

CHAPTER 1 | INTRODUCTION

1.1 Research motivation

Of course, they are two worlds [referring to Japanese and Dutch subsidiaries of Mirai Corporation]. Two separate worlds with what I always say a very small bridge between them. Japan doesn't know otherwise than their way [of working] so also imposes that upon us. And Netherlands thinks well what should we do with it because we do it differently. [And] that often clashes. . . It's not an easy task but [in] what I have done in past years [i.e., the work] you can't just ignore it. Then you'll come across all those difficulties, but that's a voyage of discovery. . . Eventually when you've overcome it all, you also see the positives and benefits. (Senior research manager Jan Kees)

This thesis seeks to advance insight into knowledge-intensive work that takes place in collaborative settings that span multiple contexts. This issue is motivated in part by the observation that firms increasingly adopt cross-boundary collaboration as an organizational form for work tasks that require specialized expertise (e.g., Baldwin and Von Hippel, 2011; Bechky, 2006, p. 1763; Gulati et al., 2012), such as between Japanese and Dutch subsidiaries of the Japanese multinational Mirai Corporation that senior research manager Jan Kees referred to in the quote above. In the view of Jan Kees, it is the absence of shared structures and work practices that often makes cross-boundary collaboration challenging and places a greater emphasis on the ability of people to organize in situ, sort out the differences between them, and to develop shared practices across contexts. But once you have dealt with those differences, Jan Kees explained, collaborating across worlds can bring many advantages.

More generally, advances in information and communication technologies (Yoo et al., 2010), together with a globalized economy (Hinds et al., 2011), have contributed to the increased permeability of traditional firm boundaries. In past decades, we have witnessed profound changes in the way work is organized and accomplished (Barley and Kunda, 2001; Okhuysen et al., 2013; Yoo et al., 2010), with many firms moving away from bureaucratic organizational forms and adopting hybrid (Battilana and Lee, 2014), heterarchic (Kellogg et al., 2006), networked (Powell, 1990), geographically distributed (Hinds and Kiesler, 2002), or meta-organizational (Gulati et al., 2012) forms. Also traditional firms have substantially changed how knowledge-intensive work is organized, thereby making collaboration across boundaries more prevalent (Kane and Levina, 2017). This is reflected in the rise of strategic and business process outsourcing (Gulati and Kletter, 2005; Srikanth and Puranam, 2010). Similarly, firms are adopting more open organizational models to solve complex problems and utilize new growth opportunities, for instance by initiating collaborative relations across firm boundaries (e.g., Lakhani et al., 2013).

Recognizing their potential in areas ranging from technology and innovation to strategic management, also multinational corporations (MNCs) such as Mirai Corporation are increasing the frequency with which they are establishing collaborative relations among actors inside and outside their firm to execute core work tasks (e.g., Huston and Sakkab, 2006; Friesl and Silberzahn, 2012). These developments are part of a broader shift in the locus of work moving towards settings that cross the boundaries of particular contexts (e.g., professional, societal, firm, industry).

Despite cross-boundary collaboration having a long history (e.g., Brytting, 1996; Harris, 1996; Fayard and Metiu, 2014; O'Leary et al. 2002) and its basic challenges remaining largely the same, the question how to collaborate effectively across boundaries so that mutual understanding is fostered and knowledge-intensive work is accomplished is one that has yet to be answered satisfactorily. In other words, while the world of practice has placed greater importance on such cross-boundary collaborations, *we have yet to develop theoretical frameworks that help us understand its true impact on the way work is executed in contemporary organizations*. I anchor this thesis in the organizational literature on collaboration and boundaries to address this particularly relevant issue in the study of work and organizing in the 21st century.

1.1.1 Collaborating across boundaries

The issue of establishing cross-boundary collaboration to execute knowledge-intensive work has been considered in part by collaboration scholars (e.g., Beck and Plowman, 2014). "Collaboration" is defined as a relational process in which actors from different practice contexts work together by developing shared rules, norms, and structures and jointly decide on issues related to a shared interest or problem (Beck and Plowman, 2014, p. 1235; Hardy et al. 2005, Wood and Gray 1991; see Appendix I). "Effective collaboration" is understood as collaboration that leverages differences among actor to produce innovative, synergistic solutions that balance divergent stakeholder concerns (Hardy et al., 2005, p. 58; Levina, 2005, p. 110). To generate such solutions, organizational actors increasingly seek sources of expertise beyond the boundaries that traditionally defined the domains of work and organizations. When collaborations deliberately or inadvertently relate actors that are separated by one or more boundaries (e.g., Levina and Vaast, 2014, p. 286), I call this "cross-boundary collaboration".

The challenges of cross-boundary collaboration have been described in literatures that focus on collaboration *between* organizations (i.e., alliances and inter-organizational collaboration) as well as collaboration *within* organizations that cross the boundaries between different knowledge, cultural, and geographical contexts (i.e., cross-functional, global, or distributed collaboration). Researchers have identified collaboration *antecedents* (e.g., Gray, 1985), such as having the right people that trust each other and work towards a common objective (e.g., Eden and Huxham, 2001; Gulati et al., 2012; Mortensen and Neeley, 2012). Strategy scholars have focused on the *motivations* and *outcomes* of collaboration, such as learning and knowledge transfer (Kale and Singh, 2007; Kotabe et al., 2003), new value creation, (e.g., Adegbesan and Higgins, 2011; Barringer and Harrison, 2000), and realizing competitive advantage (Hoffmann, 2007; Ireland et al., 2002). From these studies, we learn that when collaboration is effective, executing knowledge-intensive work across boundaries can prove beneficial, for instance to foster innovation, creativity, and learning. However, especially when collaborating in global contexts, actors often encounter challenges related to their embeddedness in different contexts and the many differences between them.

