(NOT) PASSING THE BATON: BOUNDARY SPANNING CAPABILITIES AND NEW PRODUCT INTRODUCTION

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ABSTRACT

Boundary spanners—individuals mediating knowledge flows between a firm and its external environment—are important for firms to expand their knowledge repertoire. While boundary spanning capabilities have been shown to help firms access external knowledge, less is known about their impact on innovation, i.e., on a focal firm's ability to introduce new products based on this knowledge. This paper shifts the focus from external knowledge access to external knowledge use by examining the impact of boundary spanning capabilities on innovative outcomes (i.e., new product introduction). We use unique proprietary data on 2,895 opportunities of a large multinational firm to source external knowledge from high-tech startups over a period of thirteen years. Our results show that boundary spanning capabilities are positively related to the introduction of new products based on external knowledge, especially when internal actors lack motivation to innovate. We also find that boundary spanning capabilities can only complement, not substitute, the ability of internal actors to introduce new products based on external knowledge. Finally, our results show that boundary spanning capabilities are particularly impactful when external knowledge encompasses multiple technological domains.

Keywords: Boundary spanning; external knowledge sourcing; innovation; organizational learning; inter-organizational collaborations

INTRODUCTION

Boundary spanners are individuals who mediate knowledge flows between a firm and its environment (Leifer and Delbecq 1978; Tushman and Scanlan 1981). These individuals can help firms access external knowledge and increase their knowledge repertoires. This is because boundary spanners play an important role for instance in facilitating the recombination of internal and external knowledge as well as in convincing internal and external actors to work together (Carlile 2004; Monteiro 2015; Monteiro and Birkinshaw 2017; Ter Wal, Criscuolo and Salter 2017). Eventually, spanning boundaries and accessing external knowledge has been shown to help firms generate inventions (Dahlander, O'Mahony and Gann 2016; Moreira, Markus and Laursen 2018; Tortoriello 2015; Rosenkopf and Nerkar 2001).

However, whether boundary spanning capabilities have a consequential role for innovation (Teece 1986)[1], i.e., whether they have an impact on the introduction/commercialization of new products or services, remains unclear. In fact, most research on boundary spanning focused on activities closer to invention (e.g., patenting) than innovation (e.g., new product introduction). For instance, if we apply the learnings from prior research to a very current problem, we would have predicted in 2018 that the boundary spanning capabilities that enabled Pfizer to access BioNTech's mRNA technology would have resulted in new mRNA-patents filed by Pfizer.[2] Existing research would have been much less precise however in predicting whether and under which circumstance boundary spanning capabilities would have helped Pfizer to eventually introduce a new vaccine against Covid-19.

Of course, it is much more difficult to observe internal processes leading to the introduction of new products than patenting activity, which partly explains the focus of previous research. As a result, though, we still know little about the impact (if any) and the circumstances under which boundary spanning capabilities may facilitate innovation (Teece 1986). Shedding more scholarly light on this topic is critical because a large share of external knowledge that pass the front doors of organizations remains unused and eventually does not lead to the launch of new products (Eisenhardt and Schoonhoven 1996; Klueter, Monteiro and Dunlap 2017). In those cases, boundary

[1] As Teece wrote in his seminal piece (Teece 1986: 285): "innovators [are] those firms which are first to commercialize a new product or process in the market".

[2] https://biontech.de/sites/default/files/2019-08/20180816_BioNTech-Signs-Collaboration-Agreement-with-Pfizer.pdf

spanning capabilities help firms increase their knowledge repertoires but may not necessarily allow them to be more innovative.

In this paper, we theorize that boundary spanning capabilities are positively related to the introduction of new products based on external knowledge. During the product development process, new applications of the external knowledge may have to be found (Mintzberg and Waters 1985), which makes capabilities to recombine internal and external knowledge valuable. Moreover, capabilities to convince internal and external actors to work together should continue be useful up until the new products are introduced to the market (Monteiro 2015; Monteiro and Birkinshaw 2017). In addition, we suggest that characteristics of the internal recipient may be important contingencies (Tsai 2001; Szulanski 1996). Therefore, we also hypothesize that boundary spanning capabilities will be particularly consequential for innovation based on external knowledge when internal actors are prone to inertia and thereby lack motivation to innovate (Baum et al. 2005; Greve 2003). In addition, we hypothesize that boundary spanning capabilities will be more important for innovation based on external knowledge when internal actors are less able to innovate (Aggarwal and Hsu 2009; Doz 1996). Finally, we hypothesize that boundary spanning capabilities will be more important when the external knowledge encompasses multiple technological domains.

To test our hypotheses, we use a unique proprietary database of 2,895 opportunities assessed by a large multinational company in the information and communications technology (ICT) sector to source external knowledge from high-tech start-ups based in 54 countries into its different subunits over the 2005-2018 period. The rare granularity of the data enables us to track external knowledge sourcing from the moment potentially useful knowledge is identified by the boundary spanners up to the final commercialization of a product using that knowledge. This level of detail also allows to account for the selection of external knowledge into the external innovation pipeline as well as disentangling boundary spanning experience (i.e., number of start-ups identified with potentially relevant knowledge) from capabilities (i.e., share of previous successes in convincing subunits to attempt innovating based on that external knowledge). We complemented this database with fieldwork as well as data from secondary sources (e.g., Thomson Reuters Eikon, the World Intellectual Property Organization, the Internet Archive, LinkedIn, financial reports).

Our results suggest that boundary spanning capabilities are indeed positively related to the introduction of new products based on external knowledge. This relationship is stronger when the latest performance feedback of internal subunits was around their aspirations, which makes them less motivated to innovate as they lack the pressure or the slack resources to do so (Ahuja 2000;

Baum et al. 2005; Greve 2003; Levinthal and March 1981). Contrasting with our third hypothesis, our results show that boundary spanning capabilities cannot substitute the ability of internal subunits to innovate based on external knowledge. In fact, boundary spanning capabilities are particularly helpful when internal subunits have proven successful in innovating based on external knowledge in the past. Finally, as we suggested, boundary spanning capabilities are particularly impactful when external knowledge encompasses more than two technological domains.

We make several contributions to the literature. First, we extend boundary spanning research that, for the most part, focused on invention (Moreira, Markus and Laursen 2018; Rosenkopf and Nerkar 2001; Tortoriello 2015; Tortoriello, McEvily and Krackhardt 2014) to the final (and arguably most consequential) stage of the innovation process, which is the introduction of new products. With our study, we are able to open the black box of what occurs once external knowledge is accessed and to show important contingencies to the relationship between boundary spanning capabilities and innovation based on external knowledge. We also contribute to the research on external knowledge sourcing and organizational learning more broadly (Cohen and Levinthal 1990; Levinthal and March 1993). While previous research focused on the capabilities of subunits to combine their internal knowledge with external knowledge to generate innovation (e.g., Tsai 2001), we show that these capabilities are significantly complemented by boundary spanning capabilities. Finally, our results contribute to the performance feedback literature (Baum et al. 2005; Greve 2003). While subunits whose latest performance feedback lie around their aspirations are less likely to innovate, we show that these subunits are also the ones that will particularly benefit from boundary spanning capabilities.

LITERATURE BACKGROUND

The difficulty in sourcing external knowledge resides in managing the boundaries between the organization and the knowledge source (Ancona and Caldwell 1992). Thereby, organizations willing to source external knowledge typically rely on boundary spanning individuals well connected internally and externally (Tushman and Scalan 1981) to mediate communication across organizational interfaces (Monteiro and Birkinshaw 2017; Tushman 1977). Indeed, research shows that organizations can more easily learn from other organizations if they have a common third party with the external knowledge source (Tortoriello 2015; Tortoriello and Krakhardt 2010). This suggests that boundary spanners linking two organizations are central conduits of information necessary for external knowledge sourcing to be successful.

Given the importance of boundary spanners for external knowledge sourcing, research has increased our understanding of the activities that they engage in to help organizations access external knowledge. First, boundary spanners appear capable at helping external knowledge enter organizations through activities that facilitate the recombination of internal and external knowledge. Some scholars emphasized the importance for boundary spanners of translating external knowledge (Monteiro and Birkinshaw 2017; Ter Wal, Criscuolo and Salter 2017). External knowledge likely represents new or unfamiliar ways of addressing problems that cannot obviously be linked to internal knowledge. Boundary spanners can help recombine external and internal knowledge by clarifying external knowledge such that internal actors understand which applications of it can be used internally (Monteiro and Birkinshaw 2017). Scholars also analyzed transforming activities that boundary spanners engage in to facilitate the recombination of internal and external knowledge (Carlile 2004; Monteiro and Birkinshaw 2017; Tippmann, Sharkey Scott and Parker 2017). Transforming activities refer to activities that help internal actors understand the potential of internal knowledge and how this knowledge can be used in combination with external knowledge. Engaging in transforming activities has been shown to be positively related to behaviors benefiting creativity (Tippmann, Sharkey Scott and Parker 2017).

