could overlap, making it difficult to distinguish between them or to categorize them. As previously mentioned, the value co-creation - value capture perspective is rather commonly encountered as an overarching theoretical perspective in open innovation studies (see, e.g., Appleyard & Chesbrough, 2017; Laursen & Salter, 2014). In open innovation literature, Dahlander and Gann (2010) specifically take up Arrow’s (1962) paradox in the case of outbound pecuniary openness, i.e. when “firms commercialize their inventions and technologies through selling or licensing out resources developed in other organizations” (p. 704), stating:
Understanding the disclosure paradox calls attention to the means of appropriability in open innovation, and how firms attempt to be open yet are able to appropriate commercial returns from their innovative efforts. (p. 704)

This quote emphasizes the linkages and overlap between the openness-appropriability dyad and the disclosure-appropriation dyad. Later studies highlight the paradox of disclosure in relation to inbound openness. Laursen and Salter (2014) also draw linkages between pecuniary and non pecuniary inbound openness:

We find that managerial attitudes to openness and appropriability are very closely connected. This suggests that a firm’s inbound open innovation, which Dahlander and Gann (2010) describe as often having a “non-pecuniary” logic, may in fact be strongly influenced by that firm’s “pecuniary” logic, manifested by its appropriability strategy. (p. 876)

The aforementioned quotes suggest that the paradox of disclosure and the related tensions between (co)creating and capturing value are spread over the whole spectrum of openness, not confined to pecuniary outbound openness alone, i.e. when attempting to sell ideas in the markets for technology. Tensions related to the paradox of disclosure in open innovation literature are often investigated by using openness and appropriability constructs (see Laursen & Salter, 2014; Zobel et al., 2017). In open innovation literature, openness is often measured in terms of depth and breadth of collaboration with various types of partners, and appropriability in terms of formal and informal intellectual property protection mechanisms (IPPMs) in use (see, e.g., Aloini et al., 2017; Manzini & Lazzarotti, 2016). However, the two perspectives of openness-appropriability and value co-creation - value capture do not fully overlap. Henkel (2006) highlights this in particular, referring to the distinction between protecting innovation and capturing value from innovation:
There is a long-standing debate on how profits from innovations can best be appropriated. This discussion usually makes an implicit a priori: It presupposes that exclusivity is desirable for the innovator. It thus focuses on the protection of innovations, while what actually matters is appropriation of profits from innovation. The two often go along with each other—but there are important exceptions. (p. 966)

The third perspective included in this thesis is that implicitly emphasized by Arrow (1962). Specifically, the value of a “piece of information” is unknown to a potential buyer until the seller reveals information about it; however, at this point the potential buyer may have acquired the information at no cost. The paradox of disclosure was thus initially framed in the settings of arm’s-length transactions. This perspective seems to stress the disclosure-appropriation relationship, implicitly highlighted in the seminal study of Arrow (1962). The degree of revealing (or disclosure) versus appropriation has been subsequently analysed, on one hand with the help of econometric models (see e.g. Anton & Yao, 1994), on the other hand, in more recent management studies that suggest strategies such as selective or gradual revealing (see, e.g., Alexy, George, & Salter, 2013; Henkel, 2006; Micelli, 2011).

The three perspectives highlighted in this thesis overlap but not fully. It could be argued that they represent different levels of analysis. For instance, disclosing information is inherent in outbound open innovation (Dahlander & Gann, 2010), yet reluctance to reveal due to fear of potential misappropriation in outbound open innovation (Dahlander & Gann, 2010) may also affect actors that are searching for external knowledge, i.e. inbound open innovation. Disclosure could thus be included as a subdimension in several dimensions of openness, for instance collaboration depth with different types of partners. However, extant research requires more clarity regarding the extent of overlap of the different perspectives presented above, as well as concerning the extent to which they might represent distinct levels of analysis.
2.3. Analysis model

As the previous section concludes, analysts are very important for investors and money managers because they must evaluate hundreds of companies when choosing which stocks to invest in. As mentioned in section 1.2., the overall purpose of this thesis is to gain a deeper understanding of the paradox of disclosure and related value co-creation - value capture tensions by using a paradox theory lens. This purpose is fulfilled by investigating what characterizes tensions between value co-creation and capture related to the paradox of disclosure, pinpointing factors that create such tensions, and suggesting possible solutions and pitfalls to managing such tensions. To reiterate, the three research questions that further specify the purpose are:

Q1: What characterizes the tensions between co-creating and capturing value?
Q2: What factors create tensions between value co-creation and value capture?
Q3: What are possible solutions and pitfalls to managing tensions between value co-creation and value capture?

The three research questions are illustrated in the analysis model in Figure 2.

The analysis model in Figure 2 has at its centre the two supposed paradox poles, i.e. value co-creation and value capture. The previous chapters have emphasized conceptual ambiguity surrounding the paradox of disclosure. This ambiguity partly relates to different labels and constructs used to investigate tensions linked to Arrow’s (1962) paradox of disclosure, and partly concerns overlapping yet distinct types of tensions signalled in paradox theory, e.g. dilemmatic versus paradoxical or dialectical (Smith & Lewis, 2011). Such ambiguity might blur the understanding of tensions between value co-creation and value capture. Therefore, the first research question relates to this conceptual ambiguity and refers to the possible interdependency and contradiction between the two poles, which would in turn make the tensions between them paradoxical.
As suggested by paradox theory (e.g. Smith & Lewis, 2011), tensions are spurred by various contextual factors relating to plurality, scarcity, change and increased competitiveness and globalization (Smith & Lewis, 2011). The second research question of this thesis thus aims to pinpoint such factors and further relate them to the four categories suggested by Smith and Lewis (2011). Identifying such factors would be a further step towards understanding when tensions related to the paradox of disclosure might occur and effectively managing those tensions.

The third research question refers to pinpointing both pitfalls and solutions for managing tensions between value co-creation and value capture. These relate to the vicious and virtuous cycles, respectively (Smith & Lewis, 2011).

Figure 2. Overall analysis model
Vicious cycles entail the overemphasis of one paradox pole, while overlooking the other (Smith & Lewis, 2011). For the value co-creation - value capture liaison, this would translate into either overemphasizing value co-creation, and thus not capturing (sufficient) value, or focusing too much on value capture, and thus failing to co-create value. Either of these alternatives would be a pitfall, as it would fail to balance value co-creation and value capture. Virtuous cycles imply embracing paradox and managing to balance its two poles simultaneously (Smith & Lewis, 2011). In the context of co-creating and capturing value, this would entail effectively managing tensions between these two poles – for instance, successfully allocating limited resources to both value co-creation and value capture.
3. Methods

3.1. Overall research design

This thesis set out to investigate a real-life, contemporary phenomenon, which stems from the “fundamental paradox” of disclosure proposed by Arrow (1962, p. 615). Paradox theory scholars suggest adopting a paradox lens for gaining better understanding of complex phenomena (Cameron & Quinn, 1988; Poole & Van de Ven, 1989; Lewis & Smith, 2014; Schad et al., 2016). Therefore, I adopt a paradox lens with the overall aim of gaining deeper understanding of the intricate phenomenon of paradox of disclosure in contemporary open innovation settings (see e.g. Laursen & Salter, 2014).

To gain a deeper understanding of this phenomenon, I follow several core concepts from paradox theory studies. Here, the main reference is the study by Smith and Lewis (2011). Concepts and models proposed there are used to structure the research questions and the analysis model of this thesis. The study by Smith and Lewis (2011) was chosen because it is considered to be one of the seminal studies in paradox theory (see, e.g., Schad et al., 2016) and because it is a highly cited study, published in a leading management journal, Academy of Management Review. Moreover, I consider both the delineation Smith and Lewis (2011) made between overlapping yet distinct tensions and the dynamic equilibrium model they suggest for paradoxical tensions to be particularly suitable for shedding more light on the paradox of disclosure.

In designing this study, I employed a combination of all three spotting categories suggested by Sandberg and Alvesson (2011): confusion spotting relates to concurrent explanations; neglect spotting concerns either over- or underinvestigating a topic, or even a lack of empirical support; and application spotting pertains to identifying new avenues to apply a specific theory in a particular research area. First, the phenomenon investigated, the paradox of disclosure, had competing definitions in the previous literature, labelled as either paradox or dilemma. Moreover, previous research lacked a framework that would unify the scattered studies investigating the paradox of disclosure and summarize factors that might spur tensions related to this paradox. Second, although there seemed to be an overinvestigation of the paradox of
disclosure, its depths remained underexplored by most studies. Third, paradox theory had not yet been used as a lens to study this particular phenomenon, in spite of the suggested benefits of the paradox lens (see, e.g., Putnam et al., 2016; Schad et al., 2016; Smith & Lewis, 2011).

The present thesis adopts a mixed methods approach. Three of the appended papers are empirical studies (P1, P2 and P4), employing quantitative (P1 and P2) and qualitative (P4) methods, while two are conceptual (P3 and P5): one is a systematic literature review (P3) and the other a discussion paper (P5). The five papers adopt three perspectives on the tensions related to this paradox. These three perspective focus on three possible pairs (or dyads) of possible poles of this paradox: the value co-creation - value capture perspective, the openness-appropriability perspective, and the disclosure-appropriation perspective. The overarching perspective is that of tensions between co-creating and capturing value in interorganizational collaboration for innovation. Table 1 shows which of the five papers answer the three research questions in this thesis.

The mixed methods approach is suitable mainly due to aspects of the analysed phenomenon. Although the paradox of disclosure seems at first to be an extensively investigated phenomenon (see P3 or P5), due to conceptual ambiguity regarding labels and constructs the literature is unfocused and lacks an in-depth understanding of how this paradox unfolds in contemporary settings. Therefore, while the thesis began with a quantitative approach, investigating patterns of appropriability and openness in open innovation, it soon became clear that complementary methods were needed in order to tackle this paradox in its full complexity. The mixed methods approach is also in line with Shah and Corley (2006), who suggest that in order to fully understand a phenomenon of interest, both qualitative and quantitative methods should be used.
Table 1. Research questions linked to papers

<table>
<thead>
<tr>
<th>Research questions</th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
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<tbody>
<tr>
<td>Q1: What characterizes tensions between co-creating and capturing value?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Q2: What factors create tensions between value co-creation and value capture?</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Q3: What are possible solutions and pitfalls to managing tensions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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The same authors suggest that a traditional approach to combining qualitative and quantitative methods involves “starting with qualitative methods to build an initial theoretical framework and then using the quantitative methods to test and extend that theory” (Shah & Corley, 2006, p. 1831). However, there are other approaches beyond the traditional one; conducting quantitative studies before qualitative ones is also a viable option. According to Shah and Corley (2006) this is possible when researchers are trying either to investigate unexplained patterns in the (quantitative) data or to identify mechanisms that produce unexpected patterns.

In the present thesis, the non-traditional approach is applied, i.e. the quantitative studies precede the qualitative studies. The reasons why this is so follow. In the beginning of my doctoral studies I used a pre-existing survey (the open innovation survey, described in section 3.2.1) to investigate relationships and potential tensions between the constructs of openness, appropriability and performance, an avenue for further research suggested at the time by contemporary studies (e.g. Laursen & Salter, 2014). Investigating the quantitative data revealed unexplained patterns, such as negative effects of formal appropriability mechanisms in incipient (ideation) phases of open innovation collaboration on performance in terms of efficiency, or negative effects of collaboration with suppliers in engineering in manufacturing phases on performance in terms of novelty (see Stefan & Bengtsson, 2017).

