Parent company's benefits from reverse knowledge transfer: The role of the liability of newness in MNEs

Drawing on organizational ecology theory, we develop a liability of newness argument with regard to reverse knowledge transfer (RKT) within MNEs. Prior research on RKT has relegated subsidiary age to a control variable capturing differently indistinct subsidiary-specific unobserved heterogeneity. Our theoretical argument suggests that subsidiary age captures accumulated knowledge stocks and capabilities. Accordingly, knowledge transferred from older subsidiaries is more beneficial to parent companies. Moreover, subsidiary age has a positive moderating effect on the use of transfer channels based on face-to-face communication mechanisms, as the development of social interactions displays decreasing returns to the fixed factor time.

Key words: reverse knowledge transfer, liability of newness, person-based communication mechanisms, subsidiary age, multinational enterprises.

1. Introduction

Great attention has been increasingly paid to knowledge transfer within multinational enterprises (MNEs). A major reason for this growing interest lies in the recognition that knowledge ranks first in the hierarchy of strategically relevant resources (Grant, 1996). With reference to the MNE network, the significance of knowledge as a strategic resource gains distinctive relevance as multinationals leverage knowledge-based resources and capabilities across borders (Bartlett & Ghoshal, 1989; Gupta & Govindarajan, 1991; 2000; Kogut & Zander, 1992), and engage in different types of knowledge transfer. In particular, the traditional parent-subsidiary knowledge transfer (Vernon, 1966) is increasingly combined with the less conventional lateral knowledge transfer among sister units (Ghoshal, et al., 1994; Mudambi & Navarra, 2004; Noorderhaven & Harzing, 2009) and reverse knowledge transfer (RKT) from subsidiaries to parent companies (Ambos, et al., 2006; Frost & Zhou, 2005; Håkanson & Nobel, 2000; Yang, et al., 2008).

In the last decade, international business (IB) and management research has investigated to what extent parent companies may benefit from using and integrating knowledge originating in a foreign subsidiary (Eden, 2009). This literature on RKT has documented beneficial effects on the innovative performance of the receiving unit (Iwasa & Odagiri, 2004; Subramaniam & Venkatraman, 2001; Yamin & Otto, 2004) and, in general, on the competitive advantage of the whole multinational (Ambos, et al., 2006; Haas & Hansen, 2005). Arguably, numerous determinants and obstacles have been considered in evaluating the impact of RKT on parent's benefits. Interestingly, subsidiary age, when considered, has been relegated to the status of control variable capturing differently indistinct subsidiary-specific unobserved heterogeneity. However, with the escalating interest in subsidiary experience, knowledge and capabilities (Birkinshaw & Hood, 1998; Birkinshaw, et al., 1998), subsidiary age should merit closer

attention as a specific proxy for the level of these factors. Indeed, research in the innovation and organizational ecology tradition (Hannan & Freeman, 1984; Stinchcombe, 1965) indicates that firm's age plays a crucial role in understanding firm's strategic behavior as it is a sign of accumulated knowledge stocks and capabilities. In particular, young firms suffer from the phenomenon known as *liability of newness*. In other words, young firms have a disadvantage compared to older firms that have accumulated over time absorptive capacity to recognize and assimilate new ideas, and developed capabilities to innovate (Cohen & Levinthal, 1990; March, 1991; Nelson & Winter, 1982).

In this study, we extend the concept of the liability of newness to an intra-firm inter-units context and argue its relevance when evaluating parent's benefits from RKT. It is unlikely that knowledge from every subsidiary will be equally beneficial to the parent. The liability of newness argument will suggest that foreign subsidiaries of different ages show heterogeneous stocks of knowledge and capabilities accumulated over time. Accordingly, drawing on the theoretical links between the liability of newness argument and the resource-based view, we first address the question: Does subsidiary age positively affect the impact of RKT on parent company's activities?

An important strategic component in the intra-MNE knowledge transfer processes is the recognition of person-based communication mechanisms as a powerful means for facilitating knowledge sharing in organizations (Frost & Zhou, 2005; Galbraith, 1990; Gupta & Govindarajan, 2000; Noorderhaven & Harzing, 2009; Rothwell, 1978). However, as firms become older, their internal communication systems may change. On the one hand, it may become more rigid. On the other, older organizational units should be more able to develop stable and efficient relationships. Accordingly, the role of subsidiary age as a moderator of the

well established relationship between face-to-face communication and RKT effectiveness remains unclear. Thus, drawing on the theoretical links between the liability of newness argument on the one hand, and the literature on intra-firm trust and shared vision on the other, the second question we address is: Is the impact of person-based communication systems on parent's benefits from RKT moderated by subsidiary age?

Our study offers theoretical contributions to IB theory and management literature on RKT in MNEs. First of all, we advance IB theory with regard to RKT by illustrating the relevance of organizational ecology considerations for the study of intra-MNE knowledge transfer. To this end, it is worth clarifying that we are interested in borrowing the organizational ecology argument without claiming to carry out an organizational ecology analysis. Second, the study offers a contribution to the management literature on knowledge transfer by explicitly assessing the beneficial effect of this knowledge for the recipient. In particular, we focus on a phase subsequent to the occurrence of the transfer of knowledge from subsidiaries to their parents. We aim at evaluating how the effects of this transfer on the receiving unit's activities depend on subsidiary age and its interdependence with the subsidiary-parent communication system. Finally, the results of this study have practical implications for managers as they suggest that MNE managers designing effective strategies to enjoy beneficial effects of internal knowledge transfer need to be aware that knowledge stock (being a non-tradable asset) requires to be accumulated internally through a consistent time patterns of expenditures and flows.

The paper is divided into 6 sections. In the second section we briefly review the literature on RKT and discuss the need for theorizing on subsidiary age drawing on the organizational ecology. In the third section, we develop two hypotheses on the direct and moderating effect of subsidiary age with respect to RKT. In the fourth section, we explain the method adopted to

empirically test our hypotheses. In section five, we report and discuss our empirical findings. We conclude our study highlighting the contributions to theory and suggesting directions for practice and further research.