Second, activities that help convince internal and external actors to work together also appear important for boundary spanners to help organizations act on opportunities to transfer external knowledge. Monteiro (2015) for instance shows that the selling efforts of individuals who identify external knowledge are crucial to attract the attention of internal decision-makers, especially when the knowledge is unproven and dissonant with internal business models. Ter Wal and colleagues (2017) show that championing efforts (e.g., overcoming internal resistance), combined with translating activities, facilitate the production of creative outputs.

Overall, research has significantly increasing our understanding of the importance of boundary spanners as well as the activities they engage in to ensure that external knowledge passes the front door of organizations. Still, most of this research focused on how boundary spanning capabilities facilitates *accessing* knowledge, e.g. gaining internal attention to external knowledge, increasing patenting activity based on external knowledge, smoothing initial stages of product development (e.g. Carlile 2004; Monteiro 2015; Tortoriello 2015; Tortoriello and Krackhardt 2010). Thus, whether boundary spanning capabilities (i.e., facilitating the recombination of internal and external knowledge, convincing internal and external actors) matter in later stages of the external knowledge sourcing process, up to the launch of new products based on external knowledge, remains unclear.

As several studies pointed out (Hansen 1999; Obstfeld 2005; Szulanski 2000), "generating new ideas through the availability of heterogeneous perspectives and coordinating the actions that are necessary to implement those ideas, translating them into innovations, are two distinct aspects of the innovative process" (Tortoriello 2015: 168). Therefore, we need to explore the question whether boundary spanning capabilities matter after external knowledge has already been accessed. Additionally, we need to consider the conditions that influence this relationship. Some research suggests that the benefits of boundary spanning depend on the organizational context (Klueter and Monteiro 2017; Marrone 2010). In fact, recipient units may differ in their motivation and abilities to innovate based on external knowledge, which may influence the benefits that boundary spanners can bring to the external knowledge sourcing process.

In the following, we will develop our theory regarding the relationship between boundary spanning capabilities and the introduction of new products based on external knowledge. We will also hypothesize about the contingent role of the motivation and abilities of recipient units to innovate based on external knowledge.

HYPOTHESIS DEVELOPMENT

As previous research noted, boundary spanning capabilities can help organizations access novel external knowledge (Rosenkopf and Nerkar 2001; Tortoriello 2015). This is because boundary spanners can recombine external and internal knowledge as well as convince internal stakeholders to pay attention to it (Monteiro 2015; Monteiro and Birkinshaw 2017; Ter Wal, Criscuolo and Salter 2017). A question that remains unaddressed is whether such boundary spanning capabilities are also helpful later in the innovation process, once internal actors attempt to innovate (i.e. launch a new product) based on this knowledge. This is not trivial. Indeed, boundary spanners might be highly capable at selling external knowledge internally so that they help external knowledge get a first foot in the organization. Yet, it is still unclear whether capabilities to bring novel knowledge inside influence the likelihood that such knowledge generates new products. In the following, we bring forward arguments suggesting that this is case.

First, individual boundary spanners who have successfully searched external knowledge for internal applications learned how external knowledge can be recombined and matched with internal knowledge for successful applications (Cohen and Levinthal 1990). While this helps in accessing knowledge (Monteiro 2015), we argue that these capabilities are also useful later in the integration process, in case the intended application is not realized and new ones have to be found (Mintzberg and Waters 1985). Therefore, boundary spanning capabilities should make it easier for the recipient unit to (re-)identify promising areas of applications (Tortoriello 2015). Eventually, this should facilitate the introduction of new products based on external knowledge.

Second, individual boundary spanners who developed capabilities to convince internal and external stakeholders to engage in an attempt to collaborate are more likely to know how to coordinate objectives, schedules and resources of both parties (Monteiro and Birkinshaw 2017; Ter Wal, Criscuolo and Salter 2017; Tippmann, Sharkey Scott and Parker 2017). During the attempt to develop a new product based on external knowledge, the recipient unit will often need additional information from the external knowledge source. Boundary spanners can help mitigating communication between the recipient unit and the external knowledge source (Tushman 1977) so that potential problems identified internally can be understood by the external knowledge source. Similarly, capable boundary spanners can translate additional information provided by the external knowledge source that it helps its integration. This should ensure that the recipient unit fully takes advantage of potential support and takes decisions consistent with the potential and limits of the external knowledge (Ancona 1990; Carlile 2004; Edmondson 2003).

Hypothesis 1: *The higher the capabilities of boundary spanners, the higher the likelihood of new product launch based on external knowledge.*

In the following, we theorize on the contingent role of the abilities and motivation that internal actors (i.e. the internal recipient unit using the external knowledge) have to innovate based on external knowledge.

In recipient units that have developed capabilities to innovate based on external knowledge, appropriate structures and processes should be in place (Aggarwal and Hsu 2009; Doz 1996). Such recipient units should have learned which information is necessary to gather from external sources as well as how to interact with them effectively (Criscuolo et al. 2017; Dahlander et al. 2016). As a result, managers in these units should be able to manage the recombination of external knowledge and internal knowledge to (re-)identify relevant internal applications of external knowledge. In recipient units that have been successful at innovating based on external knowledge, the help of boundary spanners should be less consequential because managers can effectively innovate autonomously. In addition, these recipient units should have set up incentives (Laursen and Foss

2003) that motivate managers to use external knowledge to innovate. Furthermore, managers in these units have seen the benefits of external knowledge and should be less likely to discard it in case issues occur (Joseph, Klingebiel and Wilson 2016). This is because managers tend to persist with actions associated with favorable outcomes (Audia et al. 2000). Therefore, we expect boundary spanning capabilities to be less salient when attempts to innovate based on external knowledge take place in recipient units who have developed capabilities to do so.

In contrast, managers in recipient units lacking capabilities to innovate based on external knowledge are prone to the issues that capable boundary spanners cover. These managers are more likely to fail at identifying relevant applications in case the initial one cannot be pursued after all. They are also more likely to fail at communicating with the external knowledge sources because they cannot identify and formulate what the relevant problems are in ways that external parties understand. In addition, they might more easily disengage from an opportunity when conflicts occur because the efforts required would be higher than for units that know how to handle such problems. In sum, we argue that the positive effects of boundary spanning capabilities on the success of attempts to innovate based on external knowledge will be more important in recipient units that lack capabilities to innovate based on external knowledge.

Hypothesis 2: *Boundary spanning capabilities will be more positively related to the launch of new products based on external knowledge in recipient units that have low abilities to innovate based on external knowledge.*

In addition to the ability of the recipient unit to innovate based on external, its motivation to do so plays an important role. We follow research on performance feedback suggesting that recipient units whose latest performance feedback was close to their aspirations are prone to inertia and less inclined to innovate based on external knowledge (Baum et al. 2005; Greve 2003; Klueter and Monteiro, 2017; Levinthal and March 1981; Schotter et al., 2017). These units do not have the slack that is associated with a performance feedback far above expectations and they do not have the pressure that typically comes with a performance feedback far below expectations (Levinthal and March 1981). Lacking slack and pressure, these units are less willing to take risk in selecting partners (Baum et al. 2005). In the following, we argue that attempts to launch new products based on external knowledge that occur in these units should benefit most from boundary spanning capabilities.

First, managers in recipient units, whose latest performance feedback lie around their aspirations, lacking slack and pressure, should be less motivated to seek for applications of external knowledge with internal knowledge in ways that help generate new products. When the original ideas of how external and internal knowledge can be recombined appear to be less promising than they were, new applications of the external knowledge will have to be found. Capable boundary spanners can compensate for lack of motivation in the recipient unit and take on part of the role of finding new, relevant applications of that knowledge.

Second, attempts to integrate external knowledge that occur in recipient units lacking pressure or slack to innovate are more likely to be dropped when problems occur. Here also, boundary spanners can help in applying their capabilities (e.g., convince and coordinate internal and external actors) so that potential problems are solved and new products can eventually be introduced based on external knowledge. As a result, boundary spanning capabilities should have a major impact on attempts occurring in units that reached a level of performance close to their aspirations.

In contrast, attempts to integrate external knowledge that occur in recipient units that exceeded their aspirations by far or that were very far from reaching them should be less likely to benefit from high boundary spanning capabilities. This is because such units are in conditions calling for innovation and distant search (Baum et al. 2005). This should make the benefits of having individuals with high boundary spanning capabilities leading integration attempts less salient.