Besides these unexplained patterns, the open innovation survey did not cover all constructs that would have been relevant to investigating value co-creation-appropriation tensions in open innovation. Moreover, many quantitative studies investigated similar topics, but there is scant evidence of in-depth, qualitative studies analyzing this topic. Possible explanations for the unexplained patterns relate to the tensions to co-create and capture value. Therefore, qualitative methods were employed, further complemented by a conceptual study and a literature review. To better explain these choices, the next subsection describes what I am calling my PhD journey and how and why my doctoral studies could be divided into two main parts.
3.1.1. The PhD journey

My doctoral studies could be divided into two parts. The first part (mid-2014 to early 2017) mainly consisting of quantitative studies based on an open innovation survey developed by a group of international researchers (see section 3.2.1 for details on this survey). At this point the first stage of a conceptual study was also developed, because early on my literature review had identified the conceptual ambiguity regarding the nature of tensions in the paradox of disclosure. The second part (late 2016 to late 2018, overlapping somewhat with the first) includes qualitative studies, including interviews with case companies and experts and a systematic literature review. Additionally, in the second part, the conceptual study was further developed. The five papers and the different methods they employ are illustrated in Table 2. The first part’s model and constructs were mainly inspired by the seminal study by Laursen and Salter (2014) and the calls for research contained in that study. Of the three aforementioned perspectives that this thesis includes, the first part of the PhD with the two quantitative studies, P1 and P2, relates to the openness-appropriability dyad.

As previously mentioned, both quantitative studies showed certain unexplained patterns, motivating the choice to adopt complementary methods. For instance, P1 analysed the potentially moderating role of partner location on the appropriability-openness relationship. While the suggestion of tensions between appropriability and openness, and the dilemma of being very open versus overly protective (see Laursen & Salter, 2014) might imply some negative relationships between appropriability and openness constructs, all statistically significant linkages in P1 are positive. This was all the more puzzling, since it is well-known that formal IPPMs, which encompass both types of openness towards international partners, entail rather high costs to enforce and maintain (see, e.g., de Rassenfosse & van Pottelsberghe de la Potterie, 2013).
Table 2. Summary of papers and methods

<table>
<thead>
<tr>
<th>Paper</th>
<th>Method and analysis</th>
<th>Data</th>
</tr>
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<tbody>
<tr>
<td>P1</td>
<td>Quantitative Linear regression analysis</td>
<td>OIS*: 415 manufacturing firms from three European countries (Finland, Italy and Sweden)</td>
</tr>
<tr>
<td>P2</td>
<td>Quantitative Linear regression analysis</td>
<td>OIS*: 415 manufacturing firms from three European countries (Finland, Italy and Sweden) enhanced with patent data 340 firms after matching OIS with patent data</td>
</tr>
<tr>
<td>P3</td>
<td>Literature review Conceptual development</td>
<td>143 empirical and conceptual studies on value co-creation and value capture from the EBSCO database</td>
</tr>
<tr>
<td>P4</td>
<td>Qualitative Case studies and constant comparative method (CCM)</td>
<td>Interview data collected from six case companies and a group of seven expert informants (Europe and US) 21 interviewees 22 interviews** (of which 16 were recorded)</td>
</tr>
<tr>
<td>P5</td>
<td>Discussion paper</td>
<td>Empirical and conceptual studies relevant for the disclosure-appropriation perspective of the paradox of disclosure</td>
</tr>
</tbody>
</table>

* Open Innovation Survey (described in detail in section 3.2.1)

** Some interviewees participated in more than one interview and/or on more than one occasion
One explanation for these unexpected patterns was that the investigation did not take into account performance resulting from the open innovation endeavour. Thus, the next step was to analyse the effects of appropriability and openness on performance, so this is done in P2. However, P2 also had several unexplained results. For instance, formal and semi-formal IPPMs display contrasting effects on performance in terms of efficiency in early phases. Potential explanations might include the high uncertainty (Vanhaverbeke et al., 2008) and tacitness (Katila & Mang, 2003) in early stages of the innovation process. Yet more in-depth studies are required in order to explain these effects thoroughly. Further unexplained patterns identified in P2 relate to negative linkages between supplier collaboration and performance in terms of novelty in engineering phases. At this point a first draft of P5 was developed to better understand paradox and related tensions (dilemmatic, paradoxical and dialectical tensions).

The second part (late 2016 to late 2018) of my doctoral studies slightly overlaps the first. In this second part, the emphasis on paradox theory and the framework by Smith and Lewis (2011) became more salient, as both the systematic literature review and the conceptual study explicitly use this study as framework and/or main reference. The qualitative data collected during the second part also implicitly rely on the framework by Smith and Lewis (2011). In order to gain a deeper understanding of the paradox of disclosure and how it reveals itself in practice, I focused on collecting qualitative data and conducted a systematic literature review.

3.1.2. Paradigmatic perspectives in mixed methods research

Many debates revolve around adopting either a positivistic or an interpretivistic stance, but choosing one way to view the world may appear rather limiting to some (Saunders et al., 2009). Moreover, conceding to the boundaries of one philosophical paradigm would rob researchers of a more holistic multi-perspective on the studied phenomenon (Shah & Corley, 2006). Mixed-methods research aims to provide deeper understandings of phenomena, which otherwise would not be possible by employing only one type of research method (Creswell & Plano Clark, 2011; Morse & Niehaus, 2009; Shannon-Baker, 2016).
Several approaches have been deemed fit for mixed methods; there is also some controversy regarding which might be more appropriate (see, e.g., Tashakkori & Teddlie, 2010; Shannon-Baker, 2016). In a recent study, Shannon-Baker (2016) compares and contrasts four major paradigms related to mixed methods research: pragmatism, transformative-emancipation, dialectics and critical realism. At first glance, dialectics might seem to be the more appropriate approach for this thesis, because it enables addressing tensions, contradictions and paradoxes (Shannon-Baker, 2016). However, dialectics also advocates for using two or more paradigms together and focuses on divergence of data and concepts (Shannon-Baker, 2016), whereas this thesis aims to unify the three perspectives on the paradox of disclosure, thereby providing a deeper and more comprehensive understanding of this phenomenon.

With this in mind, either pragmatism or critical realism would seem to characterize the thesis’s approach. One advantage of pragmatism is that it is result-oriented and focuses on communication, thus aiming to provide practical solution for problems (Shannon-Baker, 2016). However, pragmatism has also received criticism for hiding positivistic approaches and not being informative in regards to epistemology and ontology (Lincoln, 2010) or for not being a philosophical position (Biesta, 2010).

Critical realism has the advantage that it “utilizes the compatibility thesis of worldviews, supporting the point that quantitative and qualitative research can work together to address the other’s limitations” (Shannon-Baker, 2016, 329). Critical realism also seeks to “understand how phenomena are generated – in either physical or social realms – [. . . examining] underlying factors that are or potentially are at play” (Clark et al., 2007, p. 524). By employing a paradox theory lens and following the dynamic equilibrium framework by Smith and Lewis (2011), this thesis similarly aims to understand the factors that create tensions related to the paradox of disclosure, as well as ways to manage such tensions effectively.

Moreover, the grounded theory approach, which includes the constant comparative method (used for the qualitative study P4) has been linked by previous studies with critical realism (see, e.g., Oliver, 2012). Of the four
major paradigms, the one that appears to describe this thesis the least would be transformative emancipation, as it “is characterized by the intentional collaboration with minority and marginalized groups or those whose voice is not typically heard on particular issues” (Shannon-Baker, 2016, p. 326). Given the aims of this thesis and the combination of papers appended to it, it seems that of the four predominant paradigms used in mixed methods research (Shannon-Baker, 2016), the one that better characterizes this thesis would be critical realism.

3.2. Methods for quantitative studies

3.2.1. Survey data collection

The survey data (OIS) used in publications P1 and P2 (see Stefan & Bengtsson, 2016, 2017) included in this thesis was collected by an international group of researchers during 2013. Though I was not involved in the data collection, I later independently collected patent data to complement the OIS data. The data used from the survey in P1 and P2 includes responses from three European countries: Finland, Italy and Sweden. There are currently several studies that base their analyses on the OIS, published in highly ranked international journals (e.g. Bengtsson et al., 2015; Lakemond et al., 2016; Lazzarotti et al., 2016). More recent studies have even used an enhanced version of the OIS that includes UK data (see Aloini et al., 2017; Lazzarotti et al., 2017). However, the enhanced dataset with responses form the fourth country (UK) is not analysed in this thesis.

Respondents to the OIS were manufacturing firms based in the three countries. The industry codes for these firms range from codes 10-32 and 98 in NACE Rev. 2. The international group of researchers designed the survey according to guidelines by Forza (2002). Researchers chose a randomized stratified sample of 1000 companies in manufacturing industries in each of the three countries. The firms were contacted first via telephone and subsequently via e-mail. The e-mails, containing links to the online questionnaire, were sent to R&D managers or similar staff with extensive knowledge about R&D collaboration and open innovation practices within each firm. A total of three reminders were sent to the managers.
After the responses were collected, the survey data consisted of 415 full answers: 87 (Finland), 152 (Italy) and 176 (Sweden). This total represents a share (response rate) of 14% of the 3000 initially chosen firms. There were no significant differences identified between respondent and non-respondent firms, neither in terms of size of the firm, industry, nor in terms of early versus late responses. The questionnaire was validated by conducting a pilot test of two groups. The groups consisted of targeted respondents and colleagues. In order to obtain full feedback on issues that could have affected responses, the pilot questionnaire was translated into the respondents’ native languages. The questions included in the survey are mainly closed questions, with the exception of the questions concerning firm name, size, turnover, etc. Answers for the closed questions used a seven-point Likert scale as measure, from 1 (not at all) to 7 (to a very great extent). Additionally, the alternative answer ‘do not know’ was provided.

The OIS questionnaire includes questions about context (industry, size, etc.), openness dimensions, strategies and performance. In the two quantitative publications included in this thesis the focus lies on constructs related to openness (variety of partners and depth of collaboration, as well as innovation phases in which collaboration occurs), appropriability mechanisms (also labelled IPPMs), performance, and also control variables related to both context and strategies. These can be found in Appendix 2.

3.2.2. Patent data collection

The collection of additional patent data to match the OIS data was motivated by patent stocks having been associated with a sub-dimension of absorptive capacity (see, e.g., George et al., 2001). Absorptive capacity is a concept that prior studies deemed to play a crucial role in the relationship between openness and performance (e.g. Huang & Rice, 2009). I started the patent data collection by selecting the OIS responses where the company name had been provided by the respondent. At this stage, there were 358 responses with a company name and 57 without. Then I conducted a search in the Thomson Innovation database, entering keywords corresponding to the company names into the search field applicant name. Depending on how common each company name was or on the complexity (e.g. abbreviations, multiple words), several alternatives of keywords and Boolean operators were used to search
for patent stocks for each company. The period for the patent search was 1993-2013, since the OIS data was collected in 2013 and patents have a maximum validity of 20 years. In parallel, I visited the companies’ websites to cross-check the full and/or correct name, so that I could make sure the patent documents resulted after each search did all belong to the same company. The patent data retrieved from Thomson Innovation was exported to Excel files for each company. The patent data collected during November 2015 to January 2016 is only used as a control variable (logarithmized) in the quantitative study P2. Due to several missing cases in the firm size variable, also used as control in P2, the sample size decreased from 358 to 340 responses.