2. Background literature and conceptual framework

IB and management scholars have acknowledged that, although the parent company still serves as the most active creator and diffuser of knowledge, foreign subsidiaries may also engage in knowledge transfer with their parent companies and sister units (e.g. Gupta & Govindarajan, 2000). As a result, innovations can be developed at diverse worldwide units and subsidiaries' resources and capabilities can be transferred within the MNE and used as a seed for further enhancement of knowledge and capabilities (Bartlett & Ghoshal, 1989). With respect to RKT, recent studies have documented beneficial effects on the competitive advantage of the whole firm (Ambos, et al., 2006; Haas & Hansen, 2005) as subsidiaries contribute to the resource base of the parent's global operations. These studies have identified different determinants of RKT and its effectiveness, which are nowadays thoroughly conceptualized. In particular, RKT contribution to parent's competitive advantage has been traced back to subsidiary role (Ambos, et al., 2006; Iwasa & Odagiri, 2004; Yang, et al., 2008), subsidiary autonomy (Ghoshal, et al., 1994; Noorderhaven & Harzing, 2009; Schulz, 2001) and its international experience (Iwasa & Odagiri, 2004), development of intra-MNE trust relationships (Ambos & Ambos, 2009; Ambos, et al., 2006; Björkman, et al., 2004; Haas & Hansen, 2005) and different entry modes (Yang, et al., 2008) as well as technological, organizational and cultural distance (Ambos, et al., 2006; Håkanson & Nobel, 2001; Sunaoshi, et al., 2005). At the same time, research on intra-MNE knowledge flows has also documented difficulties in this process due to knowledge stickiness

within organizations (Szulanski, 1996) as knowledge, especially tacit knowledge, does not necessarily flow easily within the MNE. Some of these studies have also included subsidiary age in their empirical analyses as a control variable, in order to account for differently specified unobserved heterogeneity. In particular, Mibaeva, Pedersen, Björkman, Fey and Park (2003) consider age as a proxy for subsidiary autonomy and innovative capacity. Monteiro, Arvidsson and Birkinshaw (2008) account for age as a proxy for the efficacy/efficiency of intra-MNE communication, as older subsidiaries may have developed over time the mechanisms and relationships to share knowledge within the MNE. An argument also suggested by Birkinshaw, Nobel and Ridderstrale (2002). Yamin and Otto (2004) include subsidiary age in their analysis of the influences of inter- and intra-organizational knowledge flows on innovative performance. Similarly, Yang et al. (2008) control for subsidiary age when investigating knowledge transfers within MNEs along different directions. In both cases, the argument for accounting for subsidiary age relates to a broadly defined unobserved heterogeneity that age may capture when investigating innovation performance. Along these lines, other studies such as Ambos, Ambos and Schlegelmilch (2006) recognize the limitation of not taking into account subsidiary age in the analysis of parent company's benefits from RKT, suggesting that there are subsidiary-specific factors related to age that still need to be considered.

Drawing on the organizational ecology literature (Hannan & Freeman, 1984; Sørensen & Stuart, 2000; Stinchcombe, 1965), we argue that the age of the subsidiary is a relevant variable because older subsidiaries are likely, *ceteris paribus*, to accumulate knowledge and capabilities and hence to create value to the overall MNE. As a consequence, at any given point in time the subsidiary's stock of knowledge and capabilities is a function of subsidiary age and may influence the effectiveness of RKT. Specifically, the organizational ecology literature suggests

that firms improve over time and, with respect to innovation, two supporting arguments are put forward: the time dependency of the accumulation of knowledge and the development of capabilities to innovate. Cohen and Levinthal (1990) show that knowledge accumulation amplifies the ability of the organization to recognize and assimilate new ideas, and to convert this knowledge into further innovations. New ideas are more efficiently recognized and assimilated if organizations have established a solid knowledge base (March, 1991; Nelson & Winter, 1982). Innovation and accumulation of knowledge are indeed recognized as self-reinforcing mechanisms such that organizations with a large knowledge base are more likely to purse innovative opportunities that further contribute to knowledge accumulation (Cohen & Levinthal, 1990). Additionally, older firms have developed over time capabilities to innovate which lack to younger firms. Older firms have defined and consolidated routines, structures, incentives, programs, and the like that enable them to develop new technologies and bring them to market.

The liability of newness argument has been echoed in the resource-based view (Thornhill & Amit, 2003). In this perspective, the accumulation of valuable, unique and difficult to imitate resources lays down the foundations for firm's competitive advantage (Barney, 1991; Dierickx & Cool, 1989). Over time, resource accumulation allows to develop dynamic capabilities which enable firms to build up new related resources and exploit new opportunities from existing capabilities through a path-dependent learning process (Prahalad & Hamel, 1990). As a result, aging allows greater accumulation of resources and confers an ability to innovate through the development of combinative capabilities that "generate new applications from existing knowledge" (Kogut & Zander, 1992, p. 391).

Therefore, the liability of newness argument can be extended to the phenomena of RKT in MNEs and, in particular, it can enhance our understanding of parent companies' benefits from RKT. In fact, as the age of the subsidiary captures the level of accumulated knowledge stocks and capabilities, there should be a direct effect of subsidiary age on parent's benefits from RKT. To this end, we address the *liability of newness regarding RKT* in terms of the ability of older subsidiaries to transfer knowledge that is more likely to positively affect the parent company's activities.

3. The effects of subsidiary age on parent companies' benefits from RKT

3.1 The direct effect

The conceptualization of a MNE as "a group of geographically dispersed and goal disparate organizations that include its headquarters and the different national subsidiaries" (Ghoshal & Bartlett, 1990, p. 603) implies that different subsidiaries are characterized by different stocks of intangible resources as well as different accumulation rates of capabilities and expertise (Gupta & Govindarajan, 1991). Older subsidiaries have had more time to accumulate and develop distinctive resources and capabilities through the interaction and exchange with local counterparts and other parts of the MNE (Birkinshaw & Hood, 1998). It has been indeed recognized that over time subsidiaries can themselves acquire and develop distinctive valuable resources and, as they age, increasingly contribute to shape and define their organizational roles, although to different extents (Birkinshaw & Hood, 1998; Cantwell & Mudambi, 2005). The evolution of subsidiary role has been argued to occur over time as a result of different factors. In particular, subsidiaries achieve or do not achieve strategic roles depending upon subsidiary-, group- and location-specific factors (Birkinshaw & Hood, 1998; Cantwell & Mudambi, 2005).

Therefore, aging does not deterministically imply the achievement of a strategic role. Nonetheless, older subsidiaries have had more time to accumulate a knowledge stock (Birkinshaw, et al., 2002) which is the base for effective RKT. This is in line with the time compression diseconomies argument suggesting that knowledge stocks cannot be adjusted instantaneously as it takes time to change them to a desired level (Dierickx & Cool, 1989). Accumulated experience does not only affect frequency and significance of knowledge production but it has also been recognized as a principal determinant of technology transfer (Kogut & Zander, 1993) as more experienced units are more capable to codify and teach their knowledge to recipients.