Literature on collaboration *processes* has offered valuable insight into key work processes in cross-boundary collaboration, such as finding common ground to develop synergistic solutions (Gray, 1989; Hardy et al., 2005; Levina, 2005), the emergence of collaboration and coordination practices (Bruns, 2013; Faraj and Xiao, 2006; Lawrence et al., 2002), knowledge sharing (Cramton, 2001; Fayard and Metiu, 2014) and the role of unequal or changing status and power relations (Aime et al., 2014; Hardy and Phillips, 1998). These studies help to understand how work processes in cross-boundary collaborations are fundamentally different from standard work processes (see Table 1.1 below) and why, even when collaboration antecedents are met, realizing knowledge-intensive work in cross-boundary collaboration is often challenging. Conventionally, work processes mostly take place inside organizations or in long-lasting partnerships, involving experts on one location and remain involved throughout the collaboration, usually for a long period of time. Cross-boundary collaboration, in contrast, takes place across organizations or organizational domains, involving experts from both inside and outside the organization that are often geographically distributed, and are involved only part of the collaboration, usually short-term. Further, whereas in standard work processes, participants tend to have general and

TABLE 1.1 | Summarized comparison of work processes in standard and cross-boundary collaboration

	Standard work processes	Work processes in intra-organizational collaboration	Work processes in inter-organizational collaboration
Boundaries	Team or departmental boundaries – clearly defined	Functional/disciplinary boundaries, geographical boundaries, intra-organizational boundaries – increasingly permeable	Organizational boundaries – increasingly permeable
Participants	Experts inside organizations, fixed membership	Experts inside organizations, changing membership	Experts both in- and outside organizations, changing membership
Spatial dimension	Geographically concentrated, preferably on 1 location	Geographically distributed, partly virtual	Geographically distributed, partly virtual
Temporal dimension	Same time zone Long timespan	Different time zones, relatively shorter timespan	Different time zones Relatively shorter timespan
Organizational dimension	Within organizations	Within organizations	In established organizational partnerships
Knowledge dimension	General and shared knowledge and expertise	Unique and highly specialized knowledge	Unique and highly specialized expertise
Resources	Low	High	High
Management	Centralized, hierarchical (vertical)	Less centralized and hierarchical (horizontal and vertical)	Less centralized and hierarchical (more horizontal)
Span of control	High control on outcome	Lesser control on outcome	Relatively low control on outcome

shared knowledge, participants in cross-boundary collaboration often have unique and highly specialized knowledge. Lastly, the costs of standard collaboration are relatively low with management having tight control on the realization of outcomes due to more centralized and hierarchical coordination. In contrast, cross-boundary collaboration is often resource-intensive with coordination being more decentralized and horizontal. Therefore, management tends to have less control on outcome realization.

Whereas scholars of organizations have theorized the technological and societal changes *that* led to these collaborative forms of organizing work and their inherent challenges, we still know little about *how* such work is carried out in actual practice (e.g., Beck and Plowman, 2014, p. 1234). An important question that has received little theoretical attention is *how it changed the very nature of the work that is carried out inside cross-boundary collaboration* (Okhuysen et al., 2013; Phillips and Lawrence, 2012). This is problematic since work and organizing are interdependent (Barley and Kunda, 2001, p. 76) and hence, the growing tendency of firms to organize work in cross-boundary settings challenges our thinking about contemporary work in organizations (e.g., Okhuysen et al., 2013, p. 495). To

address this gap, this thesis develops the argument that carrying out knowledge-intensive work in cross-boundary collaborations adds an extra dimension to the work. This is especially true when work is carried out across multiple overlapping contexts, as visually represented in Figure 1.1 (Kane and Levina, 2017, p. 544; Levina and Vaast, 2008, p. 322). Effective collaboration in such complex institutional settings (Värlander et al., 2016, p. 83) requires a significant reorganization, transformation, and reconstitution of work tasks so that: “the people doing the work, the arrangements around the work, the technology used in the performance of the work, and even the very purpose of the work may change” (Okhuysen et al., 2013, p. 492). Executing knowledge-intensive work in cross-boundary collaboration thus requires actors not only to be skilled in the work that they do but also to have know-how about working together with people who may have very different knowledge, work practices, and interests.

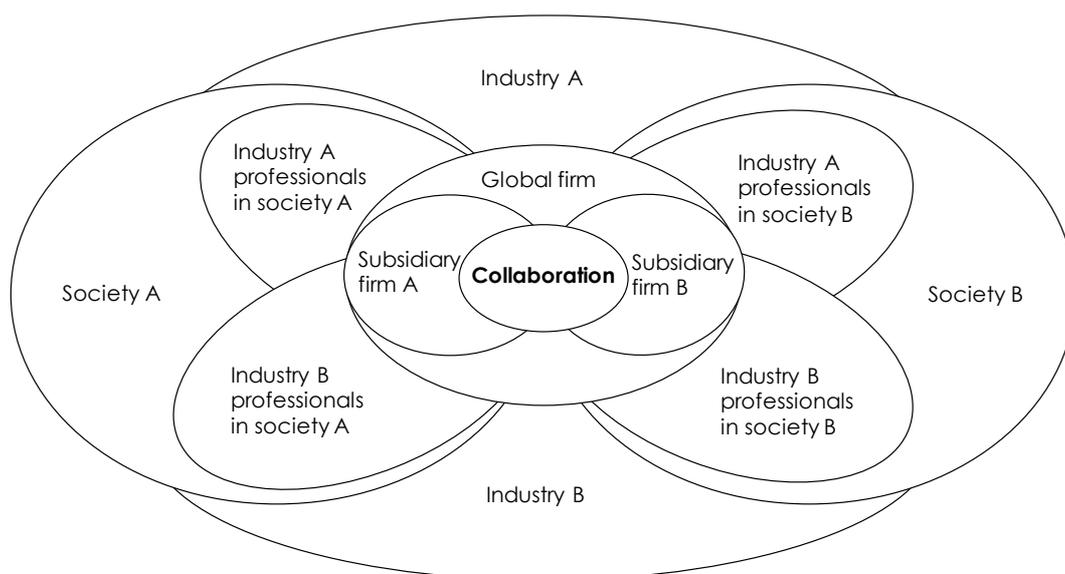


FIGURE 1.1 | Cross-boundary collaboration across multiple overlapping practice contexts (Figure after Kane and Levina, 2017, p. 544)

To conceptualize the elements of work that are affected by these changes (Phillips and Lawrence, 2012, p. 224-226), requires detailed empirical studies that offer fine-grained insight into the processes and practices through which knowledge-intensive work is accomplished in cross-boundary settings. In developing this argument, we will adopt an approach that is relational (Emirbayer, 1997; Østerlund and Carlile, 2005), focusing on the processes through which people involved in cross-boundary collaboration work together, thereby drawing on insights from practice-based studies of boundaries.