3.2.3. Quantitative data analysis

This subsection presents the main constructs used in publications P1 and P2, as well as the types of statistical analyses employed. The combined analysis models of P1 and P2 are shown in Figure 2. First, the dependent variables. P1 focuses on two dependent variables, namely partner breadth (or variety of types of partners) and partner depth (intensity of collaboration with a specific type of partner). These constructs follow Laursen and Salter (2006) yet are measured at a more fine-grained level. For practical reasons the partner depth construct groups the eight types of partners into three factors: academic/public partners (universities, government agencies, innovation consultants or intermediaries), value chain partners (suppliers, customers and consumers), and competitors (includes only competitors). P2 also includes two main constructs as dependent variables, namely performance in terms of novelty (including access to top technologies) and efficiency (encompassing reduction of risks and costs by sharing these with partners in innovation). The performance construct follows Alegre et al. (2006).

Continuing with the independent variables, in P1 the main independent variables are captured by the construct concerning appropriability mechanisms, or IPPMs. There were a total of eight mechanisms included in this question (following Hertzfeld et al., 2006), grouped into three factors: formal IPPMs (patents, industrial designs, trademarks, copyrights), so-called semi-formal IPPMs (contracts and trade secrets), and informal IPPMs (lead times, product complexity).
Additionally, P1 tested the moderating effect of partner location, measured as either national or international in the OIS. Based on this construct, three groups were constructed, including firms that collaborated mostly with local partners, mostly with international partners, and a group that collaborated with both local and international partners. P2 uses the appropriability construct (use of eight types of IPPMs) and the openness depth construct (collaboration intensity with eight types of partners) as independent variables. While the appropriability mechanisms in P2’s analysis are also grouped into the three factors specified above (formal, semi-formal and informal), the depth of collaboration included all eight types of partners in the analysis individually.
The last type of variable is the control variables: firm size, industry dummies, country dummies, and innovation ambition. Prior studies suggest that companies’ use of appropriability mechanisms varies across industry (Hall et al., 2014) and size (e.g. Neuhäusler, 2012). Therefore, the logarithmized number of employees was introduced in the regression analyses as a control for firm size. According to SCB (2014), a division into four groups (from low- to high-tech) was made based on NACE codes. This was used in P1 to create industry dummy variables. For P2 the four groups suggested by SCB (2014) were reduced to only two (high-tech and low-tech) because other control variables were added to the analysis. In both cases a group for which the NACE code was unknown was used as baseline. Further details concerning these groups can be found in Stefan and Bengtsson (2017). Country dummies were also used in P2, with Sweden as baseline, since appropriability potentially varies across national borders (see Hagedoorn et al., 2005). Constructs related to radical innovation orientation (such as the entrepreneurial orientation suggested by Hung and Chiang, 2010) were used in both P1 and P2. The extent of international partners was also used as control in P2, while in P1 it was used as a potential moderator (see also, e.g., Knudsen & Mortensen, 2011).

In both quantitative studies the main analyses performed included factors analysis (for grouping the eight types of IPPMs) and linear regression analysis. For testing moderation in each of the studies, the supposed moderating variable was divided into groups, i.e. respondents with mostly international or mostly local partners (there was also a so-called balanced third group) in P1, and three groups from early to late innovation phases in P2.

3.3. Methods for conceptual studies

3.3.1. Data collection and analysis for the systematic literature review

The systematic literature review (P3) follows the three stages of conducting a systematic literature review suggested by Watson et al. (2018). These three stages are Searching, Screening and Extraction/Synthesis (Watson et al., 2018).
P3 also follows the dynamic equilibrium model proposed by Smith and Lewis (2011) and uses it as a framework around which the literature review is structured. A simplified version of the model suggested by Smith and Lewis (2011) is shown in Figure 4.

Searching entails identifying the need for a review and supporting this with evidence from studies. Although there is abundant research that acknowledges and even analyses value co-creation - value capture tensions, there is no unified framework or synthesis of such tensions or how they may be mitigated and potential pitfalls that might occur. To narrow this gap, relevant keywords were identified and then keyword combinations were formed. The keywords relate to the poles of the paradox, i.e. value co-creation on one side and value capture on the other, but also to the interorganizational
nature of investigated relationships and to potential characteristics of jointly created value, such as the novelty of jointly created products. The keyword combinations identified a total of 384 potentially relevant articles. The combinations of keywords are detailed in P3, Table 1. In the second stage, Screening, the preliminary search results were screened according to the following inclusion and exclusion criteria: being peer reviewed, using English language, and specifically referring to interorganizational collaborations and, more specifically, acknowledging the value co-creation - value capture tensions related to these. The remaining articles (143) after having applied inclusion/exclusion criteria were coded based on main concepts from Smith and Lewis’s (2011) paradox dynamic equilibrium framework, i.e. factors that spur salient tensions, factors that lead to virtuous cycles and factors that lead to vicious cycles, but also based on type of interorganizational relationship, context, theories and methods used. In the third stage, Synthesis, the shares of code categories were described. For a detailed table of descriptives, please see Table 3 in P3).

3.3.2. Methods for the discussion paper

P5 is the second conceptual study in this thesis. While it is not as systematic a literature review as P3, P5 focuses on a different dyad of potential poles for the paradox of disclosure, namely disclosure and appropriation. P5 is a discussion paper divided into three main parts. The first part briefly reviews various labels assigned to the paradox of disclosure (Arrow, 1962) in various streams of research, with the aim to emphasize the fragmentation in extant research with regards to this phenomenon. In this first part, different dyads of possible poles of the paradox of disclosure are suggested based on prior studies. The second and third parts discuss possible tensions between a new potential dyad of poles, namely disclosure and appropriation.

Based on definitions and concepts from Smith and Lewis (2011) and other studies pertaining to paradox theory, the second part discusses the nature of tensions related to the paradox of disclosure by suggesting circumstances under which disclosure and appropriation might or might not be contradictory and/or interdependent. The third part suggests conditions under which potential tensions between disclosure and appropriation might be dilemmatic, dialectical or paradoxical, also following Smith and Lewis.
While the first part of P5 does not suggest propositions, in the second and third part propositions are suggested both regarding the contradictory and interdependent nature of disclosure and appropriation, as well as concerning the dilemmatic, dialectical or paradoxical nature of tensions between disclosure and appropriation.

3.4. Methods for the qualitative study

3.4.1. Sampling and data collection

The qualitative study of this thesis combines a case study design with a grounded theory data analysis (see Strauss & Corbin, 1997). Case studies were chosen as they enable a deeper understanding of phenomena (Eisenhardt, 1989) and provide abundant insights about organizations and managers (Yin, 2014). Multiple case studies are often thought to provide more convincing evidence than single case studies, yet it can also require more time and resources (Yin, 2009). Paraphrasing Wilbur Lang Schramm’s 1971 work, Yin (2009) defines the core of a case study as “to illuminate a decision or set of decisions: why they were taken, how they were implemented, and with what result” (p. 17). The paradox of disclosure presented by Arrow (1962) is an increasingly complex phenomenon due to exacerbated intricacies of industries and innovation collaboration (see e.g. Laursen & Salter, 2014). Such increased complexity may spur salient tensions (Smith & Lewis, 2011), yet extant research does not provide clear answers on how to reconcile tensions related to value co-creation and appropriation (see, e.g., Lorenz & Veer, 2017).

The six cases were mainly selected based on the richness of the information they could provide about the investigated phenomenon (Coyne, 1997; Patton, 1990) as well as on diverse variation in different contexts, which would ultimately enable identifying possible common patterns (Palinkas et al., 2015). Specifically, numerous previous studies focus on tensions to co-create and capture value in asymmetric collaborations, i.e. between small young firms and large companies (Baglieri et al., 2016; Hallen, Katila, & Rosenberger, 2014; Kumar, 2010; O’Dwyer & O’Flynn, 2005; Sawers et al., 2008; Yang, Lin, & Lin, 2014), at times using shark metaphors for the large partner companies (see Diestre & Rajagopalan, 2012; Katila, Rosenberger, &
Eisenhardt, 2008; Mason & Drakeman, 2014). Therefore, the qualitative study in this thesis focuses mainly on the way large companies might experience and manage tensions between co-creating and capturing value.

Prior studies signal possible conflicts and tensions in interorganizational relationships in several industry sectors: the oil and gas industry in prior studies (see Barlow, 2000; Crabtree et al., 1997; Olsen et al., 2005), the logistics sector (Klein & Rai, 2009; Lindawathi et al., 2014), construction industry (Fulford & Standing, 2014; Gottlieb & Haugbolle, 2013; Martinsuo & Ahola, 2010) or mining industry (Frishammar et al., 2015) or in the energy sector (Niesten & Jolink, 2012). Moreover, tensions between co-creating and capturing value are yet to be reconciled (e.g. Lorenz & Veer, 2017). Case companies A and D are both large global companies active in the oil and gas industry, although company D also serves in other industries such as mining or paper and pulp. Companies B and C are included in the logistics and transport sector. While case C is also a large firm and a logistics service provider, company B is a start-up, selected to further add to the diversity of the cases. Case company E is active in the energy sector, and company F mainly serves the mining, construction and engineering sectors.

The unit of analysis in the qualitative study is represented by tensions between co-creating and capturing value in interorganizational innovation collaboration. Therefore, the cases were selected also based on the criteria that the companies had experienced such tensions in prior collaborations with external partners. Managers from company A acknowledged having experienced tensions in innovation collaboration projects, some of which had resulted in several cases of misappropriation over the period of a few years. Company B’s managers had developed an invention with applications in transport industry and perceived tensions after having signed a contractual agreement with a large company that later misappropriated the idea. Managers from company C experienced tensions in collaborations with several types of partners and, aside from having experienced risks of misappropriation (as did A and B), managers also experienced tensions when potential innovation partners perceived fear of misappropriation. Company D’s managers acknowledge tensions and the likelihood of misappropriation in innovation collaboration, yet has not experienced misappropriation. Managers from
company E perceived tensions in co-creation, and although no misappropriation occurred, they believe they have not captured sufficient value from this endeavour. Company F’s managers also acknowledge and perceive tensions in collaboration with external innovation partners.

The interviewed managers from the six case companies were selected based on the contact they had previously had with innovation partners and experienced tensions in such collaborations. In most cases the snowballing technique was used to identify interviewees. For instance, in the case of company A, a technology manager and a project engineering manager were initially interviewed in an informal, unrecorded meeting. The project engineering manager, who had directly been involved in the innovation collaboration projects where tensions occurred, was subsequently interviewed (this time a recorded interview) and recommended several other colleagues that had been involved in the specific projects. These colleagues were also engineering managers but one was part of the IP department. In the case of company B, a start-up, the CEO / co-founder was interviewed, and also an external advisor who worked directly with the start-up in a business incubator. In the cases of companies C, D, E and F engineering managers and/or heads of strategy and innovation units, as well as employees of IP departments were interviewed.

