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**Citation for published version (APA):**

Ferraris, A., Bogers, M. L. A. M., & Brescianini, S. (2020). Subsidiary innovation performance: Balancing external knowledge sources and internal embeddedness. *Journal of International Management*, 26(4), [100794]. <https://doi.org/10.1016/j.intman.2020.100794>

**Document license:**  
TAVERNE

**DOI:**  
[10.1016/j.intman.2020.100794](https://doi.org/10.1016/j.intman.2020.100794)

**Document status and date:**  
Published: 01/12/2020

**Document Version:**  
Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

**Please check the document version of this publication:**

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
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# Subsidiary innovation performance: Balancing external knowledge sources and internal embeddedness

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## ARTICLE INFO

### Keywords:

Subsidiary innovation

Open innovation

Internal embeddedness

Knowledge management

## ABSTRACT

The open innovation (OI) literature has focused primarily on OI strategies and external sourcing of knowledge at the organizational level and has paid less attention to the role of subsidiaries in the OI activities of multinational corporations (MNCs). In contrast, International Business (IB) scholars have shown that subsidiaries play an emergent role in MNC innovation activities and have highlighted the relevance of subsidiaries' external and internal linkages. In this paper, we bring together these perspectives by examining OI at the subsidiary level within MNCs and test our hypotheses through an empirical analysis using data from 91 MNC subsidiaries. Our findings show an inverted U-shaped relationship between the openness of subsidiaries to external knowledge sources and innovation performance. Moreover, we find that subsidiaries' internal embeddedness positively moderates the above relationship. Practically, our findings suggest the need for MNC and subsidiary managers to develop mechanisms to manage intra-organizational relations in order to achieve improved innovation performance while leveraging of external knowledge sources at the subsidiary level, thus favoring MNCs' knowledge management (KM) approach. We contribute to different interrelated streams of research by providing compelling evidence to support the assertion that subsidiaries need to balance external and internal openness.

## 1. Introduction

The open innovation (OI) literature has grown tremendously in recent years with a primary focus on external knowledge sourcing at the organizational level (e.g. Dahlander and Gann, 2010; West and Bogers, 2014). However, there has been limited focus on related levels of analysis, e.g. lower organizational levels such as affiliated organizations, projects, groups or individuals (Chesbrough and Bogers, 2014; Schneckenberg, 2015). Therefore, a more detailed level of analysis of OI is required in order to achieve a more nuanced understanding of the contingencies or conditions that have an influence on whether OI works effectively (West et al., 2014; Bogers et al., 2017).

In this paper, we respond to this need by investigating the role of subsidiaries that serve as a potentially valuable source of

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<https://doi.org/10.1016/j.intman.2020.100794>

Received 30 January 2020; Received in revised form 27 June 2020; Accepted 28 September 2020

Available online 28 October 2020

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innovation below the headquarter (HQ) level in the context of a multinational corporation (MNC) (Monteiro et al., 2008; Asakawa et al., 2014; Lee et al., 2020). In fact, in recent decades, the role of subsidiaries in relation to the HQ has changed from being merely passive to being more pro-active (Ferraris, 2014), involving knowledge creation and sharing (Ryan et al., 2018) and demonstrating the relevance of knowledge networks for MNC innovation (Hallin et al., 2011; Liu et al., 2014). Indeed, the International Business (IB) literature has clearly highlighted the “dual embeddedness” role of innovative subsidiaries (e.g. Achcaoucaou et al., 2014; Ciabuschi et al., 2014), which demonstrates the relevance of dynamic internal and external relationships for MNCs (Ryan et al., 2018).

Traditional studies in the field of innovation management (e.g. Laursen and Salter, 2006) have suggested that there is an inverted U-shaped relationship between OI and innovation performance without providing much evidence of potential moderators. In this guise, MNC subsidiaries provide a useful and new context of analysis for testing the aforementioned relationships for several reasons. First, due to the globalization of R&D, MNC subsidiaries are increasingly being forced by their HQs to achieve improved innovation outcomes with limited or scarce resources (Ciabuschi et al., 2014; Asakawa et al., 2018). In this sense, previous authors have rarely tested for the curvilinear relationship at the MNC subsidiary level of analysis, thereby excluding the possibility of potential negative returns from higher levels of external openness (at the subsidiary level).

Second, subsidiaries hold an exclusive position as boundary spanners within knowledge-intensive processes and innovation in MNCs (Kumar et al., 2013, 2019), which enables them to access knowledge from the internal networks (other subsidiaries and HQs) across their own organizational boundaries as well as share external knowledge sourced in the local host country (Isaac et al., 2019).

Third, MNC subsidiaries are crucial in facilitating local adaptation of the MNC's products and services and/or enabling the creation and acquisition of globally relevant technology for the whole MNC (De Beule and Van Beveren, 2019).

Drawing on the IB literature, we suggest that subsidiaries can strengthen their external knowledge sourcing (making it more efficient or effective) by relying on knowledge and support coming from their HQs and other subsidiaries in their internal network, thereby increasing their innovation performance (Phene and Almeida, 2008; Figueiredo, 2011; Kotabe et al., 2017). Therefore, we expect that some entrepreneurial subsidiaries may develop some distinctive features in order to mitigate or postpone the negative outcomes resulting from further opening up their innovation boundaries (Dimitratos et al., 2014; Gölgeci et al., 2019). The literature supports the idea that the high quality of relationships is a main conduit of knowledge transfer. Furthermore, in the context of subsidiaries, a subsidiary's internal embeddedness, i.e. the knowledge-intensive linkages with HQs and sister subsidiaries, has been underlined as a relevant mechanism for enhancing innovations at the subsidiary level (e.g. Figueiredo, 2011).