Hypothesis 3: *Boundary spanning capabilities will be more positively related to the launch of new products based on external knowledge in recipient units that performed close to their aspirations.*

In a fourth hypothesis, we argue that the benefits of boundary spanning capabilities will be contingent upon the breadth of the external knowledge, i.e., the number of technological domains that it encompasses. More precisely, innovation based on external knowledge that covers multiple technological domains (e.g., voice and cloud) will likely benefit from boundary spanning capabilities more than external knowledge that covers a single technological domain (e.g., video).

First, when external knowledge covers a single technological domain, it will be relatively easy for managers in the recipient unit to identify promising areas of applications because there should be no technological boundaries to span (Rosenkopf and Almeida, 2003). Managers in the recipient units will be more likely to identify and select appropriate areas of application independently, because they master the technology of the external knowledge and can recombine it easily with internal knowledge. Moreover, when no technological boundary has to be spanned, internal managers will less likely need intermediaries to communicate with the external knowledge source, as they use similar jargon and vocabulary. Thereby, boundary spanning capabilities should not be that necessary when the external knowledge encompasses a single technological domain.

Second, when external knowledge encompasses multiple technological domains, attempts to innovate based on that knowledge are more prone to issues that capable boundary spanners can cover (Rosenkopf and Nerkar, 2001). Knowledge that covers multiple technological domains will require more translation efforts for its potential and limitations to be effectively understood by the recipient unit (Monteiro and Birkinshaw, 2017), which should make boundary spanning capabilities particularly impactful in these cases. Moreover, recipient units may be more inclined to be challenged during the attempt to innovate based on external knowledge that covers multiple technological domains and boundary spanners can mediate relationships such that attempts are not forgone too rapidly (Tortoriello and Krackhardt, 2010).

Hypothesis 4: *Boundary spanning capabilities will be more positively related to the launch of new products based on external knowledge when it encompasses multiple technological domains.*

METHODS

Data

We tested our hypotheses using detailed proprietary data from one of the largest telecommunications companies in the world, Telcorp. The company has a long history of technological innovation and a worldwide portfolio of several thousand patents and applications.

In the 1990s, however, the telecommunications industry faced major technological changes, notably the convergence of a number of formerly distinct industries, which made clusters such as Silicon Valley in California particularly important to companies in that sector (Kenney 2000; Saxenian 1994). Headquartered in Europe, Telcorp realized the importance of tapping into clusters of innovative activities. Therefore, Telcorp opened a foreign subsidiary in Silicon Valley with the mandate to scout for innovative technologies and business models. Although the majority of such innovations come from Silicon Valley, managers in the scouting unit were actively looking for innovations coming from other places in the world such as Israel, the UK, France, China, Japan and South Korea. Importantly, their mandate was limited to finding high-tech startups that could be potential partners to the internal subunits for commercial agreements (e.g., technology licensing) and did not include equity investments in the startups.

We started our investigation by interviewing all managers in the scouting function as well as corporate managers involved in global knowledge sourcing at Telcorp. We were also able to make several field observations (e.g., startup presentations, telecom conferences). This approach gave us access to critical background information about the process through which external knowledge is sourced from the very initial stages up until new products based on this knowledge are introduced.

At Telcorp, the standard operating procedure for managers in the scouting unit is to identify high-tech startups with technologies and business models relevant for the internal subunits back in Europe. Then, some of these startups are introduced to key individuals internally (typically business unit heads or their direct reports). Conditional on the agreement by these individuals that a partnership between the startups and their units would be beneficial for Telcorp, a prototyping phase generally starts, leading (or not) to a new product or service launch.

In late 2018, after signing a non-disclosure agreement, we received access to internal files of various teams within Telcorp that are engaged in global knowledge sourcing (i.e., multiple Excel files, PowerPoint presentations and various internal reports). More precisely, the files contained information on the external knowledge (i.e., startups) that were identified by managers in the scouting function between January 2005 and March 2018 (N=2895). In this paper, our unit of analysis is the opportunity to transfer external knowledge and we focus on opportunities that had been selected for integration attempt by the subunits (i.e., prototyping phase onwards).

To account for the selection of the external knowledge into the external innovation pipeline of the subunits, we ran a two-stage model (Mulotte, Dussauge and Mitchell 2013). Our dependent variable, some of our independent variables (i.e., scout boundary spanning capabilities, subunit integration capabilities) and some of our control variables (e.g., crowding, startup technological domains) were constructed based on these internal documents. In addition, as explained in more detail below, we used data from the World Intellectual Property Organization, Thomson Reuters Eikon, the Internet Archive, LinkedIn, as well as all annual and quarterly reports published by Telcorp over the 2005-2018 period as well as reports published by its external partners, whenever available.

Dependent variable

New product introduction

The ultimate goal that Telcorp had when opening the scouting function was to launch new products based on external innovative technologies and business models. Thus, beyond measuring the impact of external knowledge sourcing on patents and their citations (e.g. Rosenkopf and Nerkar 2001; Tortoriello 2015; Kovács, Carnabuci and Wezel in press), we were interested in the impact on the introduction of new products. Telcorp uses a stage-gate process and the internal documents provided a clear track record for each of the external innovation opportunities. As such, and as per previous research (Katila 2002; Li et al. 2013), we used this information to measure whether the focal opportunity to innovate based on external knowledge resulted in the launch of a new product based on that knowledge or whether it was discarded at some point in the process (1 = yes, 0 = no) (mean = 0.18; SD = 0.38).

Independent variables

Scout boundary spanning capabilities

Scouts (i.e., boundary spanners) at Telcorp were mandated to identify startups with knowledge relevant to Telcorp's subunit in order to generate collaborations that lead to new products and services. As such, each time a boundary spanner identified a startup, he/she included it in Telcorp's internal database. We selected the startups that had been identified by that individual scout prior to the focal attempt. Then, we calculated the ratio of total number of startups that subunits had selected into their external innovation pipeline to total number of startups identified (Aggarwal and Hsu 2009). This formula gives us a "hit ratio" for the boundary spanner in charge of the focal external knowledge sourcing opportunity (mean = 0.19; SD = 0.21). As an example, an opportunity managed by a boundary spanner who identified 100 startups before that focal attempt and managed to convince subunits to consider 30 of these startups gives a score of 0.3.[3]

Recipient unit external innovation capabilities

Some recipient units may be better able than others at innovating based on external knowledge and such abilities may also evolve over time. This variable measures the capabilities of the recipient unit of a focal opportunity to innovate based on external knowledge that they had accessed previously. More precisely, out of the startups that had been selected by the recipient unit before a focal attempt, we calculated the ratio of total number of new products and services launched based on external knowledge to total number of attempts to do so (Aggarwal and Hsu 2009) (mean = 0.13; SD = 0.10).

Recipient unit performance feedback

As mentioned above, managers evaluate firm performance relative to their aspirations (Cyert and March 1963; Klueter and Monteiro 2017; Levinthal and March 1981). An indicator of aspirations that is frequently used by managers and other stakeholders is recent performance history, in particular year-on-year performance (Greve 2003; Ref and Shapira 2017; Vidal and Mitchell 2015). Using Telcorp's quarterly reports, we collected the latest year-on-year percentage change in EBITDA of the receiving subunit, before the focal attempt to integrate external knowledge in that subunit (mean = 1.61; SD = 15.63). While ROA is a common measure in studies of performance feedback (Greve 2010), our interviews revealed that Telcorp managers primarily attend to EBITDA to assess performance. In fact, analyses of Telcorp annual and quarterly reports showed that EBITDA is given much more attention than other indicators: EBITDA is the only indicator that is visualized as a figure on slides presenting results of subunits, EBITDA is often mentioned in the title of slides presenting *all* performance indicators of a subunit (e.g., "[Subunit name] – continued EBITDA growth"), and EBITDA is the only indicator which is allocated entire slides when presenting subunit results.

[3] We control for the absolute experience (e.g., number of startups identified by that particular boundary spanner in the past). We also ran several robustness tests (e.g., excluding observations with little boundary spanning experience). Capabilities are very difficult to capture with formative measures; and reflective measures, such as the total number of license deals by a focal firm since its inception, have been used in previous research to capture capabilities (see e.g., Aggarwal and Hsu, 2009). Compared to previous research, though, our measure offers the advantage of considering successful *and* failed attempts (instead of only considering the total number of successes), which gets us closer to capabilities.

