Knowledge brokerage:

Towards an integrative conceptual framework

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Résumé:

La solution à un problème existe souvent dans la boîte à outils de quelqu'un d'autre. Les courtiers de connaissances, en tant qu'intermédiaires, fournissent des connexions à différentes sources de connaissance ainsi qu'à la connaissance elle-même. La littérature a utilisé le concept de courtage de connaissances de diverses manières, en analysant une variété de rôles et d'activités. L'objectif de ce papier est de faire progresser la connaissance en matière de courtage de connaissances en intégrant différents courants de recherche dans un cadre conceptuel intégré. Nous nous appuyons sur deux principaux courants de la littérature: le premier voit les courtiers de connaissances principalement comme des facilitateurs du transfert de connaissances, le second considère ces courtiers de connaissances comme des innovateurs. Basé sur un examen approfondi de la littérature existante, nous proposons un modèle processuel de courtage de connaissances incluant les antécédents et résultats des activités de courtage.

Mot-clés: Knowledge brokerage; knowledge transfer; learning; knowledge translation

INTRODUCTION

Not all good ideas originate within firms (Chesbrough & Crowter, 2006; Gassmann, Daiber & Enkel, 2011). As a consequence, firms need to absorb, integrate and reconfigure external knowledge in order to maintain competitive advantage over time (Teece, Pisano & Shuen, 1997). Knowledge brokerage plays a critical role in this process (Hargadon, 1998). Knowledge brokers have been defined as 'those individuals or organizations that profit by transferring ideas from where they are known to where they represent innovative new possibilities' (Hargadon, 1998, p. 214). Following this early definition, research has yielded a wide range of insights into knowledge brokerage. This phenomenon was studied from various perspectives such as innovation, knowledge management or sociology, and in different levels of analysis ranging from individual to organizational level. Despite this heterogeneity, the literature tends to attribute two main roles to knowledge brokers: knowledge transfer facilitators and innovators. So far, these two perspectives lack integration.

The broad range of papers adopting this concept raises important questions about the state of the knowledge brokerage literature. It remains unclear what these disparate streams have collectively achieved. Remarkably, there is no research that focuses on this issue. In this paper, we review existing conceptual and empirical contributions to propose an integrated process model that will combine these divergent literature streams. This integrative approach offers a deeper insight about knowledge brokerage's antecedents, roles, activities, and possible outcomes since these perspectives adopt distinct ground concepts and look at knowledge brokerage from different level of analysis. Thus, our model seeks to advance the academic debate, but also to enable knowledge brokers in practice to more effectively access and deploy knowledge. Based on our review of the knowledge brokerage literature, we found that seemingly different conceptual frameworks had similarities and overlaps. We have identified three common knowledge brokering activities -- knowledge acquisition, knowledge integration, and knowledge translation. For each of these activities we highlight underlying antecedents, obstacles, and process for each of the two types of brokerage.

The present paper is organized as follows: We first discuss the knowledge brokerage concepts in different traditions, looking at knowledge brokers as facilitators of knowledge transfer and knowledge brokers as innovators. Based on this discussion we then introduce our conceptual

framework and in detail discuss the overall conditions of knowledge brokerage, activities and outcomes. The final concluding section highlights remaining conceptual gaps and points to directions for future research.

Knowledge brokers roles in different literature traditions

Literature looking at the process of knowledge brokerage falls into two largely disconnected streams of research, which are organized around two major roles played by knowledge brokers. The knowledge management stream of research (e.g., Pawlowski & Robey, 2004), sees knowledge brokers primarily as facilitators of knowledge transfer. The main focus here is on the social aspects of brokerage, according to which brokers have to adapt to social differences and translate knowledge. In contrast to this view, the innovation stream (e.g., Hargadon, 1998; 2002, Verona, Prandelli & Sawhney, 2006) considers knowledge brokers as innovators. Here, knowledge brokers are portrayed as organizational actors that use their networks to access knowledge, and to use recombination to create novel solutions. In addition to the social aspects of brokerage, this stream in addition highlights the cognitive processes at play in knowledge brokerage.