In addition, as they grow older, subsidiaries develop absorptive capacity relative to the local context (Lane & Lubatkin, 1998) that newly established less experienced MNE's units lack. Over time subsidiaries can increase their capabilities by accessing and utilizing local knowledge sources (Andersson, et al., 2007; Bouquet & Birkinshaw, 2008). Supplier and customer relationships and collaborations with local actors must be cultivated and a history of honest dealings reinforces trust among partners (Dierickx & Cool, 1989). Older subsidiaries have had indeed the time to establish long term embedded relations with local actors, which ultimately influence subsidiary distinctive knowledge and capabilities that can be transferred back to the parent. Based on the previous considerations we put forward the following hypothesis:

H1. Subsidiary age will be positively related to parent's benefits from reverse knowledge transfers.

3.2 The moderating effect on person-based communication

The social interaction between employees/managers from different units of the MNE is a recognized factor stimulating intra-MNE knowledge sharing (Noorderhaven & Harzing, 2009).

In particular, face-to-face interactions based upon the use of person-based communication channels are particularly conductive to the transfer of tacit, non-codified knowledge (Bartlett & Ghoshal, 1989; Haas & Hansen, 2005; Tsai, 2001). Extant research largely converges on the positive effects of moving employees as a powerful mechanism for facilitating knowledge transfer in organizations (Frost & Zhou, 2005; Galbraith, 1990; Gupta & Govindarajan, 2000; Rothwell, 1978). Almeida and Kogut (1999) found that mobility of engineers positively contributed to the transfer of knowledge about innovations in the semiconductor industry. The use of person-based communication mechanisms confers information-processing routines that facilitate knowledge transfer from subsidiary to parent (Ambos & Ambos, 2009; Björkman, et al., 2004), and ultimately affects parent's benefits from RKT (Ambos, et al., 2006; Haas & Hansen, 2005).

However, as firms grow older their internal communication systems may change. In particular, the ultimate effect of subsidiary age on the characteristic of the parent-subsidiary communication system is not unambiguous. Specifically, both a positive and a negative effect can be identified. On the one hand, the liability of newness argument suggests that older firms organize more efficiently than younger firms because they have more cumulative (productive) experience, more experienced workforce, stronger external relationships. In particular, Stinchcombe's (1965) argument for the liability of newness of organizations suggests that the survival properties of organizations should be influenced by the duration of personal and inter-organizational relationships. The author (*Ibid*: 148-149) explicitly recognizes that:

"One of the main resources of old organizations is a set of stable ties to those who use organizational services. Old customers know how to use the services of the organization, have built their own social systems to use the old products or to influence the old type of government, are familiar with the channels of ordering, with performance qualities of the product, with how the price compares, and know the people they have to deal with, whom to call up to get action, for instance."

Accordingly, over time we should expect person-based communication mechanisms continuing to enhance RKT. On the other hand, however, a number of scholars suggest a *liability of senescence* (Barnett, 1990; Barron, et al., 1994; Ranger-Moore, 1997) since over time firms' patterns of internal communication become increasingly rigid. In this perspective, aging goes hand in hand with a decrease in efficiency with which organizations carry out their routines and, as a result, with a decline in organizational capabilities. Along these lines, Cohen and Levintal (1989; 1990) suggest that a firm's ability to use its existing knowledge base depends critically on the patterns of communication and distribution of knowledge within the firm. Accordingly, the development of obstacles to effective action (e.g. taken-for-granted understandings, political coalitions, etc.) by older firms ultimately explains the positive relationships between aging and organization mortality (Barron, et al., 1994). These arguments bring a consequent decrease in the effect of person-based communication mechanisms on RKT.

The existence of these countervailing forces strengthens the belief that subsidiary age should merit closer attention as a potential moderator of well established relationships in the intra-MNE knowledge transfer literature. Thus, in what follows we link the liability of newness argument to the literature on social capital (Coleman, 1988) and intra-firm trust and shared vision (Tsai & Ghoshal, 1998; Yli-Renko, et al., 2001) to shed more light on how parent companies may effectively enhance the use of person-based communication systems in reverse knowledge transfers through subsidiary age. We argue that the direct effect of the use of person-based communication mechanisms on parent's benefits from RKT is positively moderated by subsidiary age.

The social capital literature argues that social capital favors knowledge sharing and transfer as it influences the willingness of individuals to dedicate time and effort to cooperate with others

(Coleman, 1988; Grannovetter, 1985) and enables shared language and meanings that facilitate access to information and resources. In particular, trust provides the confidence that the knowledge shared will not be appropriated or misused (Krackhardt, 1990; McEvily, et al., 2003). Intra-firm communication based on interpersonal/face-to-face relationships is often associated with high levels of social controls (e.g. behavioral clues, non-verbal information and status cues) and, therefore, with higher levels of interpersonal trust (Wilson, et al., 2006). Person-based communication mechanisms have been related to their ability to ease trusting relationships and shared vision that lower internal information-processing costs (Grannovetter, 1985; Gulati, 1995). Several studies have demonstrated that in face-to-face communication, inhibiting factors such as uncertain, anxious and critical feelings or surface-level diversity become less potent over time (e.g. Harrison, et al., 2002) and thus resulting in an increase in the development of trust.

However, as suggested by the argument on time compression diseconomies, trust and similar resources display decreasing returns to the fixed factor time, being accumulated through, for instance, on the job learning and training (Dierickx & Cool, 1989). That is, they develop over time when communication between sources and targets becomes more mature and task-oriented (Tuckman, 1965; Wilson, et al., 2006). The development of trust and social capital is a time demanding processes and for young firms time is a scarce resource. High failure rates among young firms have been indeed attributed to the lack of stable relationships with external partners (Baron & Markman, 2003; Singh, et al., 1986). Accordingly, in parent-subsidiary communication based on face-to-face interactions, all other things being equal, trust levels should be higher between parents and older subsidiaries compared to younger subsidiaries. Thus, we expect the transfer of knowledge through person-based communication mechanisms to have a greater effect on parent's benefits in the case of older subsidiaries and we state that:

H2. Subsidiary age positively moderates the relationship between parent's benefits from reverse knowledge transfers and the use of person-based communication mechanisms as transfer channels.

4. Methods

4.1 *Sample*

We test our hypotheses on a dataset of 146 knowledge transfers occurred from 84 foreign subsidiaries to their respective parent companies. The involved 84 foreign subsidiaries belong to 41 Italian MNEs.