Thus, the primary goal of this research is to analyze the effect of internal embeddedness on external knowledge sourcing at the subsidiary level. We contend that such embeddedness helps subsidiaries to achieve centrality in the internal MNC network and, thus, benefit more from knowledge coming from the internal network, supporting and balancing external knowledge sources. More specifically, we investigate whether subsidiaries' internal embeddedness positively moderates the relationship between the breadth and depth of external searches and innovative performance at the subsidiary level.

Based on data from 91 MNC subsidiaries, we performed an OLS analysis in order to test our hypotheses, which provided compelling evidence for the crucial role of subsidiary's internal embeddedness in to MNCs' OI activities. On this basis, the contribution of this paper is two-fold. On the one hand, it explicitly connects the OI research stream with the IB literature on subsidiary's embeddedness and innovation in MNCs. This highlights the relevance of exploring OI at a lower organizational level (i.e. the subsidiary) and rethinks the relevance of internal networks within the OI literature in the context of MNCs. On the other hand, the paper suggests that subsidiaries that are better embedded in the MNC internal network may further open up their innovation boundaries at a lower cost. This key position within the internal network helps subsidiaries to source external knowledge, which increases the benefits of OI derived from different kinds of innovation outcomes, thereby making external openness more efficient or effective.

The paper is organized as follows: the next section provides a review of the literature on OI and subsidiaries' internal embeddedness. We then propose hypotheses relating to the presence of an inverted U-shaped relationship between external knowledge sourcing and innovation performance and, consequently, the moderator effect of internal embeddedness on this relationship. Subsequently, we discuss the data, methodology and variables that were used in the study. Finally, we present the results of the analysis and discuss several managerial and theoretical implications.

## 2. Theoretical background

Innovation and knowledge generation in MNC subsidiaries have been receiving increasing attention from IB scholars due to increasing empirical evidence of their contribution to overall MNC success (e.g. Andersson et al., 2002; Venaik et al., 2005). In fact, an MNC subsidiary can assimilate knowledge from a set of exhaustive and mutually exclusive sources (Phene and Almeida, 2008) under a unified corporate identity (HQs and subsidiaries in host and host countries) or from other organizations located outside the MNC's boundaries (in host and home countries). However, several knowledge management issues arise when knowledge flow across and within borders increases, such as external sourcing of knowledge, reverse knowledge flows (from subsidiaries to HQs) and knowledge sharing among MNC organizational units (e.g. Amalia and Nugroho, 2011).

Continuous complex intra- and inter-organizational knowledge flow across MNCs has been dramatically complicated by the emergence of OI phenomena (Mortara and Minshall, 2011). OI has been recently (re)defined as “a distributed innovation process based on purposively managed knowledge flows across organizational boundaries” (Chesbrough and Bogers, 2014, p. 17). Accordingly, OI research typically focuses on knowledge flows from one organization to another, in which organizations can be of any type or size, although there has traditionally been a focus on large companies and a rather recent interest in SMEs (van de Vrande et al., 2009; Brunswicker and Vanhaverbeke, 2015). At the same time, researchers have only recently been focusing more on the intra-organizational aspects of OI (e.g. West et al., 2014; Della Peruta et al., 2018). However, while some studies address OI at the level of

functional area (Bogers and Lhuillery, 2011), projects (Du et al., 2014), or individuals (Dahlander et al., 2016; Salter et al., 2015), the more fundamental notion of what comprises an organization has not been well explained. In particular, limited attention has been paid to the fact that larger companies may, in fact, consist of multiple organizations, such as HQs and subsidiaries spread across geographical borders. This implies that openness across organizational boundaries could occur within a single firm. Only recently, De Beule and Van Beveren (2019) explicitly underlined the importance of OI in foreign MNC subsidiaries, highlighting differences in terms of their use of external knowledge sources (technology exploiting vs. seeking vs. creating subsidiaries).

In addition to external sources, MNC subsidiaries may, thus, exploit workforce and ideas that are external to the subsidiary, but internal to the whole corporation that is represented by knowledge coming from other HQs and subsidiaries' R&D departments or other companies' traditional employees (Ferraris et al., 2017a). In other words, the organizational boundaries of the subsidiaries (within the single MNC) are still crossed at that level of analysis (Bogers et al., 2017; Chesbrough and Bogers, 2014).

In the context of a single firm, "openness" suggests that knowledge and the source of innovations come from outside the firm (Koulopoulos, 2009); a phenomenon that is often international in the case of MNCs. In this regard, Kafouros and Forsans (2012) highlighted that the impact of external knowledge sourcing on performance varies depending on whether it has a domestic or foreign origin. Moreover, Wu and Wu (2014) found evidence to support the assertion that a local and international external search for new knowledge involves a positive interaction effect on product innovation.

However, subsidiaries may find obtaining knowledge from the internal networks challenging (Ciabuschi et al., 2011; Del Giudice and Della Peruta, 2016), which is also related (and interconnected) to the way the subsidiaries gather knowledge from the external networks (Najafi-Tavani et al., 2014; Ferraris et al., 2017a, 2017b, 2018). Therefore, MNCs should develop knowledge management practices and tools in order to stimulate interaction among their employees as this would improve the likelihood of cooperation and joint innovation (Chesbrough, 2010; Ferraris et al., 2018). This is an important issue in MNCs as they often experience problems when attempting to efficiently access knowledge that resides in divisional or organizational silos (Chesbrough, 2003, 2006).