Knowledge Brokers role in the knowledge management literature

The knowledge brokerage phenomenon can be found in knowledge management literature. The first widely known grey paper entitled 'The Theory and Practice of Knowledge Brokering in Canada's Health System' published by Canadian Health Services Research Foundation (CHSRF) in 2003 explicitly analyzes the knowledge broker's ability to facilitate interaction, find, process and adapt knowledge in different contexts (different communities of practice). The main goal of the knowledge broker is to promote evidence-informed decision-making (Lomas, 2007) or, in other words, facilitate the exchange of knowledge between two communities (researchers and users). In this literature, knowledge brokerage is examined in either the individual or the group level where knowledge brokers work with health related topics, such as, Seniors Health (Conklin & al., 2013) or the uptake of pediatric measurement tools into clinical practice (Russell & al., 2010). In the several years since this view was introduced, the knowledge brokerage concept has attracted the attention of numerous scholars, resulting in an important number of publications analyzing knowledge brokerage antecedents, activities, challenges, etc.(Ward & al., 2009, Dobins & al., 2009, Hammami & al., 2013).

Independently, the knowledge brokering concept is also proposed by Pawlowski and Robey's

paper (2004) where the knowledge broker is seen as a knowledge transfer facilitator. These authors use the boundary spanning (Ancona & Caldwell, 1988), boundary objects (Becky, 2003, Brown & Duguid 1998) and situated learning (Wenger, 1998) concepts to explain knowledge brokerage process. This paper explicitly focused on social challenges that individual knowledge brokers have to deal on daily basis.

Knowledge brokers as facilitators of knowledge transfer are actors who 'provide connections between communities of practice, transfer elements of one practice into another, enable coordination, and ... create new opportunities for learning' (Wenger, 1998, p. 109), in other words: they enable knowledge flow across communities. Knowledge transfer is facilitated as knowledge brokers enable the translation of knowledge by framing the elements of one community's world view in terms of another community's world view (Pawlowski & Robey, 2004). Put differently, knowledge brokers make knowledge accessible and understandable across the communities they span, and they do so by adjusting their messages to characteristics of their targets thereby reducing the cognitive distance between communities (Cillo, 2005).

Ward & al. (2012) find that knowledge brokers actively facilitate knowledge exchanges between communities also by engaging in practices such as 'information management (e.g. gathering, sharing and packaging information), linkage (e.g. bringing people together or facilitating dialogue), capacity development (e.g. learning from the knowledge exchange process and ensuring sustainability), etc.' (p. 300). As a consequence, knowledge brokers as facilitators of knowledge transfer do not only engage in the search, translation and dissemination of knowledge, but also build up communication channels between disconnected communities, as well as knowledge sharing capacity within their focal communities.

Knowledge transfer requires both the crossing of boundaries, and knowing the community to which knowledge is to be transferred. By participating in a community's everyday life, knowledge brokers learn about idiosyncratic practices, for instance the work of specific IT users (Pawlowski & Robey, 2004). By doing so, knowledge brokers understand the perspective of each community and develop their ability to adapt the knowledge to be transferred. Accessing knowledge is difficult because knowledge brokers have to negotiate their positions within and between communities in a dynamic social process (Ward & al., 2012).

Knowledge Brokers roles in innovation literature

An important insight about knowledge brokers in the organizational level can be found in the innovation literature. Knowledge brokers are considered as one of the organizational innovation intermediaries. According to Howells (2006), an innovation intermediary can be defined as an organization or body that acts as an agent or broker in any aspect of the innovation process between two or more parties. Depending on the role in the innovation process, intermediaries can be called third parties, bridgers, knowledge brokers, innovation brokers, etc. (Hargadon & Sutton, 1997; McEvily & Zaheer, 1999, Klerkx & Leeuwis, 2009, Winch & Courtney, 2007). This literature most often exclusively focuses on the benefits that intermediaries can offer to the firm– e.g. leveraging the technical expertise of external individuals (e.g., Lakhani & al., 2006), and adapting existing design solutions to novel problems (Hargadon, 2002).

The most widely known knowledge brokerage concept was described by Hargadon & Sutton in 1997. Technology brokering (later renamed to knowledge brokering) is seen as a firm's ability to exploit its network position in order to access diverse knowledge, recombine it and transfer it to other fields. This first knowledge brokering process model connects the social network (Burt, 1992, Gould & Fernandez, 1989) and organizational memory aspects (March & Simons, 1958). The research is based on one product Design Company that is considered as a technology broker. In 2002, the knowledge brokerage concept receives an even further theoretical expansion, focusing on the individual and organizational learning (Lave, 1988, Weick, 1995). Finally, the updated knowledge brokerage concept is explicitly linked to the innovation process. This knowledge broker concept acquired attention from various others scholars, for instance, Verona, Prandelli & Sawhney (2006) analyzed knowledge brokering process in a virtual environment. Stuart, Ozdemir & Ding (2007) examined knowledge brokering activities of pharmaceutical firms during the drug development processes. Hsu & Lim (2013) proposed organizational factors influencing firms' knowledge brokering behavior. This stream of research emphasizes the role of knowledge brokers as innovating organizations (e.g., Hargadon, 1998; 2002). Knowledge brokers innovate by recombining existing knowledge, creating novelty through the 'recombination of conceptual and physical materials that were previously in existence' (Nelson & Winter, 1982, p.130). Recombination is cognitively demanding and requires a process of analogical reasoning. Such a process plays an important role in innovation and creativity (Goel, 1997, p. 62), involving the recognition of

links between a current problematic situation, and recalled past problems and their solutions (Hargadon, 2002; Dahl & Moreau, 2002).