1.1.2 Towards a practice-theoretical understanding of boundary work

The issue of initiating cross-boundary collaboration to execute knowledge-intensive work has also been considered in organizational scholarship on boundaries. Drawing on previous boundary research (Abbott, 1995; Levina and Vaast, 2008), I define boundaries as:

those differences that come to demarcate distinctions between actors from different practice contexts (or fields of practice) and gain salience in practices that are differentially recognized and rewarded across contexts.

Boundaries are always situated in particular contexts and define the institutional settings in which practices are historically and locally situated, and have meaning. When work tasks are carried out across boundaries, this requires a competence in boundary spanning (Orlikowski, 2002) – the activities that enable a synergistic combination of the diverse expertise and interests of collaborating actors that are separated by boundaries (Hardy et al., 2005; Kane and Levina, 2017, p. 541; Levina and Vaast, 2014). Such a competence in collaborative boundary spanning is essential as it enables organizations to create new capabilities or find novel solutions to complex problems (Carlile, 2004; Langan-Fox and Cooper, 2014). Ironically, however, while cross-boundary collaborations are initiated for complex work tasks that require actors from different geographic and expertise areas, precisely this heterogeneity among actors is often found to be most challenging (e.g., Carlile, 2002). Boundary spanning is extraordinarily challenging to achieve in global contexts where people are separated by multiple boundaries. Collaborating actors tend to differ significantly, for instance in terms of status (Levina and Vaast, 2008; Schotter and Beamish, 2011), knowledge, culture (Cramton and Hinds, 2014; Hong, 2010), and language (Barner-Rasmussen et al., 2014; Hinds et al., 2011). Hence, as Levina and Vaast (2014, p. 286) aptly concluded: “while modern technology and globalization enable boundary-spanning, it is not solving key social problems associated with the differences in practices, interests, and understandings of people coming from diverse backgrounds and lacking a common history of interaction”.

The argument presented in this thesis builds upon a practice perspective (Bourdieu, 1977; Feldman and Orlikowski, 2011; Nicolini, 2012; Schatzki, 2001). A practice-theoretical perspective focuses on micro-level work activities. Practice-based studies have identified the role of boundary organizations (O’Mahony and Bechky, 2008) and trading zones (Kellogg et al., 2006) in enabling cross-boundary interactions. Especially, practice

researchers have made significant contributions to our understanding of how effective collaboration in cross-boundary settings can be facilitated (e.g., Carlile, 1997; Levina and Vaast, 2014), for instance by nominating actors such as bicultural immigrant managers in boundary-spanning roles, i.e., boundary spanners (Levina and Vaast, 2005; 2006; Kane and Levina, 2017), and by relying on objects such as design or assembly drawings and prototypes that are able to establish a shared context for collaboration and knowledge sharing at a boundary, i.e., boundary objects (e.g., Bechky 2003a, Carlile, 2002; Barrett and Oborn, 2010).

Practice-based studies have theorized about how boundary spanners and boundary objects form *socio-material* mechanisms that can facilitate the execution of knowledge-intensive work in cross-boundary collaboration. Yet, what has been left unexplained are the *socio-symbolic* processes through which actors negotiate or configure boundaries. In other words, whereas we learned a lot from these studies about ways to execute knowledge-intensive work across boundaries, we have yet to explain the processes through which boundaries themselves can be better understood and are negotiated (see Ch. 2). This is problematic because carrying out work across boundaries also transforms the very boundaries that define work, and associated autonomy and status relations (e.g., Bechky, 2003b; Levina and Orlikowski, 2009, p. 289). Namely, when work is organized in cross-boundary collaboration, people's actions are no longer determined by the institutional norms of one particular practice context but rather is the outcome of actors' efforts to cope with the norms, rules, and routines of multiple practice contexts – the contexts in which practices are historically and locally situated and which unite actors in their pursuit of a common interest (Levina and Vaast, 2005; 2014). This opens up room for individual agency, whereby the boundary work enacted by collaborating actors to develop shared practices may also have implications for the practices of their respective parent contexts (and boundaries). Subsequently, actors may either accept or resist these transformations. Hence, collaborating actors not only have to develop shared practices and mechanisms to carry out their work but also need to cope with the changing boundaries that define their work and associated autonomy and status relations (Bourdieu, 1977; Bourdieu and Wacquant, 1992; Kane and Levina, 2017, p. 541-542).

This thesis argues that a focus on boundaries themselves – and how they are (re-) negotiated in cross-boundary collaboration – may help to address this gap. A practice

perspective recognizes that boundaries are not static but are continuously (re)negotiated in the doings and sayings of actors. I propose that shifting focus towards boundaries as “phenomena giving rise to their own dynamics” (Paulsen and Hernes, 2003, p. 3) can help to develop a framework for understanding the micro-level interactions through which actors come to perceive and negotiate boundaries, their dependencies, and associated status relations, and how this affects the work processes through which knowledge-intensive work is accomplished. To conceptualize this important element of contemporary work requires analysis of actors’ “boundary work” (Gieryn, 1983; Lamont and Molnar, 2002; Zietsma and Lawrence, 2010), that I define as:

The socio-symbolic processes through which actors (re-)negotiate or (re-)configure boundaries to achieve either greater integration or differentiation between actors from different practice contexts.