The seven expert informants similarly acknowledged tensions between co-creating and capturing value. They were selected largely for being knowledgeable in specific fields that are crucial for managing such tensions. Thus, experts 1, 2 and 3 are knowledgeable in the area of open innovation, experts 1 and 2 having been CEOs of successful open innovation intermediaries for many years, while expert 3 has long experience of being R&D and open innovation VP in an international group renowned for its success in open innovation collaboration. Experts 4 and 5 have extensive experience from venture capital and incubators, and are knowledgeable in providing IP protection and value capture consultancy and training to various types of entrepreneurs. Experts 6 and 7 have long experience in the area of IP, being specialized in the legal side of IP protection. In addition to the best practice advice on how to manage value co-creation - value capture tensions that all seven experts provided, experts 6 and 7 could also bring a
complementary perspective, since they have also been involved in lawsuits and other similar legal actions concerning IP misappropriation. The interviews were conducted during December 2016 to December 2017 with a total of 21 informants and 22 interviews (of which 16 were recorded and transcribed, while six were not recorded). Examples of the interview outline for both case companies and for expert informants can be found in Appendix 3. These questions were mainly used as a basis for the discussion, and varied depending on, for instance, whether or not there had been a prior discussion with the same informant or with informants from the same company.

3.4.2. Qualitative data analysis

The analysis of the qualitative data was done using the Nvivo software tool, following the steps of the constant comparative method (Strauss & Corbin, 1998). In the first step, open coding was used, i.e. specific words and expressions from the transcripts of the interviews were used to pinpoint emerging themes. At this point, the codes were grouped into so-called first-order categories, and the axial coding was applied (Strauss and Corbin, 1998), i.e. the first-order relationships were classified into second-order themes. The analysis pinpointed tensions (also called challenges in P4), underlying factors that create such tensions, and potential best practices for managing tensions to co-create and capture value.

The two groups of case companies and expert informants were initially selected for different purposes, i.e. the former to help identify tensions and underlying factors thereof between co-creating and capturing value in open innovation, the latter to provide a set of best practice advice for managing such tensions effectively. However, the interviews and subsequent analysis showed that some of the case companies could also provide possible solutions for managing tensions between co-creating and capturing value, as they had commenced internal and external changes to avoid future misappropriation or risks thereof. Moreover, some of the expert informants also provided information about tensions and underlying factors. Thus, interviews from the two groups could also be used for triangulation.
3.5. Overall quality of the study

This thesis adopts a mixed methods approach partly due to the nature of its research questions and partly due to issues related to the investigated phenomenon. First, the thesis research questions point to the need for both qualitative and quantitative methods. Second, the paradox of disclosure appears to be extensively researched (see P3 or P5), yet there is conceptual ambiguity regarding labels and constructs used in the analyses. Therefore, the literature referring to tensions concerning the paradox of disclosure is unfocused and lacks deeper understanding of this phenomenon in contemporary settings. Furthermore, prior studies indicate that a combination of quantitative and qualitative methods is necessary in order to fully grasp a phenomenon of interest (e.g. Shah & Corley, 2006).

In mixed methods research, there is sometimes disagreement concerning the measures of quality of the study (Onwuegbuzie & Johnson, 2006). In quantitative studies notions of validity and reliability are typical. Validity specifically encompasses internal and external validity – correlation and causality are essential to the former, while generalizability is highly relevant to the latter (Winter, 2000). Reliability most commonly relates to the degree of replicability (Winter, 2000). However, notions of validity and reliability are not generally accepted in qualitative research (Winter, 2000), which is instead concerned with issues of trustworthiness or credibility (Hammersley, 1987).

To reconcile some of the different views on qualitative and quantitative methods, Teddlie and Tashakkori (2003) argue that the concept of “inference” is common to both types of methods. Overall it might be argued that the three perspectives on tensions related to the paradox of disclosure that are combined in this thesis increase the quality of inference. Next the quality of the different research methods employed in this thesis will be discussed.

3.5.1. Quality of quantitative studies

The two quantitative studies, P1 and P2, are based on the analysis of the OIS, which amounted to 415 responses from three European countries. Analysing the respondents and non-respondents, there were no significant differences
in industry or size, which would point to rather high generalizability in terms of European companies from the manufacturing sector. However, it would be difficult to generalize the results of these studies to non-European service providers, for example.

In both quantitative studies, Harman single-factor tests were conducted following Podsakoff et al. (2003), in order to test for common method variance. In each case the test indicated low risks of common method variance, which would point to high construct validity. The reliability of the two studies is also rather high, since other researchers would be able to use the OIS data, apply the same statistical techniques and obtain the same results.

Previous studies indicate that there could be dual causality in the relationship between openness and appropriability (Laursen & Salter, 2014), which is investigated particularly in P1. However, P1 only analysed this relationship from one direction, although the authors acknowledge the possibility of analyzing the openness-appropriability liaison from the opposite direction. This would suggest lower internal validity concerning P1. For P2 this is less of a concern, because P2 investigates the way perceived performance is explained by appropriability and openness.

3.5.2. Quality of conceptual studies

The database used for the systematic literature review P3 was EBSCO Business Source Premier (BSP), which includes 98% bibliographic records for 25 of the highest impact factor business and management journals (Christoffersen, 2013; Niesten & Jolink, 2015). This ensured the inclusion of the majority of the relevant outlets.

There is the possibility of some bias in P3’s choice of the Smith and Lewis (2011) dynamic equilibrium model as a framework for the paper and categorizing tensions based on the classification of factors in that model. Nevertheless, the overall study (P3) is considered to be robust, relying on a large sample of peer-reviewed articles. Moreover, the potential use of a different framework than the dynamic equilibrium model proposed by Smith and Lewis (2011) would likely not affect the overall results of the study nor its general conclusions.
In the case of P5, the propositions formulated in the second and third part require validation in future empirical studies. This would ensure generalizability of the propositions pertaining to disclosure-appropriation tensions. The studies included in P5 are selected from the systematic literature review P3 in order to reflect the different perspectives on tensions related to the paradox of disclosure highlighted in P5, as well as to highlight various labels used to denote this paradox in different literature streams.

3.5.3. Quality of qualitative studies

The qualitative study triangulates interview data from case companies and expert informants in order to reveal tensions between co-creating and capturing value, underlying factors of said tensions, and potential best practices for managing such tensions in effective ways. Although the case companies are of different sizes and serve different industry sectors, certain patterns of factors, tensions and solutions to manage tensions can be identified across the cases and the expert informant group. Moreover, the findings of the qualitative study can be further triangulated with results of the other studies appended to this thesis, such as the systematic literature review P3 or the quantitative study P2.

For certain factors, tensions and solutions or pitfalls, commonalities were identified in several of these studies. However, for the factors, tensions or solutions that differ from those pinpointed by the other studies, the generalizability of the qualitative study P4 remains a limitation. Moreover, prior studies point to variations in appropriability across industry sectors (e.g. Neuhäusler, 2012), and therefore further empirical evidence from other industry sectors might shed light on other factors, tensions and pitfalls or solutions which were not identified in P4.

The limited time during which the qualitative data was collected, one year, was not enough to make any long-term observations. Even though the interviews were conducted in retrospect and several informants referred to previous timespans of several years when they had experienced tensions related to value co-creation and capture, this is not sufficient for evaluating any long-term effects of the tensions.
4. Summary of papers

4.1. Paper 1: Appropriability: A key to opening innovation internationally?

4.1.1. Gap and purpose

P1 takes the openness-appropriability perspective and investigates the moderating effects of partner location (national, international or ‘balanced’) on the relationship between appropriability mechanisms and openness (partner depth and breadth). This is meant to shed more light on potential challenges between growingly globalized networks and the so-called patchwork of intellectual property rights (Geller, 1998; Peukert, 2012). Law literature has investigated the IP law territoriality topic (see Trimble, 2015) yet there is scarce evidence about it in open innovation literature, particularly in studies that encompass appropriability. The purpose of P1 was to investigate the moderating effects of partner location on the association between appropriability and openness, leading to the following two research questions.

RQ1a: How does the use of different IPPMs influence firms’ openness in terms of variety of partners and depth of collaboration with each type of partner?

RQ1b: What are the effects of IPPMs on firms’ openness (variety of partners and depth of collaboration) when taking into account the location (national or international) of partners?

The paper is divided into two analysis steps: First, the association between three different types of IPPMs (formal, semi-formal, and informal, as described in section 3.1) and openness (partner variety and depth of collaboration with different types of partners). For the depth construct, the partners were categorized as academic partners, value chain partners and competitors. Second, the moderating effects of partner location on the appropriability-openness relationship are tested.
4.1.2. Results

For the first research question, the linear regression results show that the group of semi-formal IPPMs, i.e. trade secrets and contracts, is associated with partner variety and depth of collaboration (academic partners). The group of formal IPPMs explains openness in terms of partner depth (academic partners), and the group of informal IPPMs is associated with depth of collaboration (value chain partners). For a more detailed view of the findings pertaining to RQ1a please refer to Table 2 in appended P1, specifically page 241 in Stefan and Bengtsson (2016).

As for the second research question, when adding partner location as moderator, the above liaisons become more clearly delineated. For instance, the group of formal IPPMs is associated with partner variety and depth of collaboration with academic partners and competitors, when working mainly with international partners. When working with national partners, the group of semi-formal IPPMs also correlates with partner variety and depth of collaboration in terms of academic and value chain partners. Informal IPPMs are associated with depth of collaboration with national value chain partners and competitors. These results point to a propensity to use formal IPPMs when opening up the innovation process to international partners, while informal and semi-formal IPPMs seems to be more often used in local (here national) open innovation collaboration for the firms in this sample. For more details concerning results of the second research question of P1, RQ2a, please refer to Tables 3 and 4 in appended P1, specifically pages 242-243 in Stefan and Bengtsson (2016).

4.2. Paper 2: Unravelling appropriability mechanisms and openness depth effects on firm performance across stages in the innovation process

4.2.1. Gap and purpose

P2 also takes the openness-appropriability perspective and investigates the association between three groups of IPPMs (formal, semi-formal and informal) and openness in terms of depth of collaboration with eight different types of partners, with performance in terms of novelty and efficiency, across innovation process stages. By conducting this analysis P2 responds to calls
for further research to investigate appropriability, openness and performance liaisons (see e.g. Laursen and Salter, 2014) and to extend analyses related to appropriability and openness liaisons by delving deeper into phases of the innovation process (Zobel et al., 2017). The aim is further developed into six hypotheses:

**H1a**: Openness depth in terms of horizontal collaboration (universities, intermediaries, government agencies and firms in other industries) contributes more to performance in terms of innovation novelty than to innovation efficiency, specifically during the early (idea) phases of the innovation process.

**H1b**: Openness depth in terms of vertical collaboration (customers, suppliers and consumers) contributes more to performance in terms of innovation efficiency than to innovation novelty, specifically during the later phases (engineering and commercialization) of the innovation process.