Like in the case of knowledge transfer, brokers acquire knowledge through extended external networks as well as through internal channels. Knowledge acquisition involves the learning and crossing of (inter-)organizational boundaries (Hargadon, 2002). As mentioned earlier, knowledge brokerage typically occurs in fragmented environments characterized by structural holes (Burt, 1992). Brokers hold key positions in social networks that enable them to access diverse knowledge. In addition, large networks enhance brokers' capabilities of assimilating complex ideas (Reagans & McEvily, 2003). To achieve both, brokers first need to learn about existing resources of each field they relate to, and, second, about the specific problems of each domain (Hargadon, 2002).

Much of a knowledge broker's innovative recombination activity occurs when individuals within the broker organization engage in sharing and exchange of knowledge, and the broker's internal organization -- for example its organizational culture (Hargadon, 2002; Hsu & Lim, 2013) and organizational climate (Hammami & al., 2013) influencing employees' willingness to exchange knowledge -- plays a key role in these processes. Furthermore, the broker's absorptive capacity (Cohen & Levinthal, 1990), conditions the broker's ability to value, assimilate, and apply new knowledge (Kim, 1998).

In conclusion, the second stream of literature provides insight into the cognitive and innovative aspects of knowledge brokerage. It explicitly addresses the knowledge broker's ability to learn and to recombine existing knowledge, emphasizing the broker's absorptive capacity. As should have become clear from our summary of the two streams of research, even though they look at different aspects or roles of knowledge brokerage, they do not contradict but rather complement each other, as we will argue in more detail in the following section.

Towards an integrative process of knowledge brokerage

The two streams of research summarized above share some important features. In both approaches, knowledge brokers have to connect to other actors, communities, or domains that rely on different institutional logics and involve cognitive barriers. Moreover, learning plays a critical role in both literatures: knowledge brokers as facilitators of knowledge transfer need to know the communities they span (Pawlowski & Robey, 2004), while knowledge brokers as

innovators need to gain an understanding of the various domains they relate to, and need to acquire knowledge about people, technologies, and artifacts (Hargadon, 1998; 2002). In both roles, brokers are engaged in constant learning and must assimilate a huge amount of technical and social knowledge. However, the level of knowledge complexity and the amount of assimilated knowledge differ.

Knowledge brokerage aimed to facilitate knowledge transfer describes the knowledge broker as an intermediary whose purpose it is to facilitate knowledge flow between disconnected communities or fields (Pawlowski & Robey, 2004; Ward & al., 2012; Hammami & al., 2013). This broker promotes the collaboration between fields and actively involves in the co-creation with knowledge users. This knowledge broker's role is to enable others to acquire and assimilate knowledge. Overall, knowledge transfer facilitation brokerage is less complex than innovation knowledge brokerage because here knowledge brokers focus mainly on the creation and management of social ties in order to cope with social differences, and establish their own network position in an effort to know the various fields, and acquire knowledge about actors and their activities (Pawlowski & Robey, 2004). These knowledge brokers combine and manipulate knowledge only to the extent that this is necessary for effectively transferring knowledge from one context to another (Ward & al., 2012; Hammami & al., 2013). Also, these knowledge brokers usually have identified knowledge users and work on large problems/topics, like Seniors Health issue (Conklin & al., 2010) or implementation of an information system (Pawlowski & Robey, 2004). Sometimes, knowledge brokers already possess the knowledge that they need to transfer or they know where such required knowledge could be found.