In developing this argument, this thesis will draw upon a study of boundary work in cross-boundary collaborations around knowledge-intensive work at the Japanese MNC Mirai Corporation.

1.2 Research questions

To summarize the problem statement, this thesis aims to further theory development about knowledge-intensive work when it is carried out in cross-boundary collaboration. The increased frequency by which firms initiate cross-boundary collaboration to execute knowledge-intensive work is part of a broader shift in the locus of work moving towards settings that cross (multiple) boundaries. However, we have yet to understand empirically and conceptually how people can collaborate effectively across boundaries and foster mutual understanding towards accomplishing knowledge-intensive work. Whereas collaboration scholars have offered valuable insight into the differences and challenges of carrying out knowledge-intensive work in cross-boundary collaboration, what is left unaddressed is the micro-processes through which such work is accomplished in actual practice and how it changes the very nature of work carried out inside them. Furthermore, whereas boundary scholars have identified socio-material mechanisms to enable collaboration across boundaries, an important issue that has yet to be answered pertains to the socio-symbolic processes through which actors negotiate boundaries through their boundary work. In this thesis, I therefore move the relation between work, collaboration,

and boundaries center stage to offer a focused inquiry into boundary work and its relation with key work processes. To this aim, I ask the research question (RQ):

RQ: How do organizational actors enact boundary work to execute knowledge-intensive work in cross-boundary collaboration?

Specifically, then, this thesis addresses three inter-related limitations: addressing the relation between boundary work and key collaborative processes of creating common ground for collaboration, coordinating work, and knowledge sharing, and leading to its research sub-questions (SQs). The first issue is about the relation between boundary work and creating common ground for collaboration. When firms decide to organize knowledge-intensive work in cross-boundary collaboration, it becomes important for organizational actors to have created sufficient common ground to jointly execute the work. I understand “common ground” as the sum of mutual, common, or joint knowledge, beliefs, and suppositions that creates shared understanding and affiliation across groups (Bechky, 2003; Clark, 1996; Cramton, 2001). While common ground is important for realizing effective collaboration, differences in work practices between actors may demarcate distinctions that prevent the creation of common ground. Furthermore, when knowledge-intensive work is organized in collaborations that cross multiple overlapping contexts, it becomes important to understand how the actors involved in the work make sense of such differences as boundaries, thereby informing their boundary work. Hence, focusing on an open strategy initiative involving senior managers from Japan and Europe, I therefore asked the sub-question: *How do strategic actors make sense of and enact boundaries to create common ground for open strategy making? (SQ1)*

I then address the second issue, pertaining to the relation between boundary work and coordination processes in cross-boundary collaboration. When knowledge-intensive work is organized and executed in cross-boundary collaboration, it becomes important for collaborating parties to develop shared processes and mechanisms to coordinate their work. I define “coordination” as the process through which organizational actors structure their interdependent actions in a way they believe will enable them to realize a collective performance (Faraj and Xiao, 2006; Malone and Crowston, 1990; Okhuysen and Bechky, 2009; Quinn and Dutton, 2005). In organizations, coordination is usually achieved through existing practices, processes and mechanisms. Yet, in collaborative projects, actors often lack a shared history: they only work together temporarily, while remaining embedded in

their respective home contexts. Executing knowledge-intensive work therefore requires actors to balance project and organizational requirements for coordination. Hence, focusing on a multiparty engineering project involving four groups of engineers from Japan, China, Belgium, and the Netherlands, I therefore asked the sub-question: *How do organizational actors enact boundary work to coordinate work tasks in complex multiparty collaboration? (SQ2)*

The third issue is concerned with the relation between boundary work and knowledge sharing. When firms introduce cross-boundary collaboration to accomplish knowledge-intensive work, actors are confronted with the challenge how to share and integrate their knowledge across the boundaries between them. Whereas previous studies have elucidated how knowledge is embedded in practices (Lave and Wenger, 1991; Orlikowski, 2002) and the need for developing shared objects and practices to share knowledge across boundaries between groups (e.g., Bechky, 2003; Carlile, 2002; Levina and Vaast, 2005), we do not know how, once executing knowledge-intensive work in cross-boundary collaboration has been successful and its outputs are implemented in other contexts, actors can share their knowledge with adopters. Successfully implementing that knowledge requires actors to balance competing demands to maintain the practices in which their knowledge is embedded but also transform those very practices to comply with institutional norms from the implementation context – the shared meaning systems of actors in a particular practice context that are encoded in the taken-for-granted practices of that context (e.g., Clemens and Cook, 1999, p. 442; Furnari, 2016, p. 4). Hence, focusing on a radical innovation project involving research scientists, engineers, and operators from Japan and the Netherlands, I therefore asked the sub-question: *How does the boundary work of innovators and adopters affect their ability to share knowledge during innovation implementation? (SQ3)*

Hence, to develop a framework for understanding how boundary work shapes the execution of knowledge-intensive work in cross-boundary collaboration, I conducted a longitudinal and multi-sited field study of the Japanese MNC Mirai Corporation and its collaboration with the American engineering contractor Ancone. I examined the work performed by senior managers, engineers, and research scientists to realize open strategy making, engineering design work, and radical innovation. I thereby sought to understand (1) the role of boundary work in executing such knowledge-intensive work in cross-

boundary collaborative settings; (2) which boundaries become salient and are acted upon when such collaborations take place in complex institutional settings that cross multiple boundaries; and (3) the relation between boundary work on the one hand and processes of creating common ground for collaboration, coordination, and knowledge sharing on the other.