Startup number of technological domains

We assessed this variable using the information from the database. Each external knowledge sourcing attempt was categorized by Telcorp scouts into one or several of the following technological domains: voice (e.g., VoIP, VoLTE), video (e.g., IPTV, conferencing), cyber-security (e.g., deceptive-based security, DDoS), cloud (e.g., infrastructure, storage), IoT (e.g., sensors, smart devices), mobile (e.g., 4G, 5G), wireless networks (e.g., WiFi, WAN), wired networks (e.g., fiber, ADSL), virtual networks (e.g., NFV, SDN), customer service (e.g., chatbot, real-time translation) and other. Akin to previous research investigating knowledge breadth (e.g., Paruchuri and Awate 2017), our startup number of technological domains is a discrete measure which counts the number of categories in which the technology was included (mean = 1.90; SD = 0.90).[4]

Control variables

The granular nature of our data allows us to include an extensive number of control variables and account for several alternative explanations.

Startup patent stock. We controlled for the patent stock of the startup associated with the external knowledge as it might influence the integration of the related knowledge into the subunit (Aggarwal and Hsu 2009). Using data from the World Intellectual Property Organization, this variable was measured as the number of patents filed by the startup before the start of the external knowledge sourcing attempt (mean = 9.78; SD = 34.88).[5] ***Startup age.*** Older startups might be better able at facilitating partnerships with other organizations. Therefore, we collected additional data from Thomson Reuters Eikon and included a variable to control for the age (in years) of the source of the external technology at the date when the sourcing attempt was initiated (mean = 5.07; SD = 4.59). We also included a variable called "***Startup size***" being the amount of equity funding received by the startup (in million USD) (mean = 18.08; SD = 38.94) at the date when the sourcing attempt started.[6] We used the natural logarithms for both of these measures. To assess ***startup***

[4] Almost half of the startups in our sample did not have filled any patent by the time they were identified by managers in the scouting function, making the use of patent-based measures of technological domain not appropriate to our study. Similarly, using industry classification was also not appropriate. In fact, using the industry classification established by Thomson Reuters showed that most of the startups were registered within the 'Software' category (ID 174).

[5] Using data from the United States Patent and Trademark Office did not alter our results.

[6] Our results remain stable when controlling for the total amount of funding received.

market provenness, we adapted a scale from Monteiro (2015). Using the information contained in the database as well as extensive research on the Internet Archive (web.archive.org), we gathered data on whether: 1) the technology is commercially available (1 = yes, 0 = no); 2) customers are buying the technology (1 = yes, 0 = no); 3) other telecom companies are buying the technology (1 = yes, 0 = no). All three items loaded on one factor and we used the average as a measure of market provenness (mean = 0.65; SD = 0.32). ***Startup distance to recipient unit*** was calculated with geopy in Python 3.7. We used the great-circle distance in miles between the startup's city and the subunit's city (mean = 3314; SD = 2124). We measured ***scouting function age*** as the number of years the scouting function existed at the time of the focal external knowledge integration attempt (mean = 8.92; SD = 2.10). We controlled for the ***number of people*** from the subunit who were involved in the attempt as it might influence resources available. To do so, we used information from the internal documents (mean = 1.33; SD = 2.21). We controlled for ***Recipient unit crowding***, i.e., the density of alternative targets (Piezunka and Dahlander 2015) by measuring the number of external knowledge sourcing attempts initiated in a 14-day window for that particular subunit (mean = 10.44; SD = 12.32).[7] ***Recipient unit external innovation experience*** was measured as the experience of a particular subunit in innovating based on external knowledge. Using the information available in the database, we estimated subunit external innovation experience in calculating the number of times the focal subunit attempted to introduce a new product based on external prior to the focal attempt (Aggarwal and Hsu 2009) (mean = 68.70; SD = 57.94). ***Scout boundary spanning experience*** was measured as the total number of startups previously identified by the focal boundary spanner (Aggarwal and Hsu 2009) (mean = 262.48; SD = 297.56). We used data collected from LinkedIn to measure ***scout tenure*** as the number of years the scouts had worked within Telcorp (mean = 11.31; SD = 5.77). ***Scout crowding***, i.e., the intensity of alternative targets (Piezunka and Dahlander 2015) was measured as the number of startups that were identified by the focal scout in a 14-day window (mean = 15.54; SD = 15.91). To assess ***scout external innovation capabilities***, we selected the startups that had been identified by the scout prior to the focal attempt. Then, we calculated the ratio of new products and services launched based on external knowledge to total number of startups identified (Aggarwal and Hsu 2009) (mean = 0.15; SD = 0.14). ***Matching*** was measured using information from the internal database and following Monteiro

[7] Results presented here are robust to several different operationalizations of this variable using shorter and longer time windows (i.e., 7, 30, 60, 180 days).

(2015). This variable took the value of 1 if the tracking notes in the database included a specific subunit to which the startup's technology could be relevant, 0 otherwise (mean = 0.50; SD = 0.50).

Analysis

In the first-stage model, we used a probit model to examine factors driving the selection of startups into the subunits' external innovation pipeline (i.e., to be selected for prototyping)[8]. Data include 2895 startups based in 54 countries. About 12% of these startups will be selected by the subunits, which will attempt to collaborate with them to launch new products and services. The first-stage model includes all variables of the second-stage model, with the exceptions of the variables that are unknown because startups were not necessarily selected yet (e.g., number of people, recipient unit external innovation capabilities). We also included two instruments in the first-stage model that should theoretically be related to selection into the second-stage model but unrelated to the outcome variable of the second stage (i.e., fulfilling the exclusion restriction criteria) (Certo et al. 2016)[9]. One of our instruments measures whether the startup was identified in August because our fieldwork indicates that this is a month where scouts can better focus on identifying opportunities to recombine external and internal knowledge as well as on convincing subunits to select startups. This is because scouts are typically less distracted by other activities in August (e.g., industry conferences, public speaking). This should not be related to the outcome of the second-stage model (new product introduction) and the correlation to this variable was indeed very small and not significant ($r = 0.007$ and $p=0.8945$). The second instrument captures performance feedback at the company level (year-on-year percentage change in EBITDA). While group-level performance feedback might be related to the likelihood of finding individuals willing to support the selection of startups for further evaluation (e.g., because of top management pressure and/or resource allocation), this should not influence the dependent variable in our second-stage model (in fact, r =

[8] The dependent variable of our second-stage model is also a dichotomous variable. Therefore, we use the *heckprobit* command in STATA 16.0 (see e.g., Deichmann and Jensen 2018).
[9] As Certo and colleagues (2016: 2644) note: "Heckman models should include at least one variable in the first stage that does not appear in the second stage (Sartori, 2003). These variables, which are known as exclusion restrictions, influence the probability of an observation's appearing in the sample, but do not influence the ultimate dependent variable of interest in the second-stage". By "instrument", we refer to a variable that fulfills the exclusion restriction and explains selection. The Heckman selection method should not be confused with an instrumental variable approach. The Heckman selection method uses the excluded variable to generate an estimate for the inverse Mills ratio. This is then plugged into the outcome equation, whereas instrumental variable approaches use the excluded variable to get the exogenous component of an outcome equation regressor and use that in the outcome equation.

0.017 and p = 0.7345). Then, we ran the second-stage model controlling for the endogeneity of startup selection into the subunits' external innovation pipelines.

RESULTS

Table 1 includes pairwise correlations. The results of the two-stage probit regressions are included in Table 2, which displays the coefficients, robust standard errors and the marginal effects (ME). Model 1 assesses factors that affect the selection of a startup into the external innovation pipeline of a subunit. The two instruments are significantly related to selection into the second stage, but not related to the outcome of the second stage (as noted above), thereby fulfilling the exclusion restriction criteria (Certo et al. 2016). Note that we did not include Matching in the second-stage model. We did so because observations where Matching took the value of 0 could not be included in the second-stage model as we needed to match to a specific subunit. We conducted several tests to ensure that these observations (2.6% of our overall sample) were not significantly different from the ones included in the second-stage in terms of the variables included in the second stage (except the ones regarding the receiving subunits). Between the ones excluded and the ones included, we could only find differences in scout tenure (11.3 vs. 7.7; $p<0.01$) and in scout crowding (15.5 vs. 9.9; $p<0.01$). Thus, we are confident that our results are not subject to bias related to the exclusion of these observations. We also did not include Scout boundary spanning experience in the second-stage model. This variable is very highly correlated with Scout external innovation experience ($r = 0.82$; $p<0.001$) and including both would lead to significant multicollinearity problems. Note that including one versus the other does not alter our results.

Models 2 to 4 report the predictors for the second-stage model with "new product introduction" as dependent variable. Consistent with our first hypothesis, we find that scout boundary spanning capabilities is positively related to new product introduction ($\beta = 1.166$; $p < 0.001$). Additional analyses using prediction tables (*mtable* in STATA 16.0) reveal that an attempt to innovate based on external knowledge that is mediated by a scout with high boundary spanning capabilities (+1SD) have a likelihood of being successful that is 37% higher than for those with low boundary spanning capabilities (-1SD).