Leveraging knowledge from the internal network within the MNC context still entails accessing knowledge that is external to the subsidiary organization. Thus, the crucial role of an entrepreneurial subsidiary is to recombine knowledge obtained from internal networks with knowledge that resides within and outside (external to the MNC, both local and international) the subsidiary's boundaries, thereby increasing the quality of its innovation (Phene and Almeida, 2008; Dimitratos et al., 2014; Bresciani and Ferraris, 2016). However, while recombining knowledge is at the heart of innovation, certain routines and specialization efforts often prevent large organizations from leveraging sets of knowledge coming from different organizational units and combining them with external knowledge (Chesbrough, 2006).

In MNCs, this difficult task is often given to the subsidiary's managers, who are tasked with continuously performing boundary spanning activities (Schotter et al., 2017). In fact, interpersonal and cultural barriers induce negative backlashes from other internal members or from the top management, which may prevent employees from collaboratively engaging in joint innovation activities (Ardichvili et al., 2003). For example, this gives rise to important cross-cultural management issues that can be limited by the managers' past work experience in different MNEs (e.g. Nuruzzaman et al., 2019). In fact, experience may facilitate the accumulation of culturally diverse knowledge (Singh et al., 2010), thus developing a manager's ability to work with people from different cultural backgrounds, which in turn facilitates innovation in a subsidiary. Subsidiary managers may perform this role, resulting in improved knowledge transfer and sharing between different MNC organizational units (Vora et al., 2007; Del Giudice et al., 2017). In this context, the quality of the relationships developed with internal counterparts (i.e. internal embeddedness) positively or negatively affects their ability to perform this boundary spanning role.

In fact, Venaik et al. (2005) identified two independent paths – one through networking and inter-unit learning and the other through subsidiary autonomy and innovation – that led to improved performance on the behalf of the subsidiary. In the context of MNCs, internal embeddedness represents a key additional resource for the subsidiary and refers to the extent to which each subsidiary is embedded in the corporate network (Ciabuschi et al., 2011). Internal embeddedness can vary from loose short-term ties (Uzzi and Lancaster, 2003) to knowledge-intensive long-term relationships based on strong social bonds involving trust and reciprocity (Dacin et al., 1999; Uzzi, 1996). Internal embeddedness is a mechanism that reduces the need for top-down integration and it augments the power of knowledge diffusion by the subsidiary (Mudambi and Navarra, 2004). This increases the authority of the embedded subsidiary (Garcia-Pont et al., 2009), which suggests that the increase in knowledge flow within internal organizational units allows the subsidiary to adopt a more central role in the MNC's innovation activities (Birkinshaw and Pedersen, 2001).

### 3. Hypotheses

In times of increasing product complexity and global competition, large MNCs hardly rely only on internal sources for innovation but they also require a wide variety of technologies, ideas and knowledge from external sources (Chesbrough, 2003; Kafouros and Buckley, 2008). In the context of MNCs, subsidiaries' openness to the external environment may be the organizational tool used by MNCs to effectively and efficiently access external sources in different host countries (Phene and Almeida, 2008). Traditionally, external searches have been critical in providing knowledge variety and opportunities to develop new combinations of technologies and knowledge (Nelson and Winter, 1982). More recently, scholars of open innovation have shown that external knowledge sourcing is positively associated with different innovation outputs, such as sales from new products on total sales, incremental and radical innovations, and the degree of product innovativeness (Nieto and Santamaría, 2007; Parida et al., 2012; Chen et al., 2016; Bresciani, 2017).

Unpacking the external search concept, Laursen and Salter (2006) distinguished between external search breadth, i.e. the number of different search channels (sources) used by a firm, and external search depth, i.e. the extent to which a firm draws on search

channels (sources). Laursen and Salter (2006) found an inverted U-shaped relationship between both external search breadth and depth and innovation performance, showing that performance only increased up to a certain “level of openness”, after which a decrease in performance occurred.

In fact, opening up organizations' innovation processes may become very costly and complex due to increasing coordination and monitoring costs or managerial challenges (Bianchi et al., 2016). In the specific context of our study, this is even augmented as MNC subsidiaries need to achieve better innovation outcomes with limited or scarce resources (Rugman et al., 2011; Ciabuschi et al., 2014), and subsidiary managers may be forced to use more external sources for innovation without devoting the proper attention that a multitude of heterogeneous channels would require, thereby raising the risk of falling in to the trap of “over-search” (Laursen and Salter, 2006; Berchicci, 2013).

Therefore, we propose that external knowledge sourcing exhibits an inverted U-shaped relationship with innovative performance in the specific and under-analyzed context of MNC subsidiaries:

**H1.** At the subsidiary level, the impact of search breadth and depth shows an inverted U-shaped relationship with innovation performance.

Simply identifying external sources of innovation is insufficient for success in the innovation arena. In fact, OI requires procedures for acquiring and obtaining knowledge that resides outside the firm (West and Bogers, 2014). As the search for external knowledge and the subsequent access and integration can be costly (Laursen and Salter, 2006; Laursen and Salter, 2014), innovation performance also depends on the amount of resources at the subsidiary level (Rugman et al., 2011), which can affect the point when negative returns from external openness appear.

In fact, receiving external knowledge does not lead to improved innovative performance per se (Díaz-Díaz and de Saá Pérez, 2014; Santoro et al., 2017). For example, when there is a high cognitive distance between the sender and the receiver of the knowledge (in this case the external source and the MNC subsidiary), several additional problems may arise that force firms to spend more time integrating external knowledge into their internal processes (Tsai and Wang, 2009).