1.3 Research approach

My research was based on an abductive research approach that was aimed at theory development (Eisenhardt, 1989; Locke et al., 2008; Mantere and Ketokivi, 2013, p. 83). It was informed by a broad interest in understanding the micro-processes through which boundaries are constructed and enacted when knowledge-intensive work is executed in cross-boundary collaboration, and how such collaborations evolve over time. Whereas a practice lens sensitized me to how issues pertaining to boundaries and collaboration are deeply embedded in practice, a process research approach helped to trace how, over time, collaborating actors negotiated boundaries between them. Rather than being static, boundaries become salient and enacted through the micro-interactions of actors. To develop a grounded understanding of how actors make sense of and negotiate boundaries through their boundary work thus required a deep and prolonged engagement in the field (Langley et al., 2013, p. 6). I therefore conducted a field study of the Japanese MNC “Mirai Corporation” (henceforth *MCorp*) – a technology-based MNC from Japan.

The fieldwork was longitudinal in character, spanning a four-year period, allowing me to develop a fine-grained understanding of boundary work processes, how it may affect the execution of knowledge-intensive work, and how it may change over time. It was multi-sited, so I could observe how knowledge-intensive work was carried out collaboratively across multiple geographic contexts. Finally, the research followed an embedded case study design, allowing me to compare and contrast different sub-cases of cross-boundary collaboration within the broader context of the MNC in terms of enacted boundary work and how it affected the execution of knowledge-intensive work over time. The empirical chapters of this thesis describe three sub-cases of cross-boundary collaboration that MCorp initiated as part of its strategy to globalize and expand its various business activities. At the time of the research, these collaborations comprised all major instances of cross-boundary collaboration within MCorp’s technology division “Mirai Technologies” (henceforth *MTech*),

and revolving around knowledge-intensive work that required highly specialized expertise. Chapter Three provides a more detailed description of the study that is summarized below.

Study One examined an open strategy initiative, involving MTech senior managers. MCorp asked managers from Japanese and Dutch subsidiaries of MTech to form a divisional management team and engage in integrated strategy making for their business operations. However, in the process of becoming a divisional management team and integrating their strategy processes, creating sufficient common ground to collaborate around realizing integrated strategy making formed an important challenge. Focusing analytically on the relation between boundary work and creating common ground for collaboration it addresses how strategic actors make sense of and enact boundaries to create common ground for open strategy making? (SQ1).

Study Two examined the “Gyakuten Project”, a multiparty engineering project initiated by MCorp to develop the engineering design of a new production facility for MiraiNL in Asia. To this aim, Mirai Corporation sought collaboration with “Ancone” – an internationally operating engineering contractor from the United States. Gyakuten involved four groups of engineers from Japan, China, Belgium, and the Netherlands that each focused on different, yet interdependent aspects of the design work. How to coordinate work tasks in Gyakuten’s multiple collaborative relations formed an important challenge in Gyakuten. Focusing analytically on the relation between boundary work and coordination processes the study addresses how collaborating parties enact boundary work to coordinate work tasks in complex multiparty collaboration (SQ2).

Study Three examines “Project Hogo”, a radical innovation project that was initiated by MCorp to explore new avenues for the production of next-generation high-performance materials. To this aim, research scientists, engineers, and operators from Japan and the Netherlands worked together to develop and produce the new material Exomin. Following its successful development, Exomin got implemented in a large-scale production facility. A central challenge in Hogo was how to share Exomin’s innovation knowledge with the engineers and operators responsible for producing Exomin in the plant. Focusing analytically on the relation between boundary work and knowledge sharing during innovation implementation, the study addresses how the boundary work enacted by innovators and adopters shapes their ability to share knowledge (SQ3).

The data presented in this dissertation was collected during two 12-month fieldwork

periods that were carried out between September 2009 and May 2013. Data collection took place across twelve locations throughout Asia and Europe, for which I made repeated site visits to Mirai Technologies' management departments, research labs, pilot plants, and production sites. Data collection was extensive, resulting in numerous documents, an estimated 760 hours of (non-)participant observation, and a total of 114 semi-structured interviews¹ (which lasted between one and four hours each). The data collected and analyzed for the three empirical Chapters of this dissertation are summarized in Table 1.2 and discussed further in Chapter *Three* and the methods sections of Chapter 4-6. Following common practice in qualitative process research, I combined open coding (Strauss and Corbin, 1998) with temporal bracketing (Langley, 1999) to analyze embedded units of analysis (Eisenhardt, 1989). For this, I made use of various tables and figures (Miles and Huberman, 2014).

TABLE 1.2 | Details data collection

Data source	Use in the analysis
<i>MTech divisional management team</i>	
Documentary sources	Identify MCorp's management strategy; establish a timeline of events; collect evidence of performance Mirai Technologies
Other documentation	Establish timeline of events; triangulate data
Interviews (N=27)	Interviews were recorded and transcribed verbatim for over 208 single-spaced pages.
<p><i>First round:</i> interviews with 13 informants MTech General manager <u>MiraiJP</u> Financial officer and director human resources Corporate social responsibility manager Chief technology officer Manager production technology Commercial director <u>MiraiNL</u> Director human resources Chief financial officer Supply chain manager Manager research and development and total quality management Manager production technology Director manufacturing Commercial director (became CEO)</p> <p><i>Second round:</i> interviews with 14 informants MTech General manager <u>MiraiJP</u> Financial officer and director human resources Corporate social responsibility manager Chief technology officer Manager production technology Commercial director</p>	Interviews were recorded and transcribed verbatim for over 376 single-spaced pages.