**H1c**: Openness depth in terms of competitor collaboration contributes more to performance in terms of novelty innovation than to innovation efficiency, specifically during the later phases (engineering and commercialization) of the innovation process.

**H2a**: The use of formal IPPMs contributes more to performance in terms of innovation novelty than to innovation efficiency, specifically during the later phases (engineering and commercialization) of the innovation process.

**H2b**: The use of semi-formal IPPMs contributes to performance in terms of both innovation efficiency and innovation novelty, specifically during earlier phases (idea phase) of the innovation process.

**H2c**: The use of informal IPPMs contributes more to performance both in terms of innovation novelty and innovation efficiency, regardless [of] the phase of the innovation process. (see also Stefan and Bengtsson, 2017; p. 254-255)
P2 uses some of the same constructs from P1: the depth of collaboration with external partners (although all eight types of partners are included as individual variables in the analysis, as opposed to the three groups of types of partners from P1), and the three groups of IPPMs. The constructs that also appeared in P1 are both used as independent variables, and their association with two types of performance is tested. This is done across three stages of the innovation process.

4.2.2. Results

In the incipient, idea phase, the use of semi-formal IPPMs, including NDAs and other contractual agreements, as well as trade secrets, is positively associated with performance in terms of efficiency. However, formal IPPMs are negatively associated with the same type of performance. Informal IPPMs and depth of collaboration with universities and companies in other industries explain performance in terms of novelty in the idea phase. These findings partially support hypotheses H1a and H2a.

In the next, so-called engineering stage of the innovation process, openness towards innovation intermediaries has a positive correlation with performance in terms of efficiency, while using informal IPPMs, collaborating with universities, firms in other industries and customers positively associate with performance novelty. Depth of collaboration with suppliers is negatively associated with performance in terms of novelty in engineering phases of the innovation process. These provide partial support for hypotheses H1b and H2c.

In the commercialization phase, collaboration with customers explains performance in terms of efficiency, while collaboration with companies in other industries and competitors explain performance in terms of novelty. These findings support H1c and partially support H1b. No support is found for H2a. More details about the results of P2 and hypotheses support can be found in Table 1 of appended P2, specifically page 257 in Stefan and Bengtsson (2017).
4.3. Paper 3: Embracing the paradox of inter-organizational value co-creation – value capture: a literature review towards paradox resolution

4.3.1. Gap and purpose

P3 adopts the value co-creation – value capture perspective and represents a systematic literature review that focuses on tensions between co-creating and capturing value in interorganizational relationships. P3 provides a synthesis of factors affecting such tensions across various streams of literature and several fields of study.

This investigation provides a response to unreconciled tensions related to value co-creation and capture in interorganisational linkages (see Jiang et al. 2016; Lorenz & Veer, 2017). It is also a step towards unifying the variety of labels and concepts used to investigate such tensions under the umbrella of paradox. Specifically, by applying the dynamic equilibrium framework proposed by Smith and Lewis (2011), P3 pinpoints factors that spur salient tensions in value co-creation - value capture linkages, and factors that lead from said salient tensions to either vicious cycles or virtuous cycles.

As explained in section 2.1.3 in this thesis, in paradox theory vicious cycles represent lack of balance between the two supposed poles of a paradox, whereas virtuous cycles entail successful balancing the two poles simultaneously. Seeing as the perspective taken in this study is that of value co-creation – value capture tensions, the supposed poles of the paradox of disclosure in P3 are value co-creation and value capture.

4.3.2. Results

First, the review of 143 articles identifies four types of factors that spur salient tensions, those linked to: plurality, e.g. coopetition (Oxley & Sampson, 2004), scarcity of resources, e.g. lack of IPR knowledge (Pisano, 1990), change, e.g. changes in collaboration scope (Oxley, 1999), and compound factors, e.g. radical innovation at early stages (Ritala & Hurmelinna-Laukkanen, 2009). These subcategories are inspired by the subcategories suggested by Smith and Lewis (2011). The factors belonging to each category identified in P3 can be found in appended P3, Table 4, on page 21.
Furthermore, P3 reveals factors that lead to vicious cycles, such as learning races (Chesbrough & Appleyard, 2007) or over-search (Laursen & Salter, 2006). Such factors would overemphasize one of the paradox poles, in the above examples value capture and value co-creation respectively. The factors leading to vicious cycles pinpointed by P3 can be found in appended P3, Table 5, on page 25.

P3 also uncovers factors leading to virtuous cycles, which are divided into three subcategories: governance mechanisms, organizational capabilities and appropriation strategies. Unlike the categorization for the factors that spur salient tensions, these subcategories are based on the findings of P3 and developed by P3’s authors. To provide some examples, governance mechanisms include, for instance, contracts (Gander et al., 2007) or strong appropriability regimes (Kasch & Dowling, 2008); organizational capabilities entail, for example, joint venture capabilities (Kumar, 2010) or absorptive capacity (Hurmelinna-Laukkanen et al., 2012); appropriation strategies include, for instance, selective revealing (Henkel, 2006), patent pools for smaller firms (Rayna and Striukova, 2010), or combining a protective strategy with absorptive capacity (Laursen & Salter, 2014). A complete list of the factors leading to virtuous cycles identified in P3 can be found in Table 6 of P3, pages 26-27.

In addition to the three groups of factors that follow Smith and Lewis’s (2011) framework, P3 also reveals a fourth category of factors that could lead to either virtuous or vicious cycles – this is contingent upon the intensity of these factors. This fourth category of factors is dubbed as factors with dual role, since, according to the reviewed studies, these same factors may serve in either balancing the two paradox poles, i.e. virtuous cycles, or creating imbalance between the poles, i.e. vicious cycles. Examples of these factors include patents (Dosi et al., 2006) or time (Miranda & Kavan, 2005). Further factors with dual role are listed in appended P3, Table 7, on page 33. The fourth category of factors is an addition to the initial dynamic equilibrium framework suggested by Smith and Lewis (2011). This category points towards further complexity relating to tensions between co-creating and capturing value.
4.4. Paper 4: Coping with tensions in open innovation: challenges and solutions to co-create and capture value

4.4.1. Gap and purpose

P4 takes the value co-creation – value capture perspective and investigates related tensions in open innovation settings, pinpointing underlying factors of these tensions and suggesting possible solutions for managing these effectively. P4 responds to calls for further research to reconcile such tensions (see Laursen & Salter, 2014; Lorenz & Veer, 2017) and further attempts to narrow a gap related to investigating value co-creation and capture in specific industry settings outside the information and communications technology sector (Appleyard & Chesbrough, 2017). P4 is based on interviews with six case companies (companies A-F) and a group of seven experts.

RQ1: What are the tensions between value co-creation and value capture in open innovation?

RQ2: What are potential solutions and challenges to manage such tensions effectively?

4.4.2. Results

P4 identifies tensions between co-creating and capturing value and open innovation, as well as possible solutions and even challenges to managing such tensions. The tensions relate to: difficulties to commence collaborating with external partners, being (falsely) accused of misappropriating IP, a stringent need to be open, not profiting sufficiently from co-created value, internal conflicts, incomplete contracts, difficulties to separate new from prior IP and asymmetry between partners. Some of the underlying factors that create these tensions include: partners’ fear of misappropriation, own or partners’ limited resources (e.g. limited IP knowledge or awareness), changing industry settings, contradictory roles or opinion within the focal firm, or time constraints. Possible solutions relate to improving (e.g. simplifying) contracts, building a wall around own IP, increasing staff IP awareness, involving staff of IP department more in innovation collaboration, forming cross-functional teams, including neutral partners in the collaboration, building trust, or using milestone contracts. The possible challenges to managing value co-creation –
value capture tensions are partly linked to so-called subsequent tensions, but partly also to a lack of possible solutions for managing certain tensions. The subsequent tensions mainly relate to partners’ lack of IP knowledge, missing out on collaboration opportunities, poor management, a need to be open, limited resources, time constraints or divergent goals. One of the initial tensions that appears to not have potential solutions is the need to be open.

The findings of P4 not only pinpoint tensions between co-creating and capturing value and possible solutions and challenges to managing them, but also highlight value co-creation – value capture patterns. Some of these patterns follow the sequence: initial tensions (and the underlying factors that cause the initial tensions) - possible solutions - subsequent tensions. These patterns are shown in Table 3 in appended P4 on page 15.

4.5. Paper 5: Disentangling the nature of tensions in Arrow’s paradox of disclosure

4.5.1. Gap and purpose

P5 takes a disclosure.-appropriation perspective on tensions related to the paradox of disclosure. Despite presumed benefits of applying a paradox lens to complex phenomena (see e.g. Poole & Van de Ven, 1989), the so-called paradox of disclosure is yet to be investigated through such lens. Moreover, a variety of constructs and labels used to designate this paradox and related tensions in different fields of study make this phenomenon appear somewhat ambiguous. Finally, the dilemmatic, dialectical or paradoxical nature of tensions surrounding the paradox of disclosure is not clearly delineated in prior studies.

The purpose of this conceptual paper was therefore to provide some clarity about the nature of tensions related to the paradox of disclosure, by discussing to what extent these are paradoxical. This is done partly by following delineation of overlapping tensions, i.e. dilemmatic, dialectic and paradoxical, suggested by Smith and Lewis (2011).
4.5.2. Results

First, P5 summarizes a series of examples of various labels used in prior studies published in high-ranked journals from different fields of study – e.g. strategy and management, law or economics. Details about such labels can be found in Table 1 in appended P5 on pages 5-6. P5 also discusses the partly overlapping perspectives of value co-creation-value capture and openness-appropriability, and further suggest the perspective of tensions between disclosure and appropriation as a potential common denominator.

Second, P5 formulates propositions regarding the interdependent and contradictory nature of disclosure and appropriation based on: the need to be open, the type of disclosure – further contingent on the type of knowledge embedded in e.g. an invention - and availability of IPRs. A dichotomy of disclosure is also suggested here, specifically differentiating between the disclosure of the solution (solution disclosure) and the disclosure of characteristics of a product (product disclosure).

Third, P5 formulates propositions relating to the potentially dilemmatic, dialectical or paradoxical nature of tensions between disclosure and appropriation. These are based on the propositions mentioned above that pertain to the interdependency and contradiction between disclosure and appropriation, combined with the definitions suggested by Smith and Lewis (2011) for demarcating dilemmatic, dialectical and paradoxical tensions.

4.6. Results synthesis

Table 3 in this thesis summarizes the perspectives and key findings of each of the five appended papers.
<table>
<thead>
<tr>
<th>Paper</th>
<th>Perspective</th>
<th>Key findings</th>
</tr>
</thead>
</table>
| P1    | Openness-Appropriability | - Formal IPPMs explain partner variety and depth of collaboration with academic partners and competitors in international open innovation  
- Semi-formal IPPMs explain partner variety and depth of collaboration with academic and value chain partners in national open innovation settings  
- Informal IPPMs positively associate with depth of collaboration with value chain partners and competitors in national open innovation settings |
| P2    | Openness-Appropriability | - At early, idea stages: formal IPPMs have negative effects while semi-formal IPPMs have positive effects on efficiency; informal IPPMs and collaboration with universities and firms in other industries explain novelty  
- At later, engineering stages: collaboration with intermediaries explains efficiency; informal IPPMs and collaboration with universities and firms in other industries explain novelty; collaboration with suppliers has negative effects on novelty  
- At late, commercialization stages: collaboration with customers explains efficiency; collaboration with firms in other industries and competitors explains novelty |
| P3    | Value Co-Creation – Value Capture | - Factors that spur salient tensions relate to four subcategories: plurality (e.g. coopetition), scarcity (e.g. lack of IPR knowledge), change (e.g. change in collaboration scope), compound factors (e.g. early stage radical innovation)  
- Factors that lead to vicious cycles include e.g. over-search |
Factors that lead to virtuous cycles include three subcategories, namely: governance mechanisms (e.g. contracts), organizational capabilities (e.g. joint venture capabilities) and appropriation strategies (e.g. selective revealing).