Model 3 includes the interaction between scout boundary spanning capabilities and subunit external innovation capabilities. This interaction is not significant and the direct effects of both variables lose their significance. Additional analyses of marginal effects show that this is explained by the fact that the effect of scout boundary spanning capabilities is only significant when subunit external innovation capabilities are above average (see Figure 1). Moreover, prediction analyses suggest that scout boundary spanning capabilities do not substitute subunit external innovation capabilities. Indeed, at low levels of subunit external innovation capabilities (-1SD), the probability of success only increases by 4.4% between low (-1SD) and high (+1SD) scout boundary spanning capabilities. These analyses rather point towards a complementarity effect, because at high subunit external innovation capabilities (+1SD), the probability of success increases by 78% between low (-1SD) and high (+1SD) scout boundary spanning capabilities.

Model 4 includes the interaction between scout boundary spanning capabilities and subunit performance feedback. To test our third hypothesis, we conducted analyses of marginal effects. This enables us to visualize at which values of subunit performance feedback is the effect of scout boundary spanning capabilities significant (see Figure 2). Supporting our third hypothesis, we find that scout boundary spanning capabilities are significantly related to new product or service launch based on external knowledge when subunit performance feedback lies around 0% (more precisely between -12.09% and +10.48% or approximately between average -1SD to average +1/2SD).

Model 5 includes the interaction terms between scout boundary spanning capabilities and startup number of technological domains. Figure 3 includes an illustration in which we can see that the effect of scout boundary spanning capabilities is very small or not significantly different from 0 when the number of technological domains is one or two but that the effect is large when the number of technological domains is three or four. In fact, prediction analyses show that the probability of success barely changes depending on scout boundary spanning capabilities when the knowledge encompasses one or two domains. Yet this probability increases by 81% when the knowledge encompasses three domains between low (-1SD) and high (+1SD) scout boundary spanning capabilities. In the case of four domains, this probability is multiplied by three.

DISCUSSION

Our study provides new insights into the relationship between boundary spanning and the introduction of new products based on external knowledge. Thereby, we contribute to two bodies of literature.

Boundary spanning

While boundary spanning capabilities have usually been conceptualized as helping make the connections between two worlds, our results highlight a more active (and consequential) role of boundary spanning. Previous research showed that capabilities to span boundaries is important for organizations willing to access knowledge (e.g., Ancona 1990; Rosenkopf and Nerkar 2001; Tortoriello 2015; Tushman 1977). Boundary spanners act as mediators in that they search for new knowledge outside the organization and connect it to the most relevant individuals within the organization (Tushman 1977). Without boundary spanners, most new knowledge would remain unnoticed or be quickly disregarded (Monteiro 2015). Yet, going beyond accessing knowledge (i.e., receiving attention from internal stakeholders or influencing patenting activities), our results show that boundary spanning capabilities are also very influential once knowledge made its first step into the organization, up to the launch of a new product or service. This result is not as straightforward as it may seem. Some scholars pointed out to the additional information requirements of the implementation phase, and thus the importance of boundary spanning during the implementation (Edmondson 2003; Marrone, Tesluk and Carson 2007). Yet, others noted that boundary spanning can distract the internal teams responsible for the integration of the knowledge, eventually impeding coordination and control (Tushman 1977; Ancona and Caldwell 1992). With this study, we show that the involvement of the boundary spanners who initially accessed the knowledge does matter for its integration, and how much it matters. To illustrate, we include here a quote from our fieldwork:

> *"Their role is to babysit those innovation opportunities as they move down the conveyor belt […] into the business. It's like the baton in the relay race used around the track. Actually it's kind of ruining the metaphor a little bit, the guy who's running the first lap […] actually stays with the baton all the way around to make sure nobody drops it."*

In addition, some studies suggested that the effects of boundary spanning capabilities are contingent on the organizational context. Marrone (2010) for instance suggested that boundary spanning capabilities might be unproductive for teams working under stable and predictable conditions. Others discussed the past performance and resources available to suggest that boundary spanning might be more important when organizations are in slack times and when resources are abundant (Faraj and Yan 2009; Klueter and Monteiro 2017). We extend this research in showing that the integration capabilities of organizations are very important aspects influencing the benefits of boundary spanning capabilities. More precisely, organizations that often succeeded at integrating external knowledge benefit from boundary spanning capabilities while we could not find similar evidence for organizations that had low integration capabilities. Klueter and Monteiro (2017) proposed that scouts less likely intensify their efforts to span organizational boundaries when their firm performed close to its aspiration point. We go one step further and depict the importance of the scouts' boundary spanning capabilities when they try to generate collaborations between startups and subunits that performed close to their aspiration points. This is in these cases that boundary spanning capabilities matter most and scouts should in fact intensify their efforts to ensure that commercialization of innovation based on external knowledge takes place.

External knowledge sourcing

Most research addressing the question how organizations can better learn from the outside focused either on the internal knowledge base (e.g., Cohen and Levinthal 1990; Tsai 2001) or on how organizations search externally (e.g., Ahuja and Katila 2001; Leiponen and Helfat 2010). Overall, this literature suggests that organizations will be best at integrating external knowledge if their internal knowledge base is large and if they have a diverse source portfolio. In this case, organizations indeed have more possibilities to recombine internal with external knowledge, thus generating combinations of knowledge leading to innovation. Our results confirm that the capabilities to generate these combinations matter, as we show that subunits with higher external innovation capabilities are more likely to use external knowledge to introduce new products. However, we push these ideas in showing that these integration capabilities are not all that matters. In fact, the likelihood of success (i.e., introducing a new product) remains relatively small when highly capable boundary spanners are engaged in subunits with below average capabilities. Rather, our results show that a high probability of success is only reached when high boundary spanning capabilities are combined with high subunit external innovation capabilities, suggesting complementarity – rather than substitution – between external innovation capabilities of the receiving subunit and boundary spanning capabilities. In other words, boundary spanners appear to be catalysts of innovation based on external knowledge rather than enablers of it.

Interestingly, one could speculate that highly capable boundary spanners over time might eventually choose to be engaged mostly in subunits that are highly capable. This may lead to an intriguing self-reinforcing mechanism in which parts of an organization that are already better at innovating become even better at it, while the other parts become worse and worse. In fact, the first-order effect of local learning (i.e., launching a new product in a particular subunit based on external knowledge) generates a second-order effect that decreases the need to learn and the relative capabilities to do so in other parts of the organization. Eventually, attempts to integrate external knowledge might be focused on an in-crowd (i.e., the subunits that are highly capable at innovating based on external knowledge), leaving the other subunits isolated from these attempts. This second-order substitutive learning effect takes much longer to appear than the immediate local learning effect (Levinthal and March 1993; Monteiro, Arvidsson and Birkinshaw 2008). However, in the long run, the first-order learning cannot substitute for the second-order decay of capabilities in other parts of the organization, which can be highly detrimental to overall organizational performance and survival.

Managerial implications

Our study has important implications for managerial practice. First, scouting unit managers should allocate scouts who have been highly capable at identifying startups that triggered the interest of subunit managers to attempts targeting subunits that lack motivation to innovate. Indeed, these attempts are the ones where scouting capabilities matter most. Contrary to our expectations, we could not find evidence that scouting capabilities substitute the capabilities of subunits to commercialize innovation in collaboration with startups. This suggests that highly capable scouts might not make that much of a difference in subunits that often failed at commercializing innovation based on external knowledge. Executives must be aware that scouts can only do so much and some subunits may first need to develop capabilities to innovate based on external knowledge in order to benefit from boundary spanning. Second, executives of large corporations who are willing to generate collaborations with high-tech startups should ensure that mechanisms are in place that can supplant lack of motivation or ability in the subunits (e.g., by providing support teams within the subunits dedicated to facilitate such collaborations). Third, startups collaborating with large corporates run the risk of wasting time and other resources initiating partnerships that lead to nowhere. Our study suggests that scouting capabilities, subunit external innovation capabilities, subunit latest performance feedback, and number of technological domains encompassed are important cues that can help assess whether a collaboration opportunity is likely to succeed or not.