The dataset is obtained from a broader database that was the result of a survey on "Research on Innovation and Technology in Multinational Organizations" conducted in 2004-2005. 358 Italian MNEs served as sample frame. These firms represented the population (as at the beginning of 2004) of all Italian MNEs with the following characteristics: (i) 50 or more employees; (ii) operating in manufacturing industries; (iii) with at least one majority-owned subsidiary located in developed countries and involved in "primary upstream activities" such as R&D and manufacturing.[1] The data collection was conducted from December 2004 to July 2005 through face-to-face structured interviews which lasted 120-180 minutes each and involved six researchers. Parent companies' top managers were contacted by telephone and a personalized letter with the description of the project, the assurances regarding the confidentiality of collected data and a formal request for a face-to-face interview was sent to them. By the end of July 2005,

[1] The sample frame was generated from the Reprint dataset, which contains census data on the foreign activities of the Italian firms as at the beginning of 2004. The dataset Reprint is developed and yearly updated at Politecnico di Milano (Mariotti & Mutinelli, 2005). It provides a census of the Italian firms with foreign activities from the beginning of 1986 to the beginning of 2004, and contains the following information: (i) corporate name and address of the head office, for both the Italian parent companies and their foreign affiliates; (ii) the code of the industrial activity, and other relevant economic variables (the dimensional class in terms of employees and turnover) for the Italian parent companies; (iii) the year and the type of participation in each foreign affiliate participated by Italian firms (e.g. *greenfield* vs. acquisition, wholly/control/minority ownership).

the time the data collection was finished, 84 MNEs were studied (response rate of about 24 percent). During the interviews, the respondents went through a pre-tested questionnaire and notes were taken by two interviewers to ensure accurate recording of the responses. For each of the 84 MNEs, data about all their majority-owned foreign subsidiaries—wherever they were located—involved in at least some kind of manufacturing or R&D activities were collected, for a total number of about 300 usable MNE parent company-foreign subsidiary dyads. Of the 84 sampled MNEs, 80 percent reported fewer than five subsidiaries. Longer interviews with the parent company managers for MNEs that reported five or more subsidiaries were arranged.

Non-response bias was tested by comparing the 84 MNE respondents with the non-respondents within the overall sample frame of 358 MNEs in terms of size (class of number of employees) and sector. Regarding size there were no statistically significant underrepresented dimensional classes. However, the two groups differed in terms of main sector in which the MNE operates. The tests indicated that low-tech sectors were underrepresented in the sample while there was an overrepresentation of MNEs in science based and specialized supplier sectors.[2] Accordingly, the generalization of results concerning low-tech industries must be taken with the necessary caution.

The information gathered during the described data collection regards the MNE structure, intra-MNE communication mechanisms, knowledge transfers from foreign subsidiaries to their parent companies, subsidiaries characteristics, and parent companies' benefits from the use of subsidiary knowledge.

[2] According to Pavitt (1984; 1990), five technological trajectories can be identified: supplier-dominated, specialized-supplier, science-based, scale-intensive and information-intensive. These different trajectories reflect differences in the main sources of technology. In the case of supplier-dominated sectors, like packaging industry, technical change comes almost exclusively from suppliers.

For the scope of this study, from the about 300 usable MNE parent company-foreign subsidiary dyads we have extracted a sub-sample of all dyads where at least one transfer of knowledge from the subsidiary to its parent company was reported. Specifically, the data show evidence of RKT in 94 out of 301 parent company-foreign subsidiary dyads which corresponds to an overall incidence of about 31%. However, since for 10 of the 94 parent company-foreign subsidiary dyads in which knowledge transfers occurred data on the parent company's perceived benefits from subsidiary knowledge were not available, our final dataset consists of transfers occurred from 84 foreign subsidiaries to their parent companies. In particular, we have a total of 146 knowledge transfers involving 84 foreign subsidiaries and 41 parent companies. Accordingly, we evaluate parent's benefits from RKT only "in areas where knowledge was transferred in the first place" (Ambos, et al., 2006, p. 301). The choice of this dataset is coherent with the aim of the paper, which is the understanding of how specific characteristics of the subsidiary and of its relationship with the parent company affect the parent's benefits from RKT.

On average, the interviewed parent company managers reported 1.74 knowledge transfers per subsidiary. Therefore, transfers were assessed from the receiving unit's perspective, i.e. the parent company. In line with Lord and Ranft (2000, p. 582), "this was done primarily because to try to measure knowledge transfer from the sender's perspective is inherently problematic – e.g., knowledge that is 'sent' is not always 'received' (Szulanski, 1996)."

4.2 Variables

Dependent variable

Parent's benefits from RKT are evaluated as the parent company managers' perception of the impact of the use of subsidiary knowledge on the parent's innovative capacity. Drawing on extant research (Ambos & Ambos, 2009; Ambos, et al., 2006), the adoption of this perceptual measure allows us to account for the fact that not every knowledge transfer translates into value

added and that it is not the mere replication of a sender's message by the recipient which is important, but the extent to which it can generates benefits for the recipient's operations. To operationalize this measure, firstly, subsidiary knowledge that has been used by the parent company has been distinguished between know-how regarding R&D, manufacturing and process, marketing/sales, logistic/distribution, purchasing, quality control, human resource management, and general management (Gupta & Govindarajan, 2000). Secondly, following a procedure similar to the one applied by Ambos et al. (2006), using the defined knowledge dimensions, the respondents were asked to evaluate how different aspects of the parent company's innovative capacity had benefited from the use of knowledge transferred from the foreign subsidiary. Specifically, the respondents rated—on a 7-point Likert scale where 1 = 'no impact at all'; 7 = 'a very high positive impact'—the extent to which subsidiary knowledge affected the parent company's innovative capacity as far as (i) new product development, (ii) new technology development and (iii) patent activity. The variable *Parent's benefits from RKT* is a single composite measure based on the loadings from a principal component factor analysis[3] of the three indicators of innovative capacity (Cronbach's alpha = 0.86).

Independent variables

- Liability of newness. Following the organizational ecology literature, we capture the liability of newness through firm age (e.g. Sørensen & Stuart, 2000). The variable *Subsidiary age* is operationalized as the difference between 2005 (year when the data collection was finished) and the year when the subsidiary became part of the Italian MNE, either as a result of a greenfield investment or of an acquisition. A similar variable has already been used in studies on RKT by Yamin and Otto (2004) and Yang et al. (2008).

[3] Factor loadings: new product development = 0.905; new technology development = 0.947; patent activity = 0.801; eigenvalue = 2.357; variance explained = 78.58%.