	<p><u>MiraiNL</u> CEO Strategy manager Director human resources Chief financial officer Supply chain manager Manager research and development and total quality management Director manufacturing Commercial director 1 Commercial director 2</p>	
Observations	<p>First round: 1-year of participant observation at MiraiNL (11 months) and MiraiJP (1 month); observing daily working activities; sit-in on management team meetings, workshops and audit meetings as well as observation at more informal settings such as during lunch, drinks, dinners and Christmas celebrations</p>	
The Gyakuten Project		
Company documents	<p><u>MCorp</u> Annual strategy reports; Internal communication about China strategy MiraiNL; Organizational charts of MCorp; Organizational charts of project organization and members MCorp; Project schedules; Internal communication about technological requirements production process; Engineering drawings of layout China production site; MiraiNL report site selection phase for MCorp board meeting (decision moment 2); MiraiNL Front End Engineering proposal for MCorp board meeting (decision moment 3); MiraiNL Investment proposal for MCorp board meeting (decision moment 4); Internal communication assessment project requirements and objectives by expert staff MCorp; Internal communication about IP protection plan; Internal communication about patent clearance process and assessment by expert staff MCorp; Internal communication assessment expert staff of scope change</p> <p><u>Ancone</u> Organizational charts of project organization and members Ancone</p>	<p>Establish a timeline of events; captured project-level challenges and coordination practices, which were used to triangulate interview data.</p>
Other documents	<p>MCorp and Ancone company information and press accounts Drawings made by participants during interviews</p>	<p>Provide information of organizations' structures and histories; facilitating the interpretation of project data; clarifying project details All interviews were recorded and transcribed verbatim for over 616 single-spaced pages.</p>
Interviews (N=29)	<p>29 interviews with 25 informants <u>MiraiNL Steering committee</u> CEO <i>Gerard</i> Chief financial officer Strategy manager Director manufacturing Commercial director Supply chain manager <u>MiraiNL-team</u> Project manager <i>Patrick</i> (3x) Engineering manager <i>Daniel</i> All senior engineers: <i>Michiel, Rick, Ruud, Miyata-san</i> <u>MirenJP-team</u></p>	

	<p>Engineering manager <i>Naoki-san</i> All senior engineers: <i>Harry, Kazuo-san, Shichirou-san, Fujimoto-san, Takao-san</i> <u>AnconeBE-team</u> Engineering manager <i>Louis</i> Lead engineers: <i>Bastien and Guillaume</i> <u>AnconeCN-team</u> Project leader <i>Drew</i> Project manager <i>Meng Rui</i> Engineering manager <i>Yi Jue</i> Lead engineer <i>Ye Hao</i></p>	
Project Hogo		
Company documents	Books published by MCorp between 2000 and 2009; Corporate annual, strategy, and research reports; Shareholder communication	Identify MCorp's research strategy; establish a timeline of events
Other documents	Patent data related to Exomin; Video about the development of Exomin; Product, marketing and sales information; Press accounts about the development and launch of Exomin	Additional evidence of innovation outcomes during research and development used to triangulate facts and observations
Interviews (N=46)	<p>First round: 21 interviews with 21 informants <u>MiraiJP</u> MiraiJP management team (6) Research team leader <i>Moto-san</i> Researcher <i>Shimizu-san</i> Engineer <i>Saito-san</i> <u>MiraiNL</u> MiraiNL management team (7) Team leader <i>Jan Kees</i> Researchers <i>Sung Mi, Frank, Jacob, Suzuki-san</i></p> <p>Second round: 25 interviews with 22 informants <u>MiraiJP</u> MiraiJP management team (6) Researcher <i>Suzuki-san</i> <u>MiraiNL</u> MiraiNL management team (9) Directors Hogo <i>Jan Kees (2x)</i> and <i>Mike (2x)</i> Research team leader <i>Sung Mi</i> Researchers <i>Moto-san, Jacob</i> Engineers <i>Mizushima-san, Frank</i></p>	<p>Interviews were conducted by the field researcher. They lasted between one and two hours; all were recorded and transcribed verbatim for over 349 single-spaced pages.</p> <p>All interviews were conducted by the field researcher. They lasted between one and two hours; all were recorded and transcribed verbatim for over 554 single-spaced pages.</p>
Observations	<p>First round (2009-2010): non-participant observation at MiraiNL's research lab; site visits to research lab and pilot plant in Japan Second round (2012-2013): site visits to MiraiNL research lab and large-scale production site.</p>	

1.4 Dissertation outline

This *Introductory Chapter* sets the focus of this thesis on cross-boundary collaboration, arguing that organizing knowledge-intensive work across contexts has implications for the very nature of work. It introduces the general framework and the empirical studies that together constitute my doctoral thesis. I outline the basic tenets of a practice-theoretical framework for understanding the challenges of cross-boundary collaboration and introduce the notion of boundary work. The remainder of this dissertation is organized as follows (see also table 1.3).

Chapter Two discusses the theoretical background of this dissertation, starting with a discussion of the roots of the boundary concept in Sociology. It reviews the different streams of boundary scholarship that emerged in Management and Organization Studies, discusses its underlying perspectives of boundaries, and the strengths and limitations thereof. Next, I introduce a practice-theoretical framework to understand how and why boundaries come to matter in cross-boundary collaboration, and to develop a relational understanding of boundaries. The Chapter ends with a discussion of the missing elements of the framework and how these informed the central research question and the choices I made for my study.

Chapter Three subsequently introduces the research approach and design. I describe the different research sites and the process of gaining access. I elaborate on the different cross-boundary collaborations studied and the relevance of Mirai Corporation as a research setting for the study of boundary work. I then explain the process of data collection and analysis. I conclude by reflecting upon the limitations of my research approach as well as the methodological limitations of my study.

The empirical Chapters form the main body of this dissertation. I use the framework developed in Chapter Two to analyze three sub-cases of cross-boundary collaboration that MCorp initiated in the areas of open strategy (Ch. 4), engineering design work (Ch. 5), and radical innovation (Ch. 6). I describe the opportunities and challenges these collaborations entailed, and how organizational actors engaged in boundary work when executing their knowledge-intensive work. Figure 1.2 visualizes the relationship between the three studies.