In the specific context of MNCs, subsidiaries may draw on external sources of knowledge, like any firm, but they may also benefit from their position within the MNC by using additional resources and competencies dispersed throughout the MNC (Hallin et al., 2011; Najafi-Tavani et al., 2014). Subsidiaries that develop strong internal embeddedness achieve centrality in the internal MNC avoiding “isolation” (Monteiro et al., 2008), and they benefit from greater internal resource transfer through better internal relationships (Tsai, 2001; Ciabuschi et al., 2011). This may reduce resource constraints or decrease the cognitive distance between subsidiaries and external partners.

Therefore, internal embeddedness becomes a relevant managerial tool that improves the subsidiary's ability to make use of relevant resources controlled by other MNC units (Ciabuschi et al., 2011). Furthermore, it facilitates a higher volume of knowledge sharing and exchange, and it can improve the absorptive capacity of subsidiaries (Cohen and Levinthal, 1990), which has a positive effect on their knowledge acquisition (Ahn et al., 2016). Absorptive capacity refers to the extent to which a subsidiary is able to search for potentially valuable external sources of knowledge and incorporate new relevant knowledge, thereby achieving improved innovation performance (West and Bogers, 2014; Ahn et al., 2016).

Another line of reasoning suggests that there are positive interdependencies between a subsidiary's external and internal relationships (e.g. Bresciani and Ferraris, 2016). As the quality of the relationships with external sources is important in knowledge integration and innovation (Laursen and Salter, 2006; Yamin and Andersson, 2011), internal embeddedness improves the influence and power of a subsidiary compared to sister subsidiaries that compete between themselves for the HQs' resources (Andersson et al., 2007) through external networking activities (e.g. better perception of the relevance of the subsidiary's external network) and intensive knowledge-sharing activities (e.g. reverse transfer of knowledge) (Ciabuschi et al., 2011; Najafi-Tavani et al., 2014). Internal embeddedness may have a positive effect on the quality of relationships with external stakeholders due to positive interdependencies between the subsidiary's dual networks (Achcaoucaou et al., 2014; Bresciani and Ferraris, 2016; Lee et al., 2020). For example, the subsidiaries receive more resources from the HQ when they are embedded internally, which makes them more valuable partners with external actors, thereby better leveraging external knowledge (Figueiredo, 2011), which is usually tacit and difficult to integrate (Najafi-Tavani et al., 2014).

In summary, subsidiaries may draw on external sources of knowledge, but they may also specifically benefit from their position within the MNC by using additional resources and competencies dispersed throughout the MNC in order to amplify the positive effects of external openness and reduce the likelihood of the occurrence of negative outcomes related to complexity. Internal embeddedness may facilitate improved integration of external knowledge, thereby leading to improved innovation outcomes. Following these lines of reasoning, internal embeddedness amplifies the positive effect of external knowledge sourcing on a subsidiary's innovation performance. Thus, we propose the following hypothesis:

**H2.** At the subsidiary level, internal embeddedness positively moderates the relationship between subsidiary external knowledge sourcing (search breadth and depth) on innovation performance.

The hypothesized relationships proposed in this study are graphically presented in Fig. 1.



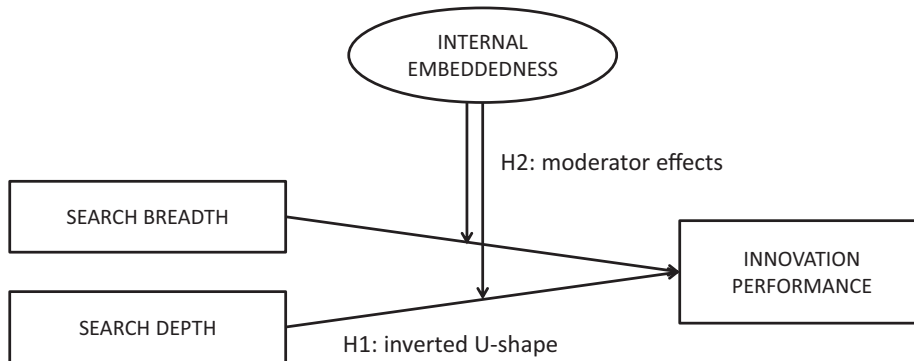


Fig. 1. Hypothesized relationships.

## 4. Methodology

### 4.1. Data

We developed a structured questionnaire based on Yamin and Andersson's (2011), which we adapted to fit the aims of this paper. The questionnaire consists of two parts; the aim of the first is to measure the subsidiaries' degree of embeddedness, which requires information from two different points of view (HQs and subsidiaries' CEOs). The aim of the second part is to evaluate the subsidiaries' innovative performance and external knowledge sourcing (search breadth and depth). Therefore, sending the questionnaires to the subsidiaries' CEOs was considered sufficient to obtain the necessary information.

The data collection process was conducted as follows: First, we compiled a list of the 500 largest multinational firms as published by *Fortune* magazine. From this list, we identified 152 European MNCs that were listed in the Amadeus database. Second, we sent the questionnaire to the managing directors of international divisions/business areas in the HQs and asked them to answer the first part and to identify the subsidiaries within their organizations that were suitable considering our research objective and to send the questionnaire to the subsidiaries' CEOs. These subsidiaries need to: a) be active in R&D activities; b) have more than 500 employees; c) be fully owned; d) have existed for at least 15 years. This allows us to select subsidiaries that are more proactive (Ferraris, 2014) and are more likely to engage in OI and be internally embedded. The time lag between the responses of the HQ and each subsidiary was less than 1 month in each case. The response rate was 19%, and the final sample included 91 subsidiaries representing 13 European MNCs. Using a standardized questionnaire, we collected data for the period 2013 to 2014.