Limitations and future research

Our study has some limitations that offer promising avenues for future research. Our data enabled us to look at something much closer to innovation (i.e., the commercialization of a new product or service) than invention (i.e., patents) (Teece 1986), thus providing important insights into how firms can innovate based on external knowledge. To investigate this issue, we used a variable that measured whether the opportunity to integrate external knowledge eventually turned into a new product introduction (see also Katila 2002; Li et al. 2013; Smith, Collis and Clark 2005 for a similar operationalization). Arguably, the appropriateness of such an operationalization rests on the assumption that the launch of a new product is relevant per se. We conducted additional fieldwork to discuss this assumption and our interviews suggest that boundary spanning capabilities positively influences the quality of the integration outcome. While we think it is a reasonable assumption, we agree that future research could look deeper into the products that are launched based on external knowledge and potentially assess the revenues and profits they generate.

Another limitation of our study relates to our boundary spanning variable. While appropriate given the development of research on this issue (Monteiro and Birkinshaw 2017; Schotter et al. 2017; Tippmann et al. 2017), we are unable to detail the engagement of boundary spanners in the integration process. Although our fieldwork gave us some information about the activities undertaken in this process, future research could look into the activities of boundary spanners that bring most value as well as under which circumstances.

Finally, we consider recipient unit capabilities to innovate based on external knowledge as well as various recipient unit characteristics including performance. Yet we could not measure recipient unit capabilities to innovate *per se* over this thirteen year period (e.g., based on internal knowledge). Future research is warranted to investigate whether boundary spanning capabilities are complementary to recipient unit capabilities to innovate based on internal knowledge or whether a substitutive effect is at play.

Conclusion

Boundary spanning individuals can help their organizations access external knowledge and eventually be more inventive. However, it is less clear that the boundary spanning capabilities they develop can be useful for outcomes that occur later in the external innovation process (i.e., as they slowly pass on the baton), and if so, how much and for whom. Using unique proprietary data, we were able to shed light on these questions. Our results show that boundary spanning capabilities significantly help receiving units to innovate based on external knowledge. Still, boundary spanning capabilities do not substitute for recipient units external innovation capabilities. Rather, our results suggest a complementary effect: for external innovation opportunities to have a large chance of leading to the launch of new products and services, recipient units must have developed high external innovation capabilities and attempts must be led by highly capable boundary spanners. We also show that boundary spanning capabilities can fight organizational inertia as they are particularly impactful in receiving subunits that performed close to their aspirations and lack the slack or pressure that typically incentive to innovate. Finally, our results depict that boundary spanning capabilities are more impactful when external knowledge encompasses multiple technological domains.

REFERENCES

Aggarwal, V. A. (2019). Resource congestion in alliance networks: How a firm's partners' partners influence the benefits of collaboration. *Strategic Management Journal*.

Aggarwal, V. A., & Hsu, D. H. (2009). Modes of cooperative R&D commercialization by start-ups. *Strategic Management Journal*, 30(8), 835-864.

Ahuja, G. (2000). Collaboration networks, structural holes, and innovation: A longitudinal study. *Administrative Science Quarterly*, 45(3), 425-455.

Ahuja, G., & Katila, R. (2001). Technological acquisitions and the innovation performance of acquiring firms: A longitudinal study. *Strategic Management Journal*, 22(3), 197-220.

Ancona, D. G. (1990). Outward bound: strategic for team survival in an organization. *Academy of Management Journal*, 33(2), 334-365.

Ancona, D. G., & Caldwell, D. F. (1992). Demography and design: Predictors of new product team performance. *Organization Science*, 3(3), 321-341.

Arora, A., Fosfuri, A., & Gambardella, A. (2004). *Markets for technology: The economics of innovation and corporate strategy*. MIT Press.

Baum, J. A., Rowley, T. J., Shipilov, A. V., & Chuang, Y. T. (2005). Dancing with strangers: Aspiration performance and the search for underwriting syndicate partners. *Administrative Science Quarterly*, 50(4), 536-575.

Carlile, P. R. (2004). Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science*, 15(5), 555-568.

Carlile, P. R., & Rebentisch, E. S. (2003). Into the black box: The knowledge transformation cycle. *Management Science*, 49(9), 1180-1195.

Cassiman, B., & Veugelers, R. (2006). In search of complementarity in innovation strategy: Internal R&D and external knowledge acquisition. *Management Science*, 52(1), 68-82.

Certo, S. T., Busenbark, J. R., Woo, H. S., & Semadeni, M. (2016). Sample selection bias and Heckman models in strategic management research. *Strategic Management Journal*, 37(13), 2639-2657.

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

Cyert, R. M., & March, J. G. (1963). *A behavioral theory of the firm*. Englewood Cliffs, NJ.

Dahlander, L., O'Mahony, S., & Gann, D. M. (2016). One foot in, one foot out: how does individuals' external search breadth affect innovation outcomes?. *Strategic Management Journal*, 37(2), 280-302.

Deichmann, D., & Jensen, M. (2018). I can do that alone… or not? How idea generators juggle between the pros and cons of teamwork. *Strategic Management Journal*, 39(2), 458-475.

Doz, Y. L. (1996). The evolution of cooperation in strategic alliances: initial conditions or learning processes?. *Strategic Management Journal*, 17(S1), 55-83.

Edmondson, A. C. (2003). Speaking up in the operating room: How team leaders promote learning in interdisciplinary action teams. *Journal of Management Studies*, 40(6), 1419-1452.

Eisenhardt, K. M., & Schoonhoven, C. B. (1996). Resource-based view of strategic alliance formation: Strategic and social effects in entrepreneurial firms. *Organization Science*, 7(2), 136-150.

Faraj, S., & Yan, A. (2009). Boundary work in knowledge teams. *Journal of Applied Psychology*, 94(3), 604.

Foss, N. J., Lyngsie, J., & Zahra, S. A. (2013). The role of external knowledge sources and organizational design in the process of opportunity exploitation. *Strategic Management Journal*, 34(12), 1453-1471.

Greve, H. R. (2003). A behavioral theory of R&D expenditures and innovations: Evidence from shipbuilding. *Academy of Management Journal*, 46(6), 685-702.

Grigoriou, K., & Rothaermel, F. T. (2017). Organizing for knowledge generation: Internal knowledge networks and the contingent effect of external knowledge sourcing. *Strategic Management Journal*, 38(2), 395-414.

Hagedoorn, J., & Wang, N. (2012). Is there complementarity or substitutability between internal and external R&D strategies?. *Research Policy*, 41(6), 1072-1083.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, 44(1), 82-111.

Kapoor, R., & Klueter, T. (2015). Decoding the adaptability–rigidity puzzle: Evidence from pharmaceutical incumbents' pursuit of gene therapy and monoclonal antibodies. *Academy of Management Journal*, 58(4), 1180-1207.

Katila, R. (2002). New product search over time: past ideas in their prime?. *Academy of Management Journa*l, 45(5), 995-1010.

Katila, R., & Ahuja, G. (2002). Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal*, 45(6), 1183-1194.

Kenney, M. (2000). *Understanding Silicon Valley: the anatomy of an entrepreneurial region*. Stanford University Press.

Klueter, T., & Monteiro, F. (2017). How does performance feedback affect boundary spanning in multinational corporations? Insights from technology scouts. *Journal of Management Studies*, 54(4), 483-510.

Klueter, T., Monteiro, L. F., & Dunlap, D. R. (2017). Standard vs. partnership-embedded licensing: Attention and the relationship between licensing and product innovations. *Research Policy*, 46(9), 1629-1643.

Kovács, B., Carnabuci, G., & Wezel, F. C. (in press). Categories, Attention, and the Impact of Inventions. *Strategic Management Journal*. doi:10.1002/smj.3271.

Laursen, K., & Salter, A. (2006). Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms. *Strategic Management Journal*, 27(2), 131-150.

Leifer, R., & Delbecq, A. (1978). Organizational/environmental interchange: A model of boundary spanning activity. *Academy of Management Review*, 3(1), 40-50.

Leiponen, A., & Helfat, C. E. (2010). Innovation objectives, knowledge sources, and the benefits of breadth. *Strategic Management Journal*, 31(2), 224-236.

Levinthal, D., & March, J. G. (1981). A model of adaptive organizational search. *Journal of economic behavior & organization*, 2(4), 307-333.

Levinthal, D. A., & March, J. G. (1993). The myopia of learning. *Strategic Management Journal*, 14(S2), 95-112.

Li, Q., Maggitti, P. G., Smith, K. G., Tesluk, P. E., & Katila, R. (2013). Top management attention to innovation: The role of search selection and intensity in new product introductions. *Academy of Management Journal*, 56(3), 893-916.

Marrone, J. A. (2010). Team boundary spanning: A multilevel review of past research and proposals for the future. *Journal of Management*, 36(4), 911-940.

Marrone, J. A., Tesluk, P. E., & Carson, J. B. (2007). A multilevel investigation of antecedents and consequences of team member boundary-spanning behavior. *Academy of Management Journal*, 50(6), 1423-1439.