Knowledge brokers as innovators, on the contrary, respond to an additional aim of innovating by recombining acquired knowledge into novel propositions and solutions. In this case, the broker's activity is more cognitively intense because innovating knowledge brokers may initially neither possess an adequate understanding of the required knowledge, nor have a clear vision of the potential end users. Innovating knowledge brokers rely on their social ties to access knowledge (Stuart, Ozdemir & Ding, 2008). They also need to cope with social differences and to manage access to different communities (Hargadon, 2002). However, their main activity resides in an innovative recombination of knowledge from various sources (Hargadon, 1998; 2002). This knowledge brokerage also implies a more active use of the broker's different social networks because brokers need to manipulate and shape their network

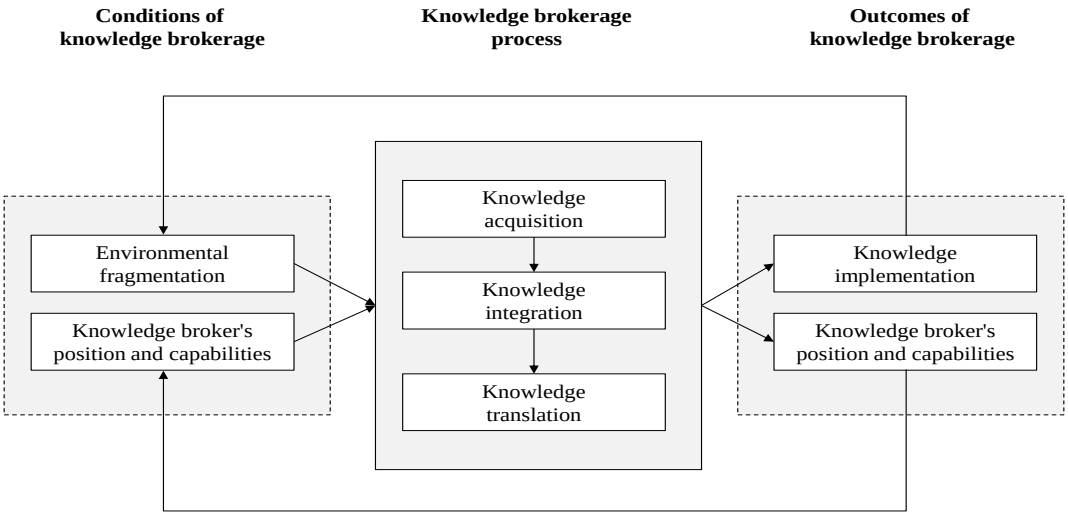
ties in order to reach their goal of creating innovative propositions (Kidwell, 2013). Further similarities can be found looking into the knowledge brokering process models found in the literature (see Table 1.)

Table 1. Knowledge brokerage's activities in the two main literatures

Knowledge brokerage process in the innovation literature **(Hargadon, 2002)**	**Knowledge brokerage in the knowledge management literature** **(Hammami et al., 2013)**
Access: Knowledge brokers creates and manages social networks	*Knowledge acquisition:* knowledge brokers engage in knowledge acquisition from various research sources in order to filter and choose the useful knowledge
Bridging Knowledge brokers access to distributed knowledge in his network	*Knowledge Integration:* knowledge brokers integrate acquired knowledge in order to effectively transfer knowledge
Learning: Knowledge broker assimilate the distributed knowledge	*Adaptation of research results:* Knowledge brokers engage in the translation activity. They adjust acquired knowledge in accordance to the recipient's properties
Linking: Knowledge broker recombines learned knowledge through analogical reasoning	*Dissemination of research results:* brokers engage in knowledge transfer's activity and share their acquired knowledge.
Building: Knowledge brokers move from innovative ideas to accepted innovations by building new network ties, embedding the emerging recombination within a new domain.	*Creating the link:* knowledge brokers engage in mediation activity between disconnected worlds and create opportunities for communication mechanisms to emerge between researchers and practitioners and as a result facilitate knowledge transfer between them.

These process models share common characteristics: knowledge brokers have to cross multiple boundaries in order to access to knowledge. When knowledge is acquired, it is integrated and modified for the knowledge brokers' needs; finally, it is diffused. We therefore propose an integrative knowledge brokerage process model (see figure 1).

Figure 1. Knowledge Brokerage Process Model: A Proposition



Our process model first highlights the principal conditions for knowledge brokerage, distinguishing between environmental fragmentation and the conditions regarding the broker's existing ties and capabilities. Both conditions taken together enable the three core processes of knowledge brokerage -- acquisition, integration, and translation --, which we describe in more detail below. Finally, the proposed process model includes the outcomes of knowledge brokerage, both in terms of the successful implementation of knowledge among the target organizations (Nelson, 1993), as well as in the form of a redefinition of the broker's network position (via newly developed ties) and capabilities (via the involved learning processes). Our overall model is dynamic in nature by assuming, first, that successful brokerage over time alters the state of fragmentation and structural holes in the broker's environment, and, second, that successful (or unsuccessful) brokerage over time also leads to a change in the broker's position and capabilities.