The average number of subsidiary employees is 231 (minimum: 159; maximum: 336) and they are located in several European countries (Belgium, Finland, France, Germany, Italy, Poland, Portugal, Spain, Switzerland and Russia). The industries in which the subsidiaries operate are textile, chemical, pharmaceutical, food and beverage, transportation, banking, and wholesale trade and they reflect the general business of the MNCs.

We took two precautions in order to limit errors due to inconsistency and common-method bias related to the use of self-reported data. First, the questionnaire was designed in such a way that the items of each variable were disseminated throughout the questionnaire to reduce the likelihood of receiving socially desirable answers, mixing items of the different constructs so that they were not bundled together (Chang et al., 2010). Second, we conducted a Harman's One-factor test (Harman, 1967), which revealed four factors with an eigenvalue greater than 1, which represented 23, 14, 11 and 10% of the variance. Therefore, we are confident that the common method variance is not a significant problem in our sample, assuming that our study is not affected by common method bias.

### 4.2. Variables

We relied on the study by Laursen and Salter (2006) to address two of our variables. First, we use *search breadth* and *search depth* in order to address the external knowledge sourcing of subsidiaries using 16 different sources of knowledge (see Table 1). The variable *search breadth* simply counts the number of sources used by the subsidiary. Regarding the construction of the variable *search depth*, each of the 16 sources were coded with 1 when the firm in question reported that it had used the source to a high degree and 0 in the case of no, low, or medium use of the given source. In this case, the variable was constructed by adding the individual sources.

Second, we use three measures for the subsidiary's innovative performance. The first is INN\_WORLD, which reflects the proportion of the subsidiaries' turnover that is derived from products that are new to the global market. The second (INN\_MNC) reflects the proportion of the firm's turnover derived from products that are new to the MNC (but are not new to the global market), while the third (INN\_SUB) reflects the proportion of the subsidiary's turnover that is derived from products that are significantly improved compared to previous products developed by the focal subsidiary.

The variable *internal embeddedness* - our moderator variable - captures the nature of the relationships within internal MNC units (HQs and other subsidiaries). The variable comprises four indicators, the aim of which is to evaluate the quality of the relationships in the internal network (Forsgren et al., 2005). We used a five-point Likert scale (where 1 was very low and 5 was very high) to collect data both from the MNCs' and subsidiaries' managers. The managers from the MNCs were asked about their relationship with the

**Table 1**  
External knowledge sources.  
Source: adapted from Laursen and Salter (2006).

Type	Knowledge sources
Market	Suppliers of equipment, materials, components, or software
Market	Clients or customers
Market	Competitors
Market	Consultants
Market	Commercial laboratories/R&D enterprises
Institutional	Universities or other higher education institutes
Institutional	Government research organizations
Institutional	Other public sector, e.g., business links, government offices
Institutional	Private research institutes
Other	Professional conferences, meetings
Other	Trade associations
Other	Technical/trade press, computer databases
Other	Fairs, exhibitions
Specialized	Technical standards
Specialized	Health and safety standards and regulations
Specialized	Environmental standards and regulations

subsidiary in question, while the managers from the subsidiaries were asked about their relationship with their counterparts in the MNC internal network. More specifically, managers answered questions about: (i) the extent of specific adaptations in technological projects; (ii) the duration of the relationships; (iii) the degree of interdependence between the parties involved and; (iv) the degree of trust among counterparts (Hallin et al., 2011). The variable *internal embeddedness* is based the average value (Cronbach's alpha is 0.78). To check for response bias across values in our study, we ran interrater reliability tests to calculate intraclass correlation coefficients using the software IBM SPSS. For all the items, values exceeded 0.8 (for average measures), which can be considered very satisfactory (Hallgren, 2012).

Furthermore, we included a control for subsidiary age as the age of a subsidiary may affect the likelihood of it having developed high quality relationships with other MNC units because it is more likely that older subsidiaries will have established solid ties (Forsgren et al., 2005) and developed OI activities. Thus, we used the natural logarithm of the number of years the developing subsidiary had existed to construct the control variable “age”. Moreover, it is also important to check the size of the subsidiary because it may affect the availability of resources needed to scan, absorb and implement new knowledge from within and across organizational boundaries. Thus, we constructed the variable “subsidiary relative size”, calculating the number of subsidiary employees as a proportion of the total number of MNC employees (Yamin and Andersson, 2011; Ciabuschi et al., 2011). Then we included R&D employees and R&D budget as a proportion of total expenditure as indicators of “R&D intensity” using their logarithmic value (Alegre et al., 2011). We added this control because investing in internal R&D allows subsidiaries to better access external knowledge. In fact, through time, a subsidiary's employees accumulate more knowledge by increasing their existing knowledge base (Cohen and Levinthal, 1990).

Furthermore, two dummy variables were included to check whether the industry (1 = retail and service sector, 0 = manufacturing sector) and the role of the subsidiary (1 = competence creating, 0 = competence exploiting) has an effect on the aforementioned relationships. In particular, subsidiary role is critical as it may affect the development of interdependencies between external and internal networks (Gammelgaard et al., 2012). We thus chose to compare the subsidiaries with different mandates (Cantwell and Mudambi, 2005; Achcaoucaou et al., 2014; Bresciani and Ferraris, 2016), thus, we asked the subsidiaries' CEOs whether the scope of their mandate was limited to sales, service, assembly or manufacturing (competence-exploiting) or whether it also included innovation (competence-creating). Descriptive statistics and correlations are presented in Table 2.