Chapter Four reports on my study of the relation between boundary work and creating common ground for collaboration by examining empirically how MTech divisional managers collaborated around an open strategy initiative. I asked the question how

strategic actors made sense of and enacted boundaries to create common ground for open strategy making? (SQ1). This question was motivated in part by the empirical puzzle how actors' boundary work towards realizing integrated strategy making actually prevented their strategy processes to become truly integrated. The answer lies in perceptions of what boundaries become salient and are acted upon when actors become involved in open strategy initiatives. Drawing upon insights from open strategy, strategic sensemaking, and boundary literature, I put forward the theoretical argument that actors may differentially cope with boundaries, depending on how they make sense of and give sense to observed boundaries-in-practice. Whereas mutually opening-up boundaries among actors can help to create common ground for executing knowledge-intensive work in cross-boundary collaboration, subtle dynamics of breaching versus maintaining boundaries or more explicit dynamics of eliminating versus bolstering boundaries can prevent it.

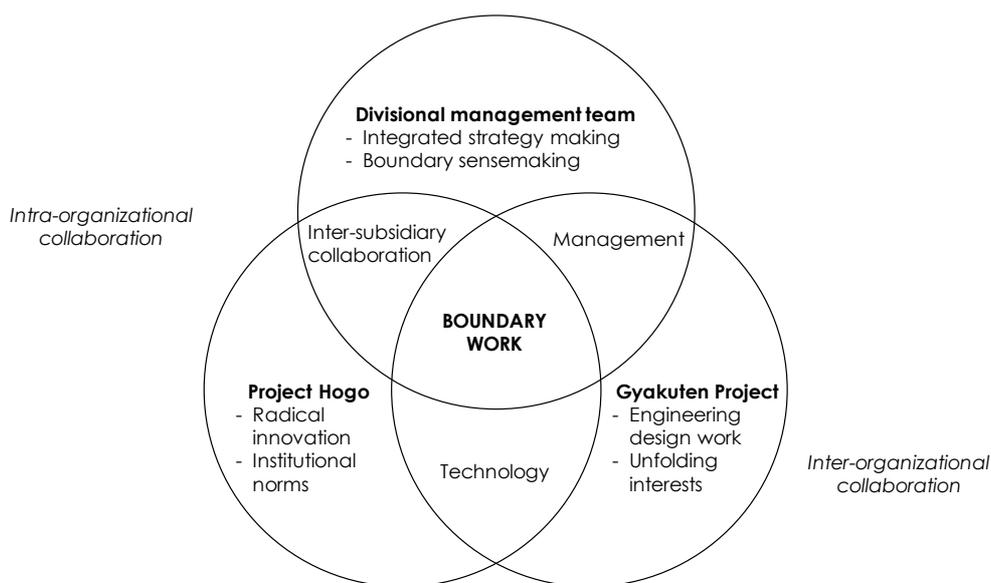


FIGURE 1.2 | Relationships between empirical studies

Chapter Five reports on my study of the relation between boundary work and coordination by examining empirically how four groups of engineers collaborated in the Gyakuten Project to develop the engineering design of a new production facility in Asia. I asked the question how collaborating parties enacted boundary work to coordinate their work tasks in a complex multiparty collaboration (SQ2). This question was motivated in part by the empirical puzzle how the boundary work enacted by collaborating parties to coordinate their work resulted in the timely realization of project objectives in one collaborative relation but resulted in substantial delays in another. The answer lies in the

way parties reconciled project requirements for coordination with organizational ones in view of their unfolding interests. Drawing upon insights from multiparty collaboration, coordination, and boundary literature, I put forward the theoretical argument that depending on parties' unfolding interests, they may either mutually open up or create boundaries between them. When project and organizational interests remain aligned, parties may open-up boundaries, allowing for frequent and intense interactions that accommodate the relational complexity necessary to execute their knowledge-intensive work in a timely manner and in line with latest project objectives. However, when parties start to prioritize organizational over project requirements for coordination, they may raise boundaries between them, thereby preventing frequent and intense interaction with other parties. Failing to accommodate relational complexity, parties may coordinate so that their work is completed as they perceive to have contractually agreed upon, yet not in line with latest project objectives.

Chapter Six reports on my study of the relation between boundary work and knowledge sharing by examining empirically how research scientists, engineers, and operators in Japan and the Netherlands collaborated in Project Hogo to develop and implement the radical technological innovation Exomin. I asked the question how the boundary work enacted by innovators and adopters shapes their ability to share knowledge during innovation implementation (SQ3). This question was motivated in part by the empirical puzzle how after having developed and successfully implemented Exomin internally and on a small scale, Hogo members nevertheless ran into trouble when subsequently implementing Exomin for large-scale production. The answer lies in how actors balance pressures to maintain sufficient shared context to socialize new members while simultaneously having to adapt to the implementation context. Drawing upon insights from radical innovation, knowledge sharing, and boundary literature, I put forward the theoretical argument that whereas opening-up team boundaries may help to share knowledge and realize knowledge-intensive work tasks in cross-boundary collaboration, successful knowledge sharing may be prevented when adopters maintain boundaries, especially when combined with a high turnover rate.