A fourth category of factors emerges from the review: dual role factors, which may lead to either vicious or virtuous cycles depending on their intensity (e.g. time).

Underlying factors that create tensions include e.g. partners’ fear of misappropriation, or limited IP knowledge or awareness.

Possible solutions relate to e.g. improving contracts, increasing staff IP awareness, or forming cross-functional teams.

Possible challenges to managing value co-creation – value capture tensions are partly linked to subsequent tensions. These include e.g. a stringent need to be open, limited resources or time constraints.

One of the initial tensions that appears to not have potential solutions is the urgent (stringent) need to be open.

Provides examples of different labels and dyads of poles used when investigating the paradox of disclosure in high-ranked journals from fields of study such as strategy and management, law or economics.

Formulates propositions concerning the extent of interdependency and contradiction between disclosure and appropriation based on the need to be open, the type of disclosure (and knowledge) and availability of IPRs.

Based on the afore-mentioned propositions, formulates further propositions relating to the dilemmatic, dialectical or paradoxical nature of tensions between disclosure and appropriation.
5. Discussion

5.1. The characteristics of tensions between co-creating and capturing value

In settings of interorganizational innovation collaboration, value co-creation and/or openness entails some disclosure (see, e.g., Dahlander & Gann, 2010). As suggested by Arrow (1962), this is also true in arm’s-length transactions. According to P5, from a disclosure-appropriation perspective, the nature of tensions in the paradox of disclosure is dependent on the extent of overlap between so-called solution disclosure and product characteristics disclosure, as well as on availability and coverage of IPRs. Solution and product disclosure are likely to overlap when there are high degrees of codified knowledge embedded in the product (see, e.g., David, 1992). Formal IPRs such as patents could alleviate tensions in the paradox of disclosure (see Arora, Athreye, & Huang, 2016; Arrow, 1962; Dahlander & Gann, 2010), yet even if available and enforceable (despite the high costs – see de Rassenfosse & van Pottelsbergh, 2012) formal appropriability is often incomplete, either due to the territorial nature of IPRs (see also Trimble, 2015) or due to a failure to effectively protect the whole product. P5 suggests that from a disclosure-appropriation perspective, tensions are paradoxical when the two poles are contradictory and interdependent, i.e. when (1) there is a stringent need to open up the innovation process due to a scarcity of resources to independently commercialize a new product; and (2) there is a high overlap between solution disclosure and product characteristics disclosure; and (3) IPRs are either absent or incomplete.

If solution and product disclosure can be clearly differentiated, the risk of paradoxical tensions decreases. In such situations, a product or its characteristics could be revealed to a potential buyer or partner without disclosing the product solution. However, here the complexity, as well as degree of tacitness versus codification of the knowledge embedded in a product may pose challenges in actually separating the knowledge that is to be revealed from that which is to be kept secret (see Oxley & Sampson, 2004). If there is no need for a buyer or partner and the inventor can independently commercialize a new product, then the choice not to disclose is available, and
tensions are more likely dilemmatic. The alternative choice could also be made, i.e. disclosing without expecting (immediate) appropriation (as illustrated by Pisano, 2006 or Alnuaimi & George, 2016), in which case tensions related to the paradox of disclosure would also be more likely dilemmatic. If tensions lean more towards the dialectical side, then the supposed poles of paradox are contradictory yet could be integrated (Smith & Lewis, 2011). From a disclosure-appropriation perspective, this would happen under the prerequisites that disclosure and appropriation be contradictory, i.e. a situation of high overlap between solution and product disclosure, and absent or incomplete IPRs. Tensions would be likely dialectical if, for instance, high levels of trust were present or in the case of incomplete IPR protection.

At the value co-creation - value capture level, P3 uncovers a new category of factors that have an apparent dual role; depending on their intensity the result might be either a vicious or a virtuous cycle, i.e. either over-focusing on one paradox pole or embracing paradox and successfully balancing both poles together (Smith & Lewis, 2011). According to P3, these factors are trust (e.g. Jiang et al., 2013), trust for dyadic relations versus trust when partners form ties with rivals (Hernandez et al., 2015); trust versus formal control (Longo & Giaconne, 2017), patents (e.g. Dosi et al., 2006), R&D intensity (e.g. Katila & Mang, 2003), extramural R&D intensity and employee retention (Wadhwa et al., 2017), research joint ventures (JVs) (Simpson & Vonortas, 1994), time (Miranda & Kavan, 2005), a shared identity (Miranda & Kavan, 2005), or coopetition (Ritala & Hurmelinna-Laukkanen, 2009). Given their ability to lead to either vicious or virtuous cycles depending on the intensity, such factors might be linked to dilemmatic, dialectical or paradoxical tensions, also contingent upon their intensity. Note that the above-mentioned category of factors from P3 is not classified (in P3) as a category of factors that directly affects tensions between poles but as a group of factors that may lead to a virtuous or a vicious cycle, following the model proposed by Smith and Lewis (2011). However, it is suggested here that this category of factors may affect the nature of tensions between the paradox poles, even though its effects may not be direct.
In the findings of P4, companies and experts alike acknowledge the challenge of balancing value co-creation and capture, rather than a trade-off or synergy between them, thus mainly pointing towards a paradoxical nature of tensions. Interviewed companies and experts report experiencing tensions related to co-creating value and capturing value, as well as experiencing difficulties balancing both at the same time.

However, some informants interviewed for the qualitative study P4 tend to emphasize an either-or perspective, which pointed to the trade-off approach of seemingly dilemmatic tensions (Smith & Lewis, 2011). One example is “building a wall” around company IP, i.e. choosing not to collaborate with external partners unless they fulfil specific conditions. This choice was due to previous misappropriation experience, in line with Lorenz and Veer (2017), although the experience in this case was not the misappropriation of proprietary company idea(s) but the false accusation that the company had misappropriated a partner’s idea, and the lack of evidence to prove otherwise. The afore-mentioned choice points to dilemmatic tensions related to the paradox of disclosure. However, P4 also emphasizes that such either-or choices may result in losing valuable opportunities to innovate with external partners, thus hinting towards the trade-off approach being only a temporary one (see Lüscher & Lewis, 2008; Smith & Lewis, 2011).

The discussion in this section has highlighted that tensions related to the paradox of disclosure may be dilemmatic, paradoxical or dialectical, following the categorization by Smith and Lewis (2011), and also that such characteristics are contingent upon several factors.

5.2. **Factors that create tensions between co-creating and capturing value**

5.2.1. **Factors related to plurality**

From the overarching value co-creation - value capture perspective, factors that spur salient tensions can be categorized into four categories linked to plurality, scarcity, change, and compound factors, a category which combines the previous three (introduced in P3), following Smith and Lewis (2011). The plurality category includes factors that relate to competing goals of partners,
e.g. coopetition – found by P3 and P4 and also in line with prior studies (Bouncken et al., 2017; Jiang et al., 2016; Ritala & Hurmelinna-Laukkanen, 2009;), and international collaboration – found by P1, P3 and P5 (see also Trimble, 2015). Some contradictory results appear in this category as well.

For instance, among plurality factors, collaboration with academic institutions is pinpointed in P3. According to Perkmann and Schildt (2015) working with universities would create conflicting incentives because of contradictory approaches to publishing knowledge. This would indicate salient tensions related to plurality. However, the contradiction lies in the fact that other studies point to positive effects of university collaboration. Among these studies, Belderbos et al. (2014) indicate that co-patenting with universities would lead to positive results, and P2 finds openness towards universities as innovation partners explains both novelty and efficiency performance throughout the innovation phases.

5.2.2. Factors related to scarcity

Much like plurality factors, the category of factors related to scarcity is based on rather rich references in prior studies. As also pointed out in P5, the lack of resources such as to commercialize a product independently may indicate paradoxical tensions concerning the paradox of disclosure. The scarcity category mainly entails factors that concern resources, e.g. the lack of R&D experience found in P3 (see also Pisano, 1990). The lack of knowledge about IP identified by P3 (also see Rayna & Striukova, 2010) as a scarcity factor also creates the rather salient tensions shown in P4. Expert informants in P4 emphasize that the combination of lack of IP experience/knowledge and other types of scarcity factors, such as asymmetric partnerships between small and large firms (see, e.g., Diestre & Rajagopalan, 2012; Hallen et al., 2014; Kumar, 2010) is particularly challenging. In relation to P4, it should also be stressed that scarcity factors which might lead to salient tensions could also be linked to a partner, not necessarily to the organization itself. Specifically, some of the case companies have experienced difficulties co-creating value with potential partners due to partners’ lack of resources and/or lack of IP knowledge.
5.2.3. Factors related to change

Compared to the previous two categories, factors related to change are not as often mentioned by prior studies (see Table 4 in P3). In P3, the change category includes factors such as shifting and the uncertain nature of future technological results (Oxley, 1999). Moreover, change may be internal or external to an organization. For instance, in P4, external changes in the industry landscape created additional tensions for some of the case companies. Specifically, due to a decrease in work (contracts), opening up to external partners in innovation escalated from a choice to an urgent need. According to P4, such need may also be triggered by the need to have access to a pool of young innovative firms as partners in order to maintain competitive advantage. This too could related to findings from P3, e.g. technological change (see Oxley, 1999).

Uncertainty-related tensions are identified in P3 and P4 and are also implied in P2, when the authors attempt to explain unexpected patterns in the quantitative study. For instance, there is uncertainty surrounding resulting IP in the early stages of innovation collaboration (Stefan & Bengtsson, 2017; Vanhaverbeke et al., 2008). Prior experiences and the way they affect subsequent decisions could also be linked to change factors. For example, a prior experience of having been falsely accused of misappropriation led on one hand to simplification of contracts in order to increase transparency and on the other hand to “building a wall” around company IP (see appended P4). While the former could be further linked to increased openness, the latter might be interpreted as moving towards a more closed approach (see also the open-closed dynamics model of Appleyard & Chesbrough, 2017).

5.2.4. Compound factors

Although this category is not labelled as such Smith and Lewis (2011), P3 dubs as the category compound factors in order to simplify and clarify the wording. This fourth category entails factors such as collaboration in specific phases of the innovation process and with specific types of partners – highlighted by P2, P3 and P4. For instance, P2 shows that collaborating with competitors explains performance in terms of novelty in later commercialization stages of the innovation process (see Stefan & Bengtsson,
P3 finds that early-stage radical innovation may be attained in collaboration with competitors (Ritala & Hurmelinna-Laukkanen, 2009; Bouncken et al., 2017). In P4, compound factors, e.g. (external) combining changing industry settings and (internal) lack of IP knowledge and lack of template agreements and routines, lead to salient tensions in open innovation collaboration.