**Table 2**  
Descriptive statistics and correlations.

	Variables	Mean	SD	1	2	3	4	5	6	7	8	9
1	Innovation performance	0.23	0.15	1								
2	External source breadth	8.23	2.45	0.24*	1							
3	External source depth	3.77	2.08	0.29	−0.09	1						
4	Internal embeddedness	2.88	1.21	0.21*	0.08	0.06	1					
5	SRS	0.14	0.11	0.07	−0.05	0.12	0.19*	1				
6	Age	2.28	1.43	0.11	0.03	0.07	0.17*	0.03	1			
7	R&D intensity	0.12	0.08	0.05	−0.04	0.12	0.11	−0.05	0.09	1		
8	Industry	0.58	0.34	0.18	0.11	0.14	−0.03	0.02	0.05	0.08	1	
9	Role	0.65	0.42	0.12	0.06	0.08	0.03	0.02	0.01	0.09	0.07	1

In this table, for the sake of brevity, innovation performance is only represented by the variable INN\_SUB, no substantially different values emerged with the other 2 measures we adopted in this study.

\* Significant at  $P < .05$ .

**Table 3**  
Results of the regression analysis.

	INN_WORLD		INN_MNC		INN_SUB	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Breadth	0.09 (2.01)*	0.06 (2.18)*	0.11 (2.24)*	0.10 (1.22)	0.04 (1.17)	0.06 (0.55)
Depth	0.02 (2.21)*	0.02 (2.02)*	0.15 (2.28)*	0.27 (2.15)*	0.14 (3.31)**	0.16 (3.65)**
Breadth <sup>2</sup>	−0.36 (3.55)**	−0.23 (3.12)**	−0.11 (1.99)*	−0.09 (1.69)*	−0.22 (2.27)*	−0.20 (2.12)*
Depth <sup>2</sup>	−0.19 (2.21)*	−0.18 (2.10)*	−0.10 (2.39)*	−0.09 (1.69)*	−0.44 (3.18)**	−0.38 (3.11)**
Breadth x internal		0.15 (2.14)*		0.14 (2.09)*		0.09 (1.61)*
Depth x internal		0.09 (1.89)*		0.31 (2.18)*		0.27 (2.92)**
Breadth <sup>2</sup> x internal		−0.46 (3.22)**		−0.17 (3.18)**		−0.22 (3.69)**
Depth <sup>2</sup> x internal		−0.35 (2.23)*		−0.19 (2.27)*		−0.54 (3.77)**
SRS	0.08 (1.21)	0.07 (1.12)	0.01 (0.88)	0.09 (0.51)	0.11 (1.06)	0.12 (0.88)
Age	0.06 (2.11)*	0.05 (2.09)*	0.09 (2.01)*	0.08 (2.22)*	0.04 (1.88)*	0.06 (1.98)*
R&D intensity	0.22 (2.19)*	0.21 (2.17)*	0.05 (2.23)*	0.09 (2.08)*	0.16 (2.77)*	0.19 (2.78)*
industry (dummy)	0.08 (0.91)	0.06 (0.85)	0.01 (0.45)	0.01 (0.54)	0.01 (0.44)	0.02 (0.49)
role (dummy)	−0.04 (−0.41)	−0.16 (−0.51)	−0.08 (−0.32)	−0.11 (−0.21)	−0.05 (−0.21)	0.36 (−0.53)
R <sup>2</sup>	0.33	0.55	0.31	0.61	0.31	0.49
Adjusted R <sup>2</sup>	0.23	0.46	0.18	0.53	0.28	0.45
F-value	2.41*	5.21***	2.42*	7.07**	2.45*	5.04***

\* P < .05.

\*\* P < .01.

\*\*\* P < .001.

## 5. Results

We constructed a number of equations to examine the effect of external knowledge sourcing on subsidiaries' innovation performance (Model 1,3,5) and test whether internal embeddedness has a moderator effect (Model 2,4,6). We used OLS regression models, the results of which are presented in Table 3. Based on our data, we test the effect of external knowledge sourcing on different kind of subsidiaries' innovation performance in order to find evidence for a curvilinear relationship (inverted U-shaped).

The results show an inverted U-shaped relationship between external knowledge sourcing and innovation performance at the MNC subsidiary level, thereby supporting H1. However, we found some differences with regard to the various innovation measures: innovations that are completely new (e.g. radical) benefit more from OI breadth activities, while innovations that are only new to the subsidiary (e.g. incremental innovation for the subsidiary itself) benefit more from OI depth activities. Interestingly, and somewhat surprisingly, these results are in contrast to those of Laursen and Salter (2006), who found that search breadth is positively associated with incremental innovation, while search depth is positively associated with radical innovation. Similarly, our results are also in contrast to those of Oerlemans et al. (2013), who suggest that partner diversity is more closely associated with incremental innovation rather than radical innovation. However, our results confirm some key assertions within the literature on MNC subsidiary's embeddedness and networks that assume that subsidiaries with weak ties (or a lower level of external embeddedness) have a greater propensity to discover new innovations (Figueiredo, 2011), while subsidiaries that are more dependent on strong ties in terms of external knowledge sourcing are less likely to be innovative (Ruef, 2002). In our view, the peculiarities of subsidiaries (being embedded in both internal and external networks) and the heterogeneity of knowledge provided by different external sources mean that subsidiaries have a larger knowledge base, which facilitates innovation. In contrast, search depth gives subsidiaries the opportunity to make incremental changes to existing products and services through the establishment of strong ties with their counterparts.

Even more interestingly, we found that internal embeddedness has a positive moderating effect on the relationship between external knowledge sourcing and a subsidiary's innovative performance, which also supports H2. In fact, the interaction term with both breadth and depth (in Table 3 "internal" refers to internal embeddedness) is positive and significant for each type of performance we examined in this study. Moreover, when we enter the interaction with the quadratic term, the results indicate that internal embeddedness has a positive moderating effect also in the context of an inverted U-shape relationship (e.g. Bianchi et al., 2016).