- Person-based communication mechanisms. Similarly to Björkman et al. (2004) and Ambos and Schlegelmilch (2004), to capture parent-subsidiary communication based on personal ties we focus on: (i) teamwork involving people from both the foreign subsidiary and the parent company; (ii) visits and meetings between managers and/or professionals within the parent-subsidiary dyad. Respondents were asked to assess the intensity of the use of the two person-based mechanisms on a 7-point Likert scale, from 'used rarely' to 'used very often'. The final measure of *Person-based communication* is a single composite measure based on the loadings from a principal component factor analysis[4] of the two items (Cronbach's alpha = 0.73).

Control variables

- Type of knowledge. Since the parent's benefits from RKT can stem from different knowledge domains which display different degree of stickiness and complexity (Foss & Pedersen, 2002; Szulanski, 1996), we control for the type of knowledge that has been transferred from the subsidiary to the parent company. Specifically, the dummy variable *R&D knowledge* takes value of one when R&D know-how has been transferred, it is zero otherwise. The dummy variable *Marketing/sales knowledge* instead takes value of one when marketing and sales know-how has been transferred, it is zero otherwise.

- Subsidiary role. It has been shown that subsidiaries with different roles behave differently in developing and transferring knowledge within their MNE (Birkinshaw, et al., 1998; Cantwell & Mudambi, 2005) and it has been documented that the parent company's perceived benefit from local knowledge will depend on the role of the foreign subsidiary (Ambos, et al., 2006; Iwasa & Odagiri, 2004; Yang, et al., 2008). Accordingly, it is crucial to control for the subsidiary role since it is a likely predictor of RKT effectiveness. Following Ghoshal (1986), we distinguish among 'implementer subsidiary', 'contributor subsidiary', and 'innovator subsidiary'. We also

[4] Factor loadings: teamwork = 0.887; visits and meetings = 0.887; eigenvalue = 1.575; variance explained = 78.72%.

follow Nobel and Birkinshaw (1998) and Ambos and Schlegelmilch (2007) and apply a rather simple heuristic based on the nature of the subsidiary activities. The respondents were asked to indicate whether the focal foreign subsidiary was devoted to 'capability-augmenting' *or* 'capability-exploiting' activities. The former group of activities are undertaken to create new products and/or new technologies whereas the latter group focuses on activities directed towards significant and/or marginal product/process improvements. Those subsidiaries that are *neither* capability-augmenting *nor* capability-exploiting are called *Implementers*; those that are capability-exploiting *but not* capability-augmenting are *Contributors*, while those that are *also* capability-augmenting are labeled *Innovators*.

- Size. The integration of subsidiary knowledge with the existing knowledge of the parent company can be affected by the number of individuals that can potentially be involved in such a process (Gupta & Govindarajan, 2000). Moreover, size and age are typically positively correlated given that firm size is often considered a proxy of the tangible and intangible resources owned by the firm. Recently, Sørensen and Stuart (2000) have recognized that the effects of aging on innovation are premised on holding size constant. Therefore, not controlling for size will yield biased estimates. Thus, we define *Relative size*, as the difference between the natural logarithm of the number of employees of the subsidiary and the natural logarithm of the parent company's number of employees as of 2004.

- Subsidiary autonomy. Since vertical knowledge flows have been found to correlate with subsidiary autonomy (Ghoshal, et al., 1994; Noorderhaven & Harzing, 2009; Schulz, 2001), we control for the degree of autonomy granted to each foreign subsidiary. Respondents were asked to indicate at which MNE level[5] each of the following three strategic decisions of the firm is

[5] Following the operationalization by Ghoshal et al. (1994), we used a five levels scale, where: (1) 'the parent company decides alone'; (2) 'the parent company decides but considers subsidiary inputs'; (3) 'both parent company

taken (Ghoshal, et al., 1994): (i) definition of R&D projects, planning, resources; (ii) introduction of new technologies; (iii) changes in products/services. The variable *Subsidiary autonomy* is a single composite measure based on the loadings from a principal component factor analysis[6] of the three strategic decisions (Cronbach's alpha = 0.79).

- Entry mode. Acquisitions and joint ventures have been recognized as a common way MNEs adopt to access new capabilities and knowledge (e.g. Gupta & Govindarajan, 2000; Yang, et al., 2008). In order to capture the effects of the entry mode on our dependent variable, we add to the model the dummy variable *Acquisition-jv* that equals one for foreign subsidiaries that were acquired or created through a majority-owned joint venture and it equals zero for greenfield subsidiaries.

- Absorptive capacity. The ability of a firm to learn from another one depends on the similarity of both firms' knowledge base and organizational structure (Lane & Lubatkin, 1998). Accordingly, we control for similarities between subsidiary and parent company concerning their technological capabilities and organizational culture and practices. Following Ambos et al. (2006), we asked the respondents to directly compare the subsidiary (i) technological capabilities and (ii) organizational culture and practices to those of the parent company (7-point Likert scale ranging from "very similar" to "extremely different"). Based on the respondent's perceived similarity, we define the variables *Technological distance* and *Organizational distance*.

- Cultural distance. Factors such as different language, culture and institutional framework generate a 'cultural distance' as perceived by the knowledge receiver that may hamper the knowledge transfer process (e.g. Håkanson & Nobel, 2001; Sunaoshi, et al., 2005). We control

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and subsidiary have roughly equal influence on decision'; (4) 'the subsidiary decides, but considers parent company suggestions'; (5) 'the subsidiary decides alone'.

[6] Factor loadings: definition of R&D projects, planning, resources = 0.923; introduction of new technologies = 0.845; changes in products/services = 0.767; eigenvalue = 2.154; variance explained = 71.81%.

for the cultural distance in the parent-subsidiary dyad adding to the model the variable *Cultural distance* measured utilizing Kogut and Singh's (1988) cultural distance index.

- Industry specific effects. Since different industries show different pace of environmental changes (Hannan & Freeman, 1984), in more dynamic industries core technologies, structures and processes of old organizations may become quickly obsolete (Sørensen & Stuart, 2000). Therefore, it is crucial to control for industry specific effects. Using the taxonomy developed by Pavitt (1984), we define the dummy variable *High-tech* that equals one if the subsidiary operates either in 'science-based' or 'specialized suppliers' sectors, with the benchmark being subsidiaries operating in medium and low tech industries.