Mintzberg, H., & Waters, J. A. (1985). Of strategies, deliberate and emergent. *Strategic Management Journal*, 6(3), 257-272.

Monteiro, F., & Birkinshaw, J. (2017). The external knowledge sourcing process in multinational corporations. *Strategic Management Journal*, 38(2), 342-362.

Moreira, S., Klueter, T. M., & Tasselli, S. 2020. Competition, Technology Licensing-in, and Innovation. *Organization Science*.

Moreira, S., Markus, A., & Laursen, K. (2018). Knowledge diversity and coordination: The effect of intrafirm inventor task networks on absorption speed. *Strategic Management Journal*, 39(9), 2517-2546.

Mulotte, L., Dussauge, P., & Mitchell, W. (2013). Does pre-entry licensing undermine the performance of subsequent independent activities? Evidence from the global aerospace industry, 1944–2000. *Strategic Management Journal*, 34(3), 358-372.

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

Paruchuri, S., & Awate, S. (2017). Organizational knowledge networks and local search: The role of intra-organizational inventor networks. *Strategic Management Journal*, 38(3), 657-675.

Piezunka, H., & Dahlander, L. (2015). Distant search, narrow attention: How crowding alters organizations' filtering of suggestions in crowdsourcing. *Academy of Management Journal*, 58(3), 856-880.

Ref, O. & Shapira, Z. (2017). Entering new markets: The effect of performance feedback near aspiration and well below and above it. *Strategic Management Journal*, 38(7), 1416-1434.

Rosenkopf, L., & Almeida, P. (2003). Overcoming local search through alliances and mobility. *Management Science*, 49(6), 751-766.

Rosenkopf, L., & Nerkar, A. (2001). Beyond local search: boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management Journal*, 22(4), 287-306.

Sartori, A. E. (2003). An estimator for some binary-outcome selection models without exclusion restrictions. *Political Analysis*, 11(2), 111-138.

Saxenian, A. (1994). *Regional networks: industrial adaptation in Silicon Valley and route 128*.

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational Behavior and Human Decision Processes*, 82(1), 9-27.

Teece, D. J. (1986). Profiting from technological innovation: Implications for integration, collaboration, licensing and public policy. *Research Policy*, 15(6), 285-305.

Ter Wal, A. L., Criscuolo, P., & Salter, A. (2017). Making a marriage of materials: The role of gatekeepers and shepherds in the absorption of external knowledge and innovation performance. *Research Policy*, 46(5), 1039-1054.

Tippmann, E., Sharkey Scott, P., & Parker, A. (2017). Boundary capabilities in MNCs: Knowledge transformation for creative solution development. *Journal of Management Studies*, 54(4), 455-482.

Tortoriello, M. (2015). The social underpinnings of absorptive capacity: The moderating effects of structural holes on innovation generation based on external knowledge. *Strategic Management Journal*, 36(4), 586-597.

Tortoriello, M., & Krackhardt, D. (2010). Activating cross-boundary knowledge: The role of Simmelian ties in the generation of innovations. *Academy of Management Journal*, 53(1), 167-181.

Tortoriello, M., McEvily, B., & Krackhardt, D. (2014). Being a catalyst of innovation: The role of knowledge diversity and network closure. *Organization Science*, 26(2), 423-438.

Tsai, W. (2001). Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance. *Academy of Management Journal*, 44(5), 996-1004.

Tushman, M. L. (1977). Special boundary roles in the innovation process. *Administrative Science Quarterly*, 587-605.

Tushman, M. L., & Scanlan, T. J. (1981). Boundary spanning individuals: Their role in information transfer and their antecedents. *Academy of Management Journal*, 24(2), 289-305.

Van de Vrande, V. (2013). Balancing your technology-sourcing portfolio: How sourcing mode diversity enhances innovative performance. *Strategic Management Journal*, 34(5), 610-621.

Vidal, E., & Mitchell, W. (2015). Adding by subtracting: The relationship between performance feedback and resource reconfiguration through divestitures. *Organization Science*, 26(4), 1101-1118.

Zollo, M., Reuer, J. J., & Singh, H. (2002). Interorganizational routines and performance in strategic alliances. *Organization Science*, 13(6), 701-713.

TABLES AND FIGURES

Table 1. Pairwise correlations

	1	2	3	4	5	6	7	8	9	10	11
New product introduction	1										
Startup age (logged)	-0.027	1									
Startup market provenness	0.072	0.373***	1								
Startup patent stock (logged)	0.006	0.391***	0.244***	1							
Startup number technological domains	0.064	0.046	0.111	0.115	1						
Startup equity funding (logged)	0.128*	0.404***	0.318***	0.456***	0.138*	1					
Startup distance to recipient unit (logged)	0.010	0.246***	0.196**	0.334***	0.132*	0.424***	1				
Scouting unit age in years	-0.016	-0.060	-0.126*	-0.147*	0.111	-0.156**	-0.196**	1			
Scout external innovation experience (logged)	-0.107	0.140*	0.119	0.128*	0.001	0.146*	0.298***	0.346***	1		
Scout external innovation capabilities	0.107	-0.075	-0.014	-0.056	-0.093	-0.104	-0.143*	0.242***	0.028	1	
Scout tenure	-0.196**	-0.029	-0.105	-0.116	-0.072	-0.220***	-0.431***	0.266***	0.227***	-0.068	1
Crowding at date added (14 days) (scout)	-0.137*	0.119	-0.0615	0.123*	0.042	0.040	-0.123*	0.150*	0.134*	0.159**	0.212***
Number of people involved in project (recipient unit)	0.600***	-0.018	0.141*	0.025	0.066	0.063	0.080	-0.159**	-0.138*	-0.080	-0.218***
Crowding at date added (14 days) (recipient unit)	-0.107	-0.037	-0.243***	-0.218***	-0.04	-0.337***	-0.480***	0.380***	-0.138*	0.138*	0.495***
Latest performance feedback (recipient unit)	-0.056	0.186**	0.0693	0.168**	-0.001	0.100	0.148*	-0.034	0.202***	-0.023	0.065
External innovation experience (recipient unit) (logged)	-0.014	-0.086	-0.186**	-0.143*	0.065	-0.197**	-0.235***	0.659***	0.207***	0.123*	0.257***
External innovation capabilities (recipient unit)	0.217***	-0.039	-0.183**	-0.075	0.129*	-0.104	-0.0811	0.331***	0.094	0.135*	0.004
Scout boundary spanning capabilities	-0.0024	0.005	-0.123*	-0.228***	-0.024	-0.170**	-0.308***	0.399***	0.091	0.162**	0.212***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

	12	13	14	15	16	17	18	19	20	21	22
Crowding at date added (14 days) (scout)	1										
Number of people involved in project (recipient unit)	-0.151*	-0.134*	-0.061	-0.069	-0.015	1					
Crowding at date added (14 days) (recipient unit)	0.340***	0.139*	-0.155*	-0.404***	-0.099	-0.184**	1				
Latest performance feedback (recipient unit)	0.085	-0.043	0.179**	0.144*	0.016	0.030	-0.052	1			
External innovation experience (recipient unit) (logged)	0.174**	0.177**	0.270***	-0.206***	0.031	-0.129*	0.477***	0.056	1		
External innovation capabilities (recipient unit)	0.028	-0.047	0.093	-0.102	0.015	0.117	0.121*	0.040	0.498***	1	
Scout boundary spanning capabilities	0.230***	0.126*	0.094	-0.429***	-0.122*	-0.104	0.524***	0.075	0.492***	0.170**	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2. Regression results

VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
Startup age (logged)	-0.178***	-0.176***	-0.168***	-0.146***	-0.233***
	(0.024)	(0.043)	(0.047)	(0.042)	(0.087)
Startup market provenness	0.833***	0.221	0.266	-0.045	0.190
	(0.102)	(0.173)	(0.243)	(0.303)	(0.210)
Startup patent stock (logged)	0.021	0.021	0.011	0.017	0.017
	(0.018)	(0.041)	(0.036)	(0.036)	(0.042)
Startup number of technological domains = 2	0.522***	0.618***	0.595***	0.461***	0.751***
	(0.133)	(0.086)	(0.051)	(0.103)	(0.188)
Startup number of technological domains = 3	0.658***	0.144	0.120	-0.099	-0.289
	(0.131)	(0.335)	(0.379)	(0.413)	(0.353)
Startup number of technological domains = 4	0.776***	0.611*	0.627	0.516	-0.324
	(0.144)	(0.352)	(0.534)	(0.419)	(1.029)
Startup equity funding (logged)	0.216***	0.328***	0.338***	0.356***	0.365***
	(0.047)	(0.029)	(0.055)	(0.016)	(0.021)
Startup distance to recipient unit (logged)	-0.037*	-0.052*	-0.048**	-0.063***	-0.090***
	(0.019)	(0.029)	(0.021)	(0.022)	(0.014)
Scouting unit age in years	0.679**	0.810***	0.866***	0.400	0.385
	(0.289)	(0.201)	(0.172)	(0.339)	(0.314)
Scout external innovation experience (logged)	0.160	-0.112	-0.139	-0.083	-0.081
	(0.177)	(0.083)	(0.092)	(0.053)	(0.068)
Scout external innovation capabilities	-0.234***	1.607*	1.497*	1.947***	1.826***
	(0.086)	(0.858)	(0.783)	(0.514)	(0.432)
Scout tenure	0.062***	-0.009	-0.008	-0.017	-0.013
	(0.021)	(0.018)	(0.019)	(0.012)	(0.010)
Crowding at date added (14 days) (scout)	-0.022***	-0.036*	-0.037*	-0.034	-0.032
	(0.004)	(0.019)	(0.021)	(0.023)	(0.020)
Number of people involved in project (recipient unit)		0.346***	0.351***	0.414***	0.410***
		(0.051)	(0.066)	(0.072)	(0.073)
Crowding at date added (14 days) (recipient unit)		0.019	0.019	0.016	0.008
		(0.013)	(0.013)	(0.017)	(0.015)
Recipient unit performance feedback		-0.008***	-0.008***	-0.014***	-0.007***
		(0.001)	(0.003)	(0.005)	(0.001)
External innovation experience (recipient unit) (logged)		0.035	0.043	0.023	0.053
		(0.057)	(0.068)	(0.084)	(0.078)
Recipient unit integration capabilities		1.606***	0.519	2.489**	2.659***
		(0.369)	(0.799)	(1.003)	(0.928)
H1: Scout boundary spanning capabilities	0.383**	1.166***	-0.601	1.061***	1.117***
	(0.180)	(0.236)	(0.679)	(0.265)	(0.242)
Matching	0.935***				
	(0.214)				
Latest performance feedback (group)	-0.033***				
	(0.005)				
Scout boundary spanning experience (logged)	-0.272				
	(0.168)				
Identified in August	0.533***				
	(0.111)				
H2: Scout boundary spanning capabilities * Recipient unit external innovation capabilities			11.800**		
			(5.059)		
H3: Scout boundary spanning capabilities * Recipient unit performance feedback				0.050	
				(0.035)	
H4: Scout boundary spanning capabilities * Startup number of technological domains = 2					-1.499***
					(0.400)
H4: Scout boundary spanning capabilities * Startup number of technological domains = 3					1.236***
					(0.479)
H4: Scout boundary spanning capabilities * Startup number of technological domains = 4					3.662**
					(1.491)
Constant	-3.067**	-4.820***	-4.836***	-3.749***	-3.749***
	(1.216)	(1.035)	(0.756)	(0.823)	(0.704)
Observations	2,895	272	272	272	272

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Figure 1. Average marginal effect of Scout boundary spanning capabilities depending on Recipient unit external innovation capabilities

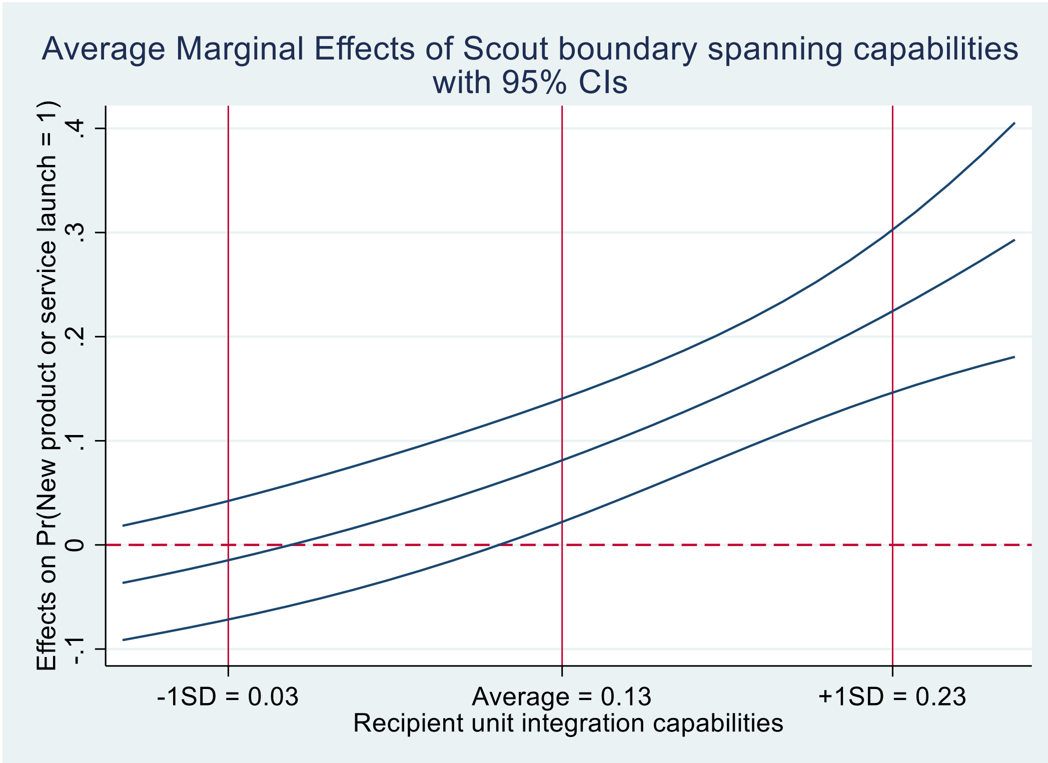

Figure 2. Average marginal effect of Scout boundary spanning capabilities depending on Recipient unit performance feedback

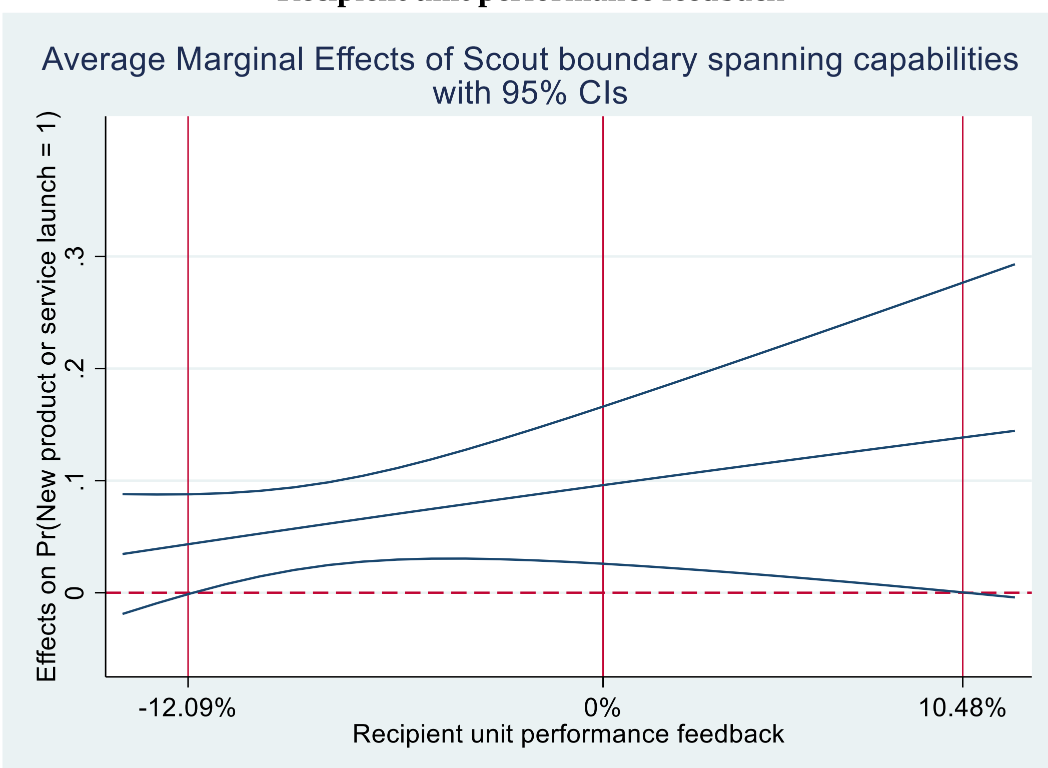

Figure 3. Average marginal effect of Scout boundary spanning capabilities depending on Startup number of technological domains