Moreover, the following two control variables significantly affected subsidiary innovation performance: the age of the subsidiary and the intensity of R&D. Regarding the age of the subsidiary; the effect on innovation performance is likely due to the fact that an older subsidiary is more likely to have developed embedded relationships and more deep and broad external knowledge sources that may affect its ability to improve innovation outcomes. With regards to R&D intensity; the effect on innovation performance is probably connected to the development of absorptive capacity that allows the subsidiaries to achieve better innovation performance by exploiting different sets of internal and external knowledge sources.

## 6. Concluding discussion

OI at the subsidiary level is an important but underdeveloped issue related to the innovation approach of many MNCs. To extend our knowledge on this relevant topic, this analysis aimed to investigate the extent to which a subsidiary's internal embeddedness



moderates the relationship between external knowledge sourcing (search breadth and depth) and innovation performance. We found an inverted U-shaped relationship between external sourcing and a subsidiary's innovation performance, highlighting a number of curvilinear effects of external search breadth and depth depending on the product innovation typology (products new to the world, new to the MNC and new to the subsidiary). Overall, we found evidence that embeddedness acts as an integrating mechanism that enhances a subsidiary's ability to exploit and capitalize on external sources of knowledge.

Our study confirms previous empirical analyses (e.g. Laursen and Salter, 2006; Berchicci, 2013) that indicate that there is an inverted U-shaped relationship between external knowledge sourcing and innovation performance. Besides this, our empirical analysis highlights a moderating effect related to the high involvement of subsidiaries in internal MNC networks. This means that subsidiaries that develop a higher level of internal embeddedness better scan, acquire and integrate external sources of knowledge and they are, consequently, more innovative.

The subsidiary's involvement within the MNC's innovation activities and knowledge flows can be interpreted as a relational mechanism that allows the firm to be more responsive to the changes in the external environment (Ciabuschi et al., 2011; Bianchi et al., 2016). This highlights even more the key role of knowledge-intensive relationships with internal counterparts in the subsidiary's innovation process.

### 6.1. Theoretical contributions

This research makes three important theoretical contributions. First, this is one of the first studies that attempts to link the literature on subsidiary embeddedness — a relevant topic in international business studies (Andersson et al., 2002; Gölgeci et al., 2019) with the OI literature (cf. Asakawa et al., 2014). It highlights the relevance of OI at a lower organizational level of analysis (MNC subsidiary) and the interrelated role of internal MNC networks, adding to studies of OI at the corporate level (Chesbrough and Bogers, 2014; West et al., 2014). Thus, this research increases our knowledge on OI by signaling that large firms may have superior chances of finding and accessing internal knowledge “on the shelf” (Chesbrough, 2003) through the action of subsidiaries' managers who act as boundary spanners, thereby developing a high level of internal embeddedness. The dual role of these managers is crucial because it implies that they need to act not only in the subsidiary's interest, but also in the interest of the whole MNC. In the knowledge management and sharing domain (e.g. Lotti Oliva, 2014), it means that they should effectively transfer knowledge from the HQs to the subsidiary and vice versa (Vora et al., 2007; Ferraris, 2014), carefully evaluating the potential of internal and external knowledge exploitation and utilization at different organizational levels. This is a relevant issue in MNC management, and it offers some concrete contributions to the OI literature. This study also offers an empirical analysis of OI at a lower organizational level (i.e. subsidiary) and its impact on a firm's innovation performance, thus offering an important contribution in this field (Laursen and Salter, 2006; Berchicci, 2013; West and Bogers, 2014).

Second, our results suggest that the incremental cost of opening up innovation boundaries is lower for subsidiaries that are better embedded in the MNC internal network. This is because they may benefit from the transfer of much more resources, while they also receive more support from HQs and other subsidiaries (Ciabuschi et al., 2011). Moreover, embedded subsidiaries achieve better innovation performance because they gain more power and visibility within the MNC network (Bouquet and Birkinshaw, 2008), increasing the likelihood to detect, unveil, draw and exploit external sources compared to sister subsidiaries. This is because they are more actively involved in the MNC's innovation activities, achieving centrality in the MNC network that implies a crucial position in internal and external MNC knowledge flows.

Third, this research argues that there is a need to view the phenomenon of OI from an alternative perspective (contingency view), in particular at the subsidiary level. MNC subsidiaries represent a valuable context to empirically test this phenomenon, as confirmed by emerging IB studies (e.g. De Beule and Van Beveren, 2019), which are starting to investigate the sourcing of knowledge and OI peculiarities of foreign subsidiaries. In this guise, the expertise with which a subsidiary accesses and absorbs external knowledge is influenced by several internal organizational and relational mechanisms. As such, the attention on internal embeddedness contributes to the OI stream of literature, where little research has been focused on organizational and relational capabilities and aspects in the context of OI and innovation performances (Ahn et al., 2016). This could also extend previous knowledge on absorptive capacity (Bogers et al., 2017; Cohen and Levinthal, 1990). In the MNC literature, at the subsidiary level, this key capability has been typically empirically calculated with variables such as the subsidiary's R&D expenditure or the number of patents (Rothaermel and Alexandre, 2009) or R&D offshoring (e.g. Nieto and Rodríguez, 2011). However, this should be extended given the fact that previous findings suggest that the firm's broader stock of knowledge may help it to absorb and exploit external knowledge (Bogers and Lhuillery, 2011; Lane et al., 2006). In line with Bianchi et al. (2016), our analysis highlights that only focusing on existing resources is not sufficient, especially at the MNC subsidiary level, because innovation outcomes are heavily dependent on the development of strong internal ties and relationships that influence the capacity needed to convert external knowledge into improved innovation performance. More generally, our findings provide important insights into the role intra-organizational attributes play in external knowledge sourcing in order to improve innovation efforts and outcomes.