The category of compound factors from P3 provides tentative explanations of the unexplained patterns in the quantitative studies P1 and P2. The combinations of contextual factors in P4 match or at times complement the findings of P3. Therefore it would be of interest to place more emphasis on configurations of factors and their potential effects. Perhaps P2 suggests compound factors as well. For instance, the collaboration with suppliers in the engineering phase of the innovation process is associated with negative effects on performance in terms of novelty.

5.3. Possible solutions and pitfalls to managing tensions between value co-creation and value capture

5.3.1. Possible solutions

In the broader perspective of value co-creation - value capture tensions taken in P3, possible solutions include the following: governance mechanisms, e.g. contracts (Contractor & Ra, 2002; Gulati & Singh 1998) or joint ventures, equity sharing (Oxley, 1999; Simpson & Vonortas, 1994), organizational capabilities, e.g. partner-specific experience (Dekker, 2008; Katila & Mang, 2003) or absorptive capacity (Hurmelinna-Laukkanen et al., 2012), appropriation strategies, e.g. interactive revealing (Jarvenpaa & Välikangas, 2014), dual value appropriation (Pérez & Cambra-Fierro, 2015) or combining a protective strategy and absorptive capacity (Laursen & Salter, 2014). For more details, see Table 6 in P3. The findings of P4 complement those of P3 in terms of possible solutions to managing tensions between co-creating and capturing value. Case companies or expert informants that perceived such tensions first hand find different ways to cope (see P4). For instance, after having experienced misappropriation, case companies illustrated in P4 attempted to change their internal routines in order to avoid similar events in the future. P4 shows that steps companies take include involving IP
departments more in the fast-track projects where misappropriation had occurred and encouraging all employees involved in such projects to attend training in the area of IP, in order to increase their awareness of the topic and what should or should not be disclosed to external partners in innovation.

A similar attempt to increase awareness about disclosure and IP issues entails creating new cross-functional teams and roles (in line with Saebi & Foss, 2015) in a similar attempt to increase staff awareness about IP importance. Contracts can also be simplified to increase transparency towards potential partners in innovation. A similar way of increasing transparency and gaining trust from partners is revealing to potential innovation partners the status of internal R&D endeavours (not yet released to the public or market). This would in turn incentivize partners to reveal their own progress and developments. The potential involvement of a neutral partner, such as an open innovation intermediary, particularly in asymmetric collaborations, is also recommended by experts interviewed for P4.

P5 suggests possible solutions to managing tensions that relate to a clear separation between knowledge that needs to be disclosed (so-called product characteristics disclosure) and knowledge that should not be revealed to external partners (so-called solution disclosure). This builds on prior studies that signal difficulties distinguishing between the two types of knowledge, e.g. Oxley and Sampson (2004). Another possible solution implied in P5 is the enforcement and coverage of IP protection. Since IP protection mechanisms are particularly costly (de Rassenfosse & van Pottelsberghe de la Potterie, 2012) and territorial in nature (Trimble, 2015), it is important to ensure suitable IP protection, if available.

5.3.2. Possible pitfalls

Some of the possible pitfalls highlighted in P3 include: overlooking value created by both partners (Möller et al., 2008), myopia of learning (Laursen & Salter, 2006; Levinthal & March, 1993), focus on the creative process at the expense of value capture (Henning & Saggau, 2013; Vafeas, Hughes, & Hilton, 2016) or vice versa (West & Bogers, 2014) or learning races (Chesbrough & Appleyard, 2007; Gander et al., 2007). For a more comprehensive list, see Table 5 in P3.
The overemphasis on value co-creation (Henning & Saggau, 2013) or on value capture (West & Bogers, 2014) is also highlighted in the findings of P4. P4 further emphasizes the potential pitfalls of lack of awareness about IP protection and/or risks of disclosing too much knowledge. Moreover, fear of misappropriation – at times due to such prior experiences – on the part of either the focal organization or the partner may lead to failure to co-create value. This is in line with recent studies that investigate effects of prior misappropriation on the likelihood to engage in future collaboration (see Lorenz & Veer, 2017).

According to P5, the overlap between solution and product disclosure, or incomplete IP protection (particularly when the afore-mentioned overlap is high) are likely to lead to pitfalls when managing tensions between disclosure and appropriation.

There are also factors that, depending on their intensity, may prove to either lead to failures or solutions to managing value co-creation and capture tensions, as pointed out in P3. Such factors are, for instance, patents (e.g. Dosi et al., 2006), R&D intensity (e.g. Katila & Mang, 2003) or time (Miranda & Kavan, 2005). P2 also hints at the dual role of patents depending on the innovation phase. While in earlier phases formal IPPMs such as patents have negative effects on performance, in later phases the effect fades (see Stefan & Bengtsson, 2017). A tentative explanation is that due to high uncertainty in early phases (Vanhaverbeke et al., 2008) and the high costs of enforcing formal IPPMs (see de Rassenfosse & van Pottelsbergh de la Potterie, 2012), such negative effects might be observed early on in the collaboration. On the other hand, P2 also reveals that in early innovation phases contracts correlate with performance, thus confirming findings of P3 (see also Contractor & Ra, 2002; Gulati & Singh, 1998).

5.4. Overall discussion

Overall, the five studies included in this doctoral thesis bring new empirical evidence and make several contributions to better understanding the paradox of disclosure and related tensions between co-creating and capturing value, particularly in open innovation settings. Figure 5 illustrates the enhanced
analysis model from Figure 3 and highlights some examples of the findings from the five studies appended to this thesis. Rather than including all findings, this section focuses on the corresponding concepts that emerge across two or more of the studies appended in the thesis, as well as unique takeaways from each of the five studies. The suspension points at the bottom of Figure 5 also indicate that there are further findings than can be fitted in the analysis model. A more comprehensive overview of the findings of this thesis is presented in the figure in Appendix 1.

The two quantitative studies, P1 and P2, take the perspective of openness-appropriability tensions and are based on previously tested constructs of openness and appropriability. The main takeaways of these two studies are identifying new openness-appropriability and openness-appropriability-performance patterns, thus responding to calls for research from such scholars as Laursen and Salter (2014). P1 considers partner location to be a moderator in the appropriability-openness relationship, and P2 considers innovation phases as a moderator in the openness-appropriability-performance relationship. The former is a relationship little explored in open innovation literature, in spite of ‘patchwork-network’ tensions being signalled, for example in law literature (see, e.g., Trimble, 2015). The latter, taking into account phases in the innovation process when investigating openness and appropriability (P2) is a response to calls for research by Zobel et al. (2017). As highlighted in its results section, P1 shows that formal IPPMs are predominantly used in open innovation settings with most types of international partners, including competitors, while formal and semi-formal IPPMs are mostly used in local open innovation. However, the expected negative effects of higher costs of formal IPPMs in international open innovation settings do not appear in the findings of P1; this is the first unexplained pattern of the quantitative studies. One explanation could be that performance was not included in this analysis. P2 does take into account performance in terms of novelty and efficiency, though the moderating variable in this study is represented by innovation phases. However, there are unexplained patterns here too, such as the unexplained negative effects of formal IPPMs in the idea phase or negative effects of openness towards suppliers in the engineering phase.
P3, which takes a broader value co-creation - value capture perspective on tensions related to the paradox of disclosure, suggests some findings that might help explain some of the patterns in the quantitative studies. For instance, P3 hints at salient tensions in the presence of factors related to international collaboration in weak regimes (Oxley, 1999) – this could be linked to the presumed tensions concerning partner location and IPR territoriality in P1. Collaboration with competitors in the exploitation phase (Belderbos et al., 2014) is also signalled by P3 to spur salient tensions. Although this finding does not precisely match the unexplained pattern, such as the negative effect of collaborating with suppliers in engineering phases from P2, it might instead suggest that collaboration with specific partners in various innovation phases might be more challenging. Nevertheless, the findings of P4, which takes a value co-creation - value capture perspective to empirical open innovation settings, show that this is also contingent upon other contextual factors.

For example, P4 illustrates cases of misappropriation in innovation collaboration with suppliers, in settings of high uncertainty about IP outcome (and implicitly the potential value of IP) and tight project deadlines. This further matches findings from P3 that point to time (and several other factors) as having a dual role depending on their extent, thus leading to either virtuous or vicious cycles (see also Miranda & Kavan, 2005). The qualitative study P4 also sheds light on how formal IPPMs such as patents are not particularly useful at early stages of product development when the knowledge is more tacit, thus in line with prior work by Katila and Mang (2003) and others. The difficulty of IP protection at early stages combined with employees’ lack of awareness about disclosure strategies and IP protection is likely to lead to misappropriation of IP, i.e. vicious cycles, as they are called by paradox studies (Smith & Lewis, 2011). Linkages between the systematic literature review in P3 and the qualitative study of P4 could also be drawn. For instance, factors such as lack of knowledge and awareness about disclosure and IP protection issues (Oxley, 1999), uncertainty about IP outcomes (e.g. Vanhaverbeke et al., 2008), or the salience of asymmetric partnerships, particularly between young small firms and large firms (Hallen et al., 2014), are examples of factors that emerge from both studies.
Figure 5. Overall analysis model – answering the three research questions
The disclosure-appropriation perspective (P5) is less reflected in the quantitative studies P1 and P2, and even in P3, the systematic literature review. However, the qualitative empirical evidence also points to a need to focus on disclosure. Specifically, both P4 and P5 emphasize difficulties distinguishing between types of knowledge (e.g. Oxley & Sampson 2004) and a lack of awareness about how much to disclose and about potential risks of misappropriation. Thus, there is partial support for the propositions formulated in P5 concerning the potentially simultaneous interrelated and contradictory nature of tensions related to the paradox of disclosure.
6. Conclusions and contributions

6.1. Summary of conclusions

The overall purpose of this thesis has been to gain a deeper understanding of the paradox of disclosure and related tensions in open innovation, by using a paradox theory lens. Tensions that relate to this paradox are investigated from three different perspectives in this thesis. The overarching perspective is that of tensions between value co-creation and value capture. To achieve this purpose, the thesis explored the characteristics of tensions related to the paradox of disclosure, identifying factors that lead to tensions and pinpointing possible solutions and pitfalls to managing such tensions.

The characteristics of tensions between co-creating and capturing value are highly contingent upon the extent to which these two so-called poles of the paradox (value co-creation and value capture) are interdependent and contradictory. Specifically, for technological innovations, resources available to develop and commercialize an invention independently, the delineation between solution and product characteristics – which further depends on the extent to which knowledge is easily codified (O’Dwyer & O’Flynn 2005) – as well as the availability of appropriability mechanisms play crucial roles. Moreover, the nature of tensions also depends on the extent to which either/or choices are temporary.