Finally, the main findings of this thesis are summarized in **Chapter Seven**. I draw on the theoretical insights developed in the preceding Chapters to analyze their implications for Organizational scholarship. To this aim, I review the key findings and discuss how they

TABLE 1.3 | Outline of dissertation

Chapter	Purpose	Related output	Co-authors
Ch. 1	Setting the scene, introduce research topic, theoretical background, research question, approach, and thesis outline	Previously presented at: - 2016 <i>Journal of Management Studies conference</i> , Warwick, UK. - 2015 <i>Annual meeting of the Academy of Management</i> (OCIS PhD Doctoral Consortium), Vancouver, Canada - 2013 <i>Annual meeting of the Academy of Management</i> (OMT Dissertation Proposal Workshop), Orlando (USA) Chapter is intended for submission to <i>Academy of Management Annals</i>	
Ch. 2	Outlines the theoretical background and relevance	Chapter is intended for submission to <i>Academy of Management Annals</i>	
Ch. 3	Outlines the research setting, approach, and methods		
Ch. 4	Empirical study of how strategic actors make sense of and enact boundaries to create common ground for open strategy making.	Chapter intended for submission to <i>Administrative Science Quarterly</i> (previously R&R at Organization Science). It was previously presented at: - 2017 <i>Annual meeting of the Academy of Management</i> (All Academy Theme), Atlanta (USA) - 2015 <i>UEBS Strategy Conference</i> (winner of best paper award), Edinburgh, Scotland - 2013 <i>Annual meeting of the Academy of Management</i> (OMT division), Orlando (USA) - 2011 <i>IACCM Annual Conference</i> (winner of best doctoral student paper award), Ruse, Bulgaria - 2011 <i>CMS Conference</i> , Naples, Italy	A previous version has been written together with Julie Ferguson, Dick de Gilder, and Peter Groenewegen
Ch. 5	Empirical study of how organizational actors enact boundary work to coordinate work tasks in complex multiparty collaboration?	Chapter intended for submission to <i>Academy of Management Journal</i> (previously R&R at Journal of Management Studies). It was previously presented at: - 2015 <i>Annual meeting of the Academy of Management</i> (OMT division), Vancouver, Canada - 2014 <i>International conference on collaboration across boundaries: culture, distance and technology</i> , Kyoto, Japan - 2014 <i>EGOS colloquium</i> , Rotterdam, The Netherlands - 2014 <i>Journal of Management Studies Conference</i> , Cambridge, UK Chapter intended for submission to <i>Organization Science</i> . It was previously presented at	A previous version has been written together with Julie Ferguson, Peter Groenewegen, and Dick de Gilder
Ch. 6	Empirical study of how the boundary work of innovators and adopters shapes their ability to share knowledge during innovation implementation?	Chapter intended for submission to <i>Organization Science</i> . It was previously presented at - 2016 <i>EGOS colloquium</i> , Naples, Italy - 2016 <i>European Theory Development Workshop</i> , Helsinki, Finland - 2016 <i>Organization Science Winter Conference</i> , Park City (USA) - 2015 <i>Annual meeting of the Academy of Management</i> (TIM division), Vancouver, Canada - 2010 <i>IACCM Annual Conference</i> , Preston, UK	A previous version has been written together with Natalia Levina and Julie Ferguson
Ch. 7	Summarize findings, discuss overall conclusion, limitations, and implications		

answer the central research question. I discuss the theoretical implications of these findings for literature on collaboration and boundaries. Subsequently, I articulate the boundary conditions of this thesis and consider avenues for future research. I conclude by discussing the practical implications of my findings and some final thoughts and remarks.

1.5 Contributions

This thesis draws attention to the socio-symbolic processes involved when knowledge-intensive work is organized and executed across boundaries. Specifically, by studying how organizational actors enact boundary work in cross-boundary collaborations around realizing integrated strategy making, complex engineering design work, and radical technological innovation, this thesis as a whole contributes to organizational scholarship on collaboration and boundaries.

First, by studying how key work processes are taking shape in cross-boundary settings, I explain the relation between boundary work and realizing effective collaboration in cross-boundary settings. Collaboration literature has elaborated upon the technological, social and economic changes that led to organizing work in cross-boundary collaborative settings (e.g., Yoo et al., 2012; Hinds et al., 2011), but less attention has been paid to how such a trend changes the very nature of work (e.g., Barley and Kunda, 2001; Okhuysen et al., 2013). Whereas collaboration scholars have explained the differences and inherent challenges of collaborating across contexts (e.g., Beck and Plowman, 2014), I bring socio-symbolic processes of boundary work into the realm of collaboration to explain how executing knowledge-intensive work across multiple overlapping contexts (Levina and Vaast, 2008; Kane and Levina, 2017) changes the very nature of the work that is carried out inside such collaborations. I explain how organizing knowledge-intensive work in cross-boundary collaboration results in a transformation of key work processes (e.g., Okhuysen et al., 2012) and how it informs actors' engagements in boundary work. I thus elaborate theory on key work processes in cross-boundary collaboration by explaining that boundary work constitutes a form of socio-symbolic work that is gaining in importance when knowledge-intensive work is carried out across multiple overlapping contexts.

Second, I develop a framework to explain the socio-symbolic processes through which collaborating actors come to perceive and negotiate boundaries between them. Boundary scholarship has explained the socio-material mechanisms that can enable cross-

boundary collaboration (e.g., Bechky, 2003; Carlile, 2002; Levina and Vaast, 2008). Yet, less attention has been devoted to understanding the socio-symbolic processes through which collaborating actors come to perceive and negotiate boundaries during concrete work activities. Whereas boundary scholars have been struggling with inconsistent results (e.g., Watson-Manheim et al., 2012), I propose that shifting focus towards boundaries themselves, and their emergence and (re-)negotiation in practice, may help to address this gap (Heracleous, 2004; Montgomery and Oliver, 2007; Paulsen and Hernes, 2004). I bring sensemaking processes into the realm of cross-boundary collaboration to explain how boundaries become salient through the way actors interpret and give meaning to boundaries. Furthermore, my processual analysis explains how actors engage in boundary work to (re-)negotiate boundaries, thereby shaping key work processes and outcomes. I also explain how actors' boundary sensemaking, their unfolding interests, and their pressures to comply with institutional norms of their respective practice contexts may shape how actors enact boundaries. Hence, whereas previous studies shed light on the role of actors and artefacts in developing a competence in collaborative boundary spanning (e.g., Kane and Levina, 2017), this thesis conceptualizes boundaries themselves and how they may change when knowledge-intensive work is organized across them.

Notes

¹ Of the 114 interviews, 68 interviews were included in the analyses of the empirical studies of this thesis.