### 6.2. Managerial implications

This paper highlights the positive impact of OI at the subsidiary level of analysis, which has important relevance for MNC and subsidiaries' managers. This means that innovation-oriented subsidiaries can absorb knowledge from the external host context in order to improve their innovation performance. However, this is not such an easy task at the subsidiary level with limited managerial and financial resources. We suggest that subsidiary managers carefully “balance” their strategic choices in term of openness (external

vs. internal) where internal embeddedness is supportive of external sourcing. Based on our findings, we also advise managers not to search for external knowledge past a certain threshold due to managerial constraints and the higher incremental costs that occur. Our paper shows that an optimal level of external sourcing exists with regard to both breadth and depth. After this point, accessing external knowledge has detrimental effects on innovation performance.

Our results also show how subsidiaries that develop high-quality relationships within their internal network may benefit from these in several ways: a) they are able to search wider, augmenting the number of sources as a counter-force to the negative returns that otherwise set in; b) they are able to search deeper, augmenting the number of sources they may exploit; and c) they achieve better innovation performance by exploiting the MNC's internal knowledge and resources.

Depending on the subsidiary's innovation strategy, this suggests that resources need to be carefully "balanced" between external breadth, which has been found to have a greater impact on radical innovations, and external depth, which has been found to have a greater impact on incremental innovations.

Moreover, the implications this has for subsidiaries' managers include the need to understand that the effort and resources invested in developing internal relationships (among HQs and sister subsidiaries) lead to superior innovation performance. This study also gives managers some indications about how they can exploit the advantages of OI to the benefit of performance, i.e. through the development of internal embeddedness. This is not only valid for knowledge transfer, which has been suggested in the previous literature (e.g. [Ciabuschi et al., 2011](#)), but also for knowledge creation and exploitation through external knowledge sourcing. The management of knowledge outside the MNC network combined with knowledge within the subsidiary and outside the subsidiary, but within the MNC network, represents an important effort for MNC managers. Because a subsidiary's financial and managerial resources are limited, another implication of this study is that "entrepreneurial" subsidiaries can utilize the internal network to tap into more external and internal sources of knowledge. In line with our results, the development of internal embeddedness could be one way to increase the effectiveness of external sourcing of knowledge, and MNC managers should evaluate which subsidiaries are receiving more support from the HQs and are more involved in overall OI activities.

### 6.3. Limitations and future studies

As with all studies, this paper has some limitations. First, our study does not specifically describe the impact of each individual external knowledge source on innovation performance. In future research, it will be useful to use new items for validation and to identify the effect of different external sources in order to highlight differences and similarities on innovation performance. Second, as embeddedness develops through time there may be a time lag before the effect of embeddedness on innovation performance becomes visible. Longitudinal data should be collected in order to test the long-term effects of internal embeddedness. In fact, internal embeddedness may have a different effect on the searching and knowledge-integrating capabilities of subsidiaries in the long run because firms need time to strengthen these capabilities. Future studies should focus on identifying the potential obstacles to developing embeddedness and how embeddedness is connected to OI at the subsidiary level. Third, it is important to emphasize that not only organizational and relational factors related to knowledge-based activities influence a subsidiary's performance. In fact, host context factors such as location-specific advantages and national culture may have an impact on subsidiaries' innovation. Future studies could extend our analysis by taking into account external subsidiaries' host country characteristics or analyzing differences between developed and emerging market contexts in which subsidiaries are embedded ([Choi et al., 2019](#); [Kumar et al., 2019](#)).

More generally, future studies in the field of OI in MNCs need to carefully address the role of subsidiaries in general and of subsidiaries' managers in particular. In fact, a key function of MNCs is the coordination and integration of knowledge flows within dispersed organizational units, which implies that subsidiaries' managers often face a trade-off between local responsiveness and global integration regarding innovation activities. In the context of innovation, these managers should be able to share knowledge while acting as knowledge brokers for different groups or units comprised of several hierarchical or function levels. Future studies should investigate how boundary-spanning managers in MNCs strategically manage knowledge (internal and external to the organization) and OI activities in order to identify more detailed managerial actions and key knowledge management practices ([Del Giudice et al., 2014](#)). Furthermore, assessing how to align OI subsidiary strategy with MNC innovation activities while efficiently coordinating different transactions becomes of crucial importance in order to create value by managing interdependencies with external parties (e.g. [Zobel and Hagedoorn, 2018](#)).

Overall, our study is part of a larger research agenda to uncover how intra-organizational attributes are related to the "distributed innovation process based on purposively managed knowledge flows across organizational boundaries" ([Chesbrough and Bogers, 2014](#), p. 17). More specifically, as recently argued by some scholars (e.g. [West et al., 2014](#)), there is a strong need to further explore such internal aspects in the context of OI because a growing number of subsidiaries are increasing their innovation activities ([Lim et al., 2017](#)). This could for example be connected to issues such as functional area ([Bogers and Lhuillery, 2011](#)), projects ([Du et al., 2014](#)), or individuals ([Dahlander et al., 2016](#); [Salter et al., 2015](#)) — all in line with a search for the boundary conditions and contingencies for OI activities in different types of organizations ([Bogers et al., 2017](#)). Within this broader research agenda, our study takes a step toward clarifying some of the relationships between intra-organizational attributes with a specific emphasis on the international business context.

### Acknowledgement

Marcel Bogers would like to acknowledge the support of the Novo Nordisk Foundation (grant number NNF16OC0021630).

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