The factors that spur tensions relate to plurality, scarcity, change, and a fourth combined category, compound factors. Plurality factors relate to incongruent and/or coopetitive goals between partners (e.g. Kasch & Dowling, 2008), scarcity factors include lack of resources or lack of knowledge about IP (e.g. Rayna & Striukova, 2010), change factors concern such issues as difficulties distinguishing among knowledge types (e.g. Oxley & Sampson, 2004), and compound factors include collaborating for radical innovation in coopetition (e.g. Ritala & Hurmelinna-Laukkanen, 2009).

Possible solutions and pitfalls to managing the tensions between value co-creation and value capture could be related to the vicious and virtuous cycles proposed by Smith and Lewis (2011). Putting too much focus on one of the
poles while overlooking the other, such as by overemphasizing external search (Laursen & Salter, 2006) would lead to a vicious cycle, representing potential pitfalls. In this example, no value would be captured. Vicious cycles could also be created by uncertainty regarding IP outcomes (see Vanhaverbeke et al., 2008) or a high degree of tacitness of knowledge in early collaboration phases (Katila & Mang, 2003). Virtuous cycles are created by balancing the two poles and represent possible solutions to managing value co-creation and value capture tensions effectively. For instance, selective revealing (e.g. Henkel, 2006) would be a way to balance value co-creation and value capture. Another example of reaching towards virtuous cycles is making internal organizational changes such as simplifying contracts for increased transparency or increasing staff awareness about IP and disclosure.

However, this thesis also unveils a new category of factors, which may lead to either solutions or pitfalls depending on their intensity. Such factors include patents (Dosi et al., 2006) or time (Miranda & Kavan, 2005). Overall, this thesis takes a step forward in reconciling tensions between co-creating and capturing value (see Jiang et al., 2013; Katila et al., 2008; Laursen & Salter, 2014; Lorenz & Veer, 2017). The findings have important implications for theory, practice and policy.

6.2. Theoretical contributions

6.2.1. Contributions to open innovation literature

This thesis contributes to open innovation literature by responding to recent calls for research to focus more on openness-appropriability-performance tensions (see Laursen & Salter, 2014) and innovation phases when investigating openness-appropriability relationships (see e.g. Zobel et al., 2017), and to provide empirical evidence of balancing value co-creation and capture from various industries outside the software industry (see, e.g., Appleyard & Chesbrough, 2017).

Moreover, this thesis shows how the paradox of disclosure unfolds in inbound, as well as in bidirectional and interactive coupled open innovation processes, adding to previous contributions by such studies as Dahlander and Gann (2010) or Laursen and Salter (2014). This thesis thus provides new
dimensions to the increased complexities related to the paradox of disclosure in open innovation settings (Laursen & Salter, 2014) and suggests further empirical settings for investigating this paradox. By identifying factors that create tensions related to the paradox of disclosure, specific combinations of factors are pinpointed (particularly in the qualitative study) where tensions are more likely to be perceived by actors. This contributes to understanding and possibly managing such tensions in better ways. In open innovation settings, the paradox of disclosure is present in coupled processes, which means that future investigations of tensions related to this paradox should go beyond unidirectional perspectives (inbound versus outbound).

The findings of this thesis further identify a need for better constructs of openness. Theoretical and empirical evidence provided by this thesis indicates that the tensions between co-creating and capturing value in open innovation settings often occur at the disclosure level, being strongly linked to the nature and amount of information revealed to a potential external partner. Therefore, the suggestions for more refined openness constructs that this thesis advances could perhaps add clarity to the concept of openness. Analysing disclosure, particularly in contexts of technological innovation, might benefit from the suggested dichotomy between solution and characteristics of a product highlighted in the conceptual study P5.

6.2.2. Contributions to paradox theory

In regards to paradox theory, this thesis contributes by applying a paradox lens to a complex phenomenon (see Smith & Lewis, 2011; Schad et al., 2016) and by developing the framework of paradox dynamic equilibrium, suggested in the seminal study of Smith and Lewis (2011). This thesis uncovers the new dual role factors category that may lead to either solutions or pitfalls depending on their intensity. The potential dual role of such factors hints at increased complexity in paradox investigation. It is not clear whether such factors would apply to a general dynamic equilibrium model (Smith and Lewis, 2011), or if this new category is only present when investigating tensions related to the paradox of disclosure.
Although some paradox scholars suggest time is part of the definition of paradox (e.g. Putnam et al., 2016), time has emerged from the conceptual and empirical results of this thesis as a factor that has a dual role, possibly leading to either vicious or virtuous cycles, depending on its extent. Moreover, as highlighted in the theory section of this thesis, earlier paradox studies such as Poole and Van de Ven (1989) suggest time could be a way to work with paradox. A possible contribution based on the findings of this thesis would be to suggest that time has less of a role in delineating paradox and more of a role in determining how paradoxical tensions are managed.

6.2.3. Contributions to appropriability literature

The theoretical and empirical findings of this thesis point to a need for better, more encompassing constructs related to appropriability. Although appropriability mechanisms such as patents, trade secrets or contracts (Hertzfeld et al., 2006) are crucial for co-creating and appropriating value in open innovation, there are other factors that hinder or contribute to effectively managing tensions between value co-creation and value capture. For instance, staff awareness (and training) about IP and disclosure emerges as an essential factor. Moreover, the findings of this thesis highlight that only the use of certain appropriability mechanisms may not fully capture the complexity of appropriability. Details pertaining e.g. contracts complexity, are also highly important. Therefore, another suggestion for improved appropriability constructs would be to add a more fine-grained measures that pertain to e.g. the complexity and quality of contracts, as well as the territorial coverage of certain formal IPPMs such as patents. These contributions add to prior work by Hurmelinna-Laukkanen (2011), who proposes enhanced appropriability constructs including human resource management, labor legislation and level of tacitness and complexity of knowledge.
6.3. Practical implications

6.3.1. Implications for practitioners

Small and/or young firms such as start-ups or small and medium enterprises often lack knowledge about IP protection and disclosure, yet this is a crucial issue for balancing value co-creation and value capture in open innovation collaboration. Thus, participating in trainings on IP or pursuing other ways of gaining more knowledge about such topics would improve the chances for e.g. entrepreneurs and start-ups to manage effectively possible tensions between co-creating and capturing value in an effective way.

Specifically being aware of formal IPR costs and limitations, as well as awareness about the overlap between solutions and the characteristics of a product are recommended. It is essential to understand what can be protected, and hence what can be disclosed, but also where it could be protected, which in turn is a function of costs and access to partners and markets in different national territories. When evaluating potential partners in innovation, the reputation of a possible partner could also be a key to avoiding risks of misappropriation. Moreover, involving a neutral partner such as an open innovation intermediary could also aid smaller and/or young firms in managing potential tensions.

Managers in larger organizations are advised to beware of time-sensitive collaboration projects, particularly when there is initial uncertainty about the resulting IP. Managers in larger companies are also encouraged to increase awareness about issues relating to IP through trainings and increased communication with IP departments. Additionally, constituting cross-functional teams designated to deal with external partnerships (contracts, IP, etc.) might also be a solution to avoid or effectively manage tensions between co-creating and capturing value.

This thesis also provides empirical evidence that one partner’s fear of misappropriation might hamper successful value co-creation and also value appropriation for both or all stakeholders involved in innovation collaboration. Therefore, a further recommendation for larger firms would be to increase transparency (e.g. by simplifying complex contractual agreements.
or by providing information about internal R&D progress), while also clearly delineating between information that should be disclosed and information that should remain secret. Increased transparency and simplified processes and routines for innovation collaboration, combined with awareness about IP protection and disclosure risks, would enable balancing value co-creation and value capture and would also aid in overcoming any fear of misappropriation.

Managers of larger firms are also cautioned to avoid putting too much emphasis on either value co-creation or value capture. For instance, too much focus on IP protection – i.e. building so-called walls around the company’s IP – might be an efficient safeguard from being wrongly accused of misappropriation, yet it may also hamper opportunities to co-create value with external partners. Moreover, in open innovation settings, the paradox of disclosure is present in coupled processes, which means that future investigations of tensions related to this paradox should go beyond unidirectional perspectives (inbound versus outbound).

6.3.2. Implications for policy makers

Policy makers should be more aware about issues related to the costs of formal IP protection (particularly when this is required in several national territories), details concerning contractual agreements and terms thereof, and also the lack of awareness about IP protection and disclosure among employees of both small and large firms.

Regarding effective IP protection, a key question that is yet to be answered is: how can entrepreneurs and/or organizations with limited resources protect their IP while revealing it to a potential partner, in the context of costly formal IP procedures that also take a long time to enforce? This is particularly a challenge when knowledge is highly codified; in such case it is difficult to apply secrecy or to reveal the knowledge gradually.

Concerning the lack of awareness about IP issues, policy makers might consider ways of contributing to increased awareness about IP protection and disclosure. Organizing free workshops or similar trainings for companies in specific areas might aid in bridging this practical knowledge gap.
6.4. Limitations and future research

This thesis has a number of limitations, which nevertheless might provide potential for future research.

For instance, the thesis is limited to interorganizational relationships, and specifically settings pertaining to open innovation. Future research might benefit from exploring tensions related to the paradox of disclosure at the individual level. This would follow suggestions of recent studies in paradox theory, which make a distinction between the collective and individual levels (see Schad et al., 2016). Moreover, since the literature review in P3 applies the perspective of value co-creation-value capture tensions to studies in different literature streams, it could be useful to explore such tensions more in depth in empirical settings other than open innovation collaboration.

Another limitation is that propositions formulated in the conceptual study P5 have not yet been tested. This represents an opportunity for future studies too. In relation to this limitation, the focus on technological innovation is a further limitation, seeing as such type of innovation is often protected either by trade secrets or by patents, although this is most often done in combination with other appropriability mechanisms such as contracts, product complexity, trademarks, etc. (see Hall et al., 2014). It would be of additional interest to explore potential dichotomies between solutions and product characteristics, such as the one suggested in P5, in other types of innovations.

Some future research avenues also stem from the above-mentioned theoretical contributions. For instance, fear of misappropriation or the occurrence of misappropriation may hamper the propensity to collaborate in innovation, as previously pointed out by Lorenz and Veer (2017), and might thus stall innovation and economic growth. Therefore, there is a need for more research on different aspects of and perspectives on tensions related to the paradox of disclosure. Moreover, this thesis’s Discussion emphasized that there is somewhat of an overlap between factors that spur tensions and factors that determine the dilemmatic, dialectical or paradoxical nature of tensions. Therefore, there is a need to clarify and delineate such concepts and any potential overlap and/or linkages between them.
This thesis also indicates that paradox theory models such as the dynamic equilibrium model suggested by Smith and Lewis (2011) might contain hidden components (e.g. additional types of factors), possibly contingent upon the specific paradox that is being investigated. This further implies the need to clarify linkages between vicious and virtuous cycles and how it might be possible to bridge from one to the other. Possible configurations of factors that spur salient tensions might be relevant for pinpointing specific settings under which paradoxical tensions are more likely to occur.

The role of time in defining paradox as opposed to the effects of time in managing paradoxical tensions should also be further explored in future research. While it is possible that the investigation of this particular paradox revealed the dual role of time, leading to either vicious or virtuous cycles, it is also possible that time displays similar roles when applying a paradox lens to other phenomena. Therefore, a question that arises is whether and to what extent time is part of paradox definitions and potential paradox theory models.
7. References


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