4.3 Common Method Bias Considerations

In order to examine whether common method bias augmented relationships, we performed the Harman's single-factor test on the items included in our econometric model (Podsakoff & Organ, 1986). If common-method bias exists in the data, a single factor will emerge from a factor analysis of all measurement items included in the study, or one general factor that accounts for most of the variance will result. The factor analysis revealed 6 factors with eigenvalues greater than 1, the first of which (eigenvalue = 3.21) explains 18.88% of the total variance. Thus, the factor analysis did not indicate the presence of a single background factor, supporting the validity of the data.

In addition, following Podsakoff et al. (2003) we checked for common method variance by introducing a *method variance factor* in our model. This factor is operationalized as the first unrotated factor identified conducting explorative factor analysis of the items derived from the survey and included in the present study. The method variance factor "is assumed to contain the best approximation of common method variance" (Podsakoff, et al., 2003, p. 893), therefore,

when it is added to the model, its effect is partialled out and it is possible to determine whether the relationships between the variables of interest are still significant. When the method variance factor has been added to the model, all of the found significant correlations remained significant (see, Model 4 in Table 2). Accordingly, we conclude that common method variance does not play an important role in our findings.

5. Results and discussion

The summary of the descriptive statistics and correlations for all variables considered in the econometric exercise are reported in Table 1. No variables appear to suggest distribution or correlation problems.

– INSERT TABLE 1 ABOUT HERE –

Results from the linear regression estimations are reported in Table 2. Since for a set of subsidiaries we observe more than one knowledge transfer, an issue of possible non-independence among the observations may rise (Greene, 2000). Therefore, in order to rule out firm level effects, we use the Stata's cluster option and obtain a robust variance estimate that adjusts for within-cluster correlation (Williams, 2000). In this way, we are able to control for the fact that observations (i.e., knowledge transfers) occurred within the same parent-subsidiary dyad are possibly not independent.

Five models are presented in Table 2. In Model 1, we enter only the control variables, in Model 2 we add the independent variables, and in Model 3 we insert the interaction term to test our moderation hypothesis. In each of the models we checked for possible collinearity problems calculating the variance inflation factors (VIF). The highest VIF value is of 1.65 and it refers to the equation estimated in Model 3. This result suggests that multicollinearity is not an issue.

Finally, Model 4 shows our findings controlling for common method variance and Model 5 is used in the discussion that follows as a robustness check.

– INSERT TABLE 2 ABOUT HERE –

With respect to the control variables, not surprising the coefficient of the variable *R&D knowledge* is positive and statistically significant at $p<0.01$, suggesting that parent companies perceive a greater benefit when they use R&D know-how transferred from their foreign subsidiaries. In line with the extant literature on subsidiary role, our findings show that compared to implementers, subsidiaries with an innovator and a contributor role are able to engage in effective intra-firm knowledge transfer. Knowledge flows from a subsidiary are indeed precious to the parent to the extent that the subsidiary has superior resources and capabilities and, therefore, that its stock of intangible assets (such as expertise, skills, capabilities or creativity knowledge) is valuable for other parts of the MNE. Units that have stronger capabilities have been recognized as more likely to act as sources of knowledge than units that are relatively deprived of capabilities, and *vice versa* (Cantwell & Mudambi, 2005; Frost, et al., 2002; Gupta & Govindarajan, 1991; Holm & Pedersen, 2000). Considering Model 2, in line with the theory on intra-MNE knowledge transfer (e.g. Ambos, et al., 2006; Schulz, 2001; Yang, et al., 2008) our estimations reveal that the direct effect of the independent variable *Person-based communication* is positive and statistically significant. Specifically, we find that the effect on parent's perceived benefits from RKT increases when person-based communication mechanisms are used as transfer channels ($p<0.01$).

Extending the liability of newness argument (Hannan & Freeman, 1984; Stinchcombe, 1965) to the understanding of intra-MNE knowledge transfer, we expect subsidiary age to positively influencing parent company's benefits from RKT. We argued that older subsidiaries—

compared to younger subsidiaries—are senders with a relative greater stock of knowledge and capabilities. Accordingly, knowledge that is transferred from older subsidiaries and used by their parents is perceived as more valuable by the receiving units. This effect is very clear and consistent: in all the estimated models the variable *Subsidiary age* shows a positive and significant coefficient ($p<0.01$) supporting our hypothesis 1.

However, in the context of our analysis, different entry modes may bias our results. In particular, acquisitions (as opposite to greenfields) may downplay the impact of subsidiary age on the parent's benefits from RKT as we observe acquired subsidiaries only from the acquisition time. To this end, we conduct a robustness test of our hypothesis by interacting subsidiary age with the dummy variable *Acquisition-jv* in order to check whether the impact of subsidiary age on parent's benefits from RKT is contingent on entry modes. The results reported in Model 5 (Table 2) show that the effect of subsidiary age on the dependent variable does not change across different entry modes. Thus, younger greenfield investments and recently acquired subsidiaries equally suffer from the liability of newness within the MNE network by comparison to older greenfield and acquired subsidiaries. Although acquired subsidiaries might have accumulated knowledge over the time prior to their integration in the MNE network, strategic combinations are not automatically realized. The realization of synergies critically depends on the post-acquisition integration (Datta, 1991; Hunt, 1990; Larsson & Finkelstein, 1999; Schweiger, et al., 1987). Common skills and cognitive structures, among others, enable technical communication and learning while unrelated knowledge bases make the assimilation or application of new knowledge difficult and resource consuming (Haspeslagh & Jemison, 1991). This argument is supported by empirical findings reporting a negative impact of acquisitions on the post-acquisition R&D performance of the acquiring firms (Hitt, et al., 1991).

We also argued that when knowledge inflows occur using person-based communication mechanisms the effect of RKT on parent's benefits is stronger for older subsidiaries as they had more time to explore and develop the transmission channels needed for knowledge sharing. In Model 3, the coefficient of the interaction term *Subsidiary age×Person-based communication* is positive and significant at $p<0.05$. This finding is well in line with our theoretical predictions, thus supporting hypothesis 2. The liability of newness affects the creation and recognition of transmission channels within the parent-subsidiary dyad. The development of inter-unit strong ties indeed requires time commitments which older subsidiaries have afforded over time. This process facilitates the transfer of knowledge between business units (Bartlett & Ghoshal, 1988; Hansen, 1999) and subsidiary-parent especially. Parent companies and older subsidiaries have had more time to develop the communication mechanisms and relationships to share knowledge (Birkinshaw, et al., 2002) and, as a result, knowledge transfer is more effective, ultimately positively influencing parent's activities and capabilities. Older subsidiaries have had also more time to establish trusting relationships within the MNE's network, and share internal common goals and values that facilitate knowledge exchange and combination (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998).[7] Tushman and Anderson (1986) and Henderson (1993) show that in established experienced firms incremental innovation is facilitated by investments in communication channels that reduce the cost of processing routines. This is again in line with the time compression diseconomies argument suggesting that trust and similar resources display decreasing returns to the fixed factor time (Dierickx & Cool, 1989). Thus, established experienced subsidiaries have had more time to develop such resources which ease and make more effective RKT.

[7] It is worth mentioning that recent empirical evidence on knowledge transfer in MNEs shows a differential influence of trust and shared vision on knowledge transfer identifying shared vision as a more influential factor in intra- (rather than inter-) organizational relationships (Li, 2005).

We can also note that adding the interaction term to the model (Model 3), the coefficients of the independent variables *Subsidiary age* and *Person-based communication* continue to be positive and statistically significant. To better explain the interaction between subsidiary age and person-based communication mechanisms, we plot the interaction effect in Figure 1. Specifically, the graph shows the effect of person-based communication mechanisms on parent's benefits from RKT when subsidiary age is set to its mean and to one standard deviation above and below the mean. We use the results obtained from Model 3 and we consider dummy variables set at zero.

– INSERT FIGURE 1 ABOUT HERE –

In line with the numerical findings we just described, we can observe that increasing the use of face-to-face communication in the parent-subsidiary relationship generates a positive effect on the parent's perceived benefits from RKT. Moreover, the positive effect is emphasized by subsidiary age since the effect of person-based communication mechanisms on parent's perceived benefits from RKT is greater when the transfers occur from older subsidiaries. However, it is also interesting to note that when face-to-face interactions are used well below the average (for instance, below two standard deviations from the mean) RKT from older subsidiaries is less beneficial than from younger ones. In other words, our data suggest that it is much more harmful for parent companies to use lower levels of face-to-face communication mechanisms with older subsidiaries than with younger subsidiaries. In this case, a limited (well below the average) use of person-based communication mechanisms with older subsidiaries does not permit to fully exploit the advantages of subsidiary age derived from the development of trusting relationships and shared common goals. In tune with the time compression diseconomies argument (Dierickx & Cool, 1989), the limited use of person-based communication mechanisms

may lower the beneficial effects of RKT from older subsidiaries, which have had more time to cultivate and earn over time trusting relationships, and share common goals and values, which are acknowledged to facilitate inter-unit resource exchange and combination (Tsai & Ghoshal, 1998) and shape inter-unit strategic linkages (Tsai, 2000). In particular, trust has been recognized as a governance mechanism influencing knowledge sharing by increasing openness on knowledge transfer through the facilitation of joint problems solving (McEvily, et al., 2003). Similarly, management scholars have unanimously pointed out that shared vision facilitates meaningful inter-unit communication by increasing the level of mutual understanding (Nahapiet & Ghoshal, 1998) and relative absorptive capacity (Yli-Renko, et al., 2001). Therefore, the limited use of person-based communication mechanisms may lower the beneficial effect of RKT from older subsidiaries, which have had more time to develop trusting relationships and shared common goals and values, *vis à vis* younger ones.

6. Conclusions

Extending the liability of newness argument developed within the organizational ecology literature to an intra-firm inter-units context, we proposed, and our findings confirmed, that subsidiary age *per sé* has a direct positive impact on parent companies' benefits from RKT as it captures subsidiary's accumulated knowledge stocks and capabilities. As the effect of subsidiary age on internal communication systems is unclear, we argued and provided empirical evidence that subsidiary age positively emphasizes parents' benefits from RKT when parent-subsidiary communication relies on person-based communication mechanisms, as older subsidiaries enjoy less cognitive barriers than younger ones.

The study makes important theoretical contributions. First of all, our findings suggest that organizational ecology theory has much to offer to the IB theory. In particular, based on the liability of newness argument, we proposed to incorporate subsidiary age into theories of intra-MNE knowledge transfer and not to relegate it to the simple role of a control variable. Our claim is based on the idea that subsidiary age captures the accumulation of knowledge and capabilities and plays an important moderating role on well established relationships of RKT predictors.

A second contribution the study offers is to the literature on intra-MNE knowledge transfer in general, and on RKT, in particular. Precisely, this study examines to what extent parent companies' innovative capacity improves when parents internalize and use knowledge transferred from foreign subsidiaries in their activities. Despite the fact that most studies have investigated the RKT phenomenon, its effects on the receiving unit have been usually implicitly considered beneficial. In this perspective, knowledge transfers are beneficial to the extent that the transferred knowledge is used (Björkman, et al., 2004; Minbaeva, et al., 2003). However, Doz (2006) has recently challenged this perspective by arguing that knowledge transfer *per sé* hardly implies the beneficial effect of this knowledge for the recipient. Along this line, there are few works that explicitly show the impact of RKT on the receiving unit's capabilities and performance (Ambos, et al., 2006; Iwasa & Odagiri, 2004; Yamin & Otto, 2004). These studies embrace the view that transfers and benefits need to be analyzed as two separate dimensions (Ambos, et al., 2006; Subramaniam & Venkatraman, 2001). We contribute to this literature highlighting that parent companies perceive their innovative skills and capabilities to benefit from the use of knowledge that is transferred from foreign subsidiaries and this benefit increases with subsidiary age.

6.1 Managerial relevance

The study bears practical implications for managers. Extant research on time compression diseconomies (e.g., Dierickx & Cool, 1989) has argued that firms' competitive advantage critically depends on the accumulation of stocks of distinctive resources which display decreasing returns to the fixed factor time. In the context of intra-MNE knowledge transfer, this implies that both the accumulation of stocks of these distinctive resources and capabilities by the subsidiary and the development of trusted and shared values in the parent-subsidiary communication relationship are time dependent and could hardly be compressed over short periods. Therefore, older subsidiaries are to some extent the reservoir of those kinds of resources and capabilities which are of central concern to resource-based theory. That is, they have built over time organizational capabilities, knowledge about products, markets, technologies, institutional contexts, and developed networks of contacts with peers and corporate headquarters, and local customers, suppliers and competitors. This stock of knowledge is strategic for the MNE management as it is not tradable and needs to be internally accumulated. Unlike flows, stock cannot be adjusted instantaneously and it takes a consistent pattern of resource flows to accumulate a desired change in strategic asset stock. Thus, for example, MNE managers need to be aware that "crash" R&D or marketing programs are less effective that programs where annual R&D/marketing expenditures are lower but spread over a long period of time. Similarly, our study warns MNE managers on the significance of extra investments to better define mutual relations within the parent-subsidiary dyad, to structure and share communication rules and opportunities in order to temporary reduce inefficiencies that can rise when knowledge is transferred from younger subsidiaries.

6.2 Limitations and future research

Our study is characterized by several limitations. The dependent variable and a subsample of the independent variables are perception-based measures and operationalized using the same method instrument. In order to partially control for method biases, the survey was designed selecting appropriate procedural remedies and we implemented a statistical technique recently proposed by Podsakoff et al. (2003). A further limitation lies in the nationality of the MNEs, all of which are Italian. In these MNEs, management culture and knowledge management practices may be expected to be relatively more hierarchical and less collegially oriented than MNEs based in U.S. and Nordic Europe. Finally the majority of the MNEs analyzed in this study are small firms compared to the MNE traditionally considered in the literature. On the one hand, this peculiarity makes more difficult the direct comparison with previous findings. On the other hand, having a population of small/medium MNEs offers the advantage to observe knowledge transfers within parent-subsidiary dyads more clearly than in a large complex organization.

Despite these limitations, we believe that our analysis may provide suggestions for future research on intra-MNE knowledge sharing. In particular, our study suggests important implications when considering subsidiary age in vertical knowledge inflows. Our analysis could be replicated in context of different types of intra-firm knowledge transfer such as lateral transfers, from subsidiaries to other sister units (e.g. Gupta & Govindarajan, 2000; Noorderhaven & Harzing, 2009). Questions are indeed open on whether the underlying mechanisms explaining and driving these effects apply also to lateral knowledge flows. On the grounds of our results, future research should also aim at revisiting the analysis of RKT in MNEs to account for the moderating effect of units' age on other well recognized drivers.

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TABLES AND FIGURES

Table 1 – Descriptive statistics

Variable	Mean	S.D.	Min	Max	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Parent's benefits from RKT	0.00	1.00	-0.70	3.18													
(2) R&D knowledge	0.35	0.48	0.00	1.00	0.46												
(3) Marketing/sales knowledge	0.29	0.45	0.00	1.00	-0.16	-0.47											
(4) Relative size	-1.54	1.13	-4.42	2.02	0.06	-0.05	-0.08										
(5) Subsidiary autonomy	0.00	1.00	-1.78	3.75	0.08	0.07	0.07	0.13									
(6) Acquisition-jv	0.55	0.50	0.00	1.00	0.17	0.09	-0.09	0.32	0.05								
(7) High-tech	0.29	0.45	0.00	1.00	0.34	0.26	-0.14	0.01	0.07	0.30							
(8) Cultural distance	1.18	0.98	0.00	3.80	0.03	0.18	0.07	-0.39	-0.13	-0.28	-0.12						
(9) Organizational distance	2.70	1.82	1.00	7.00	0.13	-0.06	-0.08	0.23	-0.04	0.36	0.32	-0.37					
(10) Technological distance	3.62	1.23	1.00	7.00	0.11	0.18	-0.15	-0.09	-0.03	-0.14	0.09	0.15	0.19				
(11) Contributor	0.22	0.42	0.00	1.00	-0.04	-0.11	-0.19	0.09	-0.19	-0.02	-0.01	-0.12	0.13	-0.11			
(12) Innovator	0.36	0.48	0.00	1.00	0.28	0.06	0.03	0.14	0.24	0.45	0.51	-0.25	0.41	-0.16	-0.39		
(13) Subsidiary age	10.09	5.92	2.00	31.00	0.09	-0.14	0.16	0.01	-0.03	-0.08	0.04	-0.24	0.04	-0.26	0.07	0.02	
(14) Person-based communication	0.00	1.00	-2.99	1.37	0.14	-0.01	-0.07	0.05	0.09	0.16	-0.20	0.19	-0.14	-0.04	-0.22	0.03	-0.27

Table 2 – Regression analysis of parent's benefits from RKT

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	-0.92 (0.40)**	-1.52(0.45)***	-1.63 (0.47)***	-1.72(0.48)***	-1.63 (0.43)***
R&D knowledge	0.87 (0.17)***	0.93(0.16)***	0.88 (0.15)***	0.89(0.16)***	0.94 (0.16)***
Marketing/sales knowledge	0.19 (0.15)	0.24(0.14)*	0.22 (0.14)	0.25(0.14)*	0.23 (0.14)*
Relative size	0.06 (0.07)	0.05(0.06)	0.02 (0.06)	0.01(0.06)	0.03 (0.07)
Subsidiary autonomy	0.00 (0.10)	-0.01(0.09)	-0.01 (0.09)	-0.47(0.53)	-0.01 (0.09)
Acquisition-jv	-0.02 (0.18)	-0.08(0.16)	-0.06 (0.16)	-0.04(0.15)	-0.06 (0.15)
High-tech	0.19 (0.23)	0.26(0.20)	0.25 (0.20)	0.25(0.19)	0.23 (0.20)
Cultural distance	0.05 (0.10)	0.04(0.10)	0.04 (0.09)	0.02(0.09)	0.04 (0.10)
Organizational distance	-0.01 (0.07)	-0.01(0.06)	-0.02 (0.06)	-0.01(0.06)	0.00 (0.06)
Technological distance	0.07 (0.10)	0.12(0.10)	0.14 (0.10)	0.14(0.10)	0.11 (0.10)
Contributor	0.34 (0.25)	0.47(0.24)*	0.54 (0.25)**	0.56(0.25)**	0.47 (0.24)*
Innovator	0.56 (0.26)**	0.59(0.24)**	0.69 (0.24)***	0.79(0.28)***	0.57 (0.23)**
Subsidiary age		0.04(0.01)***	0.04 (0.01)***	0.04(0.01)***	0.05 (0.01)***
Person-based communication		0.25(0.08)***	0.20 (0.07)***	0.17(0.08)**	0.24 (0.08)***
Subsidiary age[a]×Person-based communication			0.02 (0.01)**	0.02(0.01)**	
Method variance factor				0.50(0.57)	
Subsidiary age[a]×Acquisition-jv					-0.02 (0.03)
F-test	4.48***	4.60***	4.99***	4.71***	4.77***
R^2	0.309	0.392	0.413	0.417	0.40

[a] The variable has been centered around its mean value in order to avoid high correlations between the interaction term and the variable subsidiary age (Haas & Hansen, 2005; Smith & Sasaki, 1979).
In brackets, robust standard errors corrected for heteroscedasticity and cluster-correlated data.
* p< .10; ** p< .05; *** p< .01 (two-tailed tests applied).

Figure 1 – Interaction results by subsidiary age