The following sections address knowledge brokerage conditions, the three core processes of knowledge brokerage in more detail and the outcomes, and we address some of the dynamic issues in the final discussion section of the paper.

Conditions of knowledge brokerage

Processes of knowledge brokerage involve individuals, organizations, and networks (Hargadon, 2002). Prior research on knowledge brokerage identified various conditions ranging from context-level social network structures (e.g., Hargadon, 1998; 2002) to broker-level processes of imprinting (e.g., Hsu & Lim, 2013). Context-level conditions refer to a

specific environment conducive to knowledge brokerage, its social structure and underlying mechanisms, and broker-level conditions primarily focus on organizational characteristics such as routines, organizational culture, etc.

Context-Level Conditions of Knowledge Brokerage

Prior literature has highlighted the role of fragmented environments in the emergence of knowledge brokerage (Hargadon, 1998; 2002; Pawlowski & Robey, 2004; Hammami & al., 2013). Theoretically several frameworks, including structural holes and communities of practice have been used to conceptualize fragmentation.

For the structural holes' theory (Burt, 1992), knowledge brokerage responds to imperfect competition, and to the resulting structure of competitive arenas. Organizations only have a limited number of alternative partners, and partner search, contractualization, and withdrawal are associated with cost. In this context, structural holes refer to the absence of a link between two contacts that are both linked to a third actor (Brass & al., 2004), resulting in a situation in which 'people on either side of a structural hole circulate in different flows of information' (Burt, 1992, p. 209). The existence of structural holes constitutes opportunities for third parties to mediate the flow of information among disconnected actors (Burt, 1992; 2004).

In his work on knowledge brokerage, Hargadon (2002) builds upon the notion of structural holes and further expands the social aspect of knowledge brokerage. He suggests that fragmented environments are marked by the phenomenon of 'small worlds', allowing knowledge brokers to operate in a context in which every domain is characterized by habitualized actions, interactions, and beliefs resulting in distinct 'institutional logics' (Friedland & Alford, 1991), which are both shaping and legitimizing individuals' understandings and appropriate actions (Hargadon, 2002, p. 53).

Similar insights can be found in the literature examining knowledge brokerage from the vantage point of communities of practice (Pawlowski & Robey, 2004; Hammami & al., 2013, Ward & al., 2011). In this perspective, fragmentation results from differentiation in learning as, over the time, the learning establishes 'epistemic differences' (Brown & Duguid, 2001) based on which people taking part in a community of practice develop their distinct identity, language and perception. This process creates boundaries between communities and hinders free knowledge flow across communities. In this context, the presence of a knowledge broker is useful as it serves as knowledge translator.

Under both conditions, structural holes and communities of practice, fragmented environments create opportunities for knowledge brokerage and at the same time constitute challenges to effective brokerage as knowledge broker need to cross social boundaries to access information and knowledge held within different communities or networks that are characterized by distinct mindsets and attitudes, and also by different ways of processing knowledge.

Broker-Level Conditions

The most important resources for knowledge brokering firms are its people (Hargadon, 2002). Developing a knowledge brokerage capacity entails specific human resource practices seeking to attract, select, and train organization members in a way that ensures compatible organizational culture and climate, and enhances employees' skills in the areas of knowledge research and processing (Hargadon, 2002), as well as in the area of relationship management (Hammami & al., 2013; Pawlowski & Robey, 2004).

Knowledge brokerage requires that firms are able to process an important amount of knowledge. Hence, their employees should be able distinguish and appreciate the information and knowledge they come across (Hammami & al., 2013). Especially the practitioner-oriented literature on knowledge brokerage suggests that this requires ‘expertise..., skills in literature research, critical appraisal, and the ability to synthesize information and assist in translating evidence into different local contexts’ (Robeson, Dobbins & DeCorby., 2008, p. 2). Another important aspect involves the management of the brokering firm's knowledge base. As every person in the organization possesses a distinct knowledge base that should be preserved and developed (Spender, 1996), firms should seek to moderate employee turnover in order to retain valuable knowledge and continuously investment in employee learning and develop their knowledge processing abilities (Hargadon, 2002).

Extended social networks constitute a critical source of knowledge. As a brokering firm's overall social network can be understood as an aggregation of its employees' individual networks, firms should hire people with different profiles and past experiences, ensuring that employees bring extensive and rich networks of contacts that allow to access diverse knowledge bases (Fleming, Mingo & Chen, 2007). Employees' past networks allow combining experiences, access to knowledge, visibility, and power, and over time provide a brokering firm with opportunities to strengthen their networks (Stuart, Ozdemir & Ding,

2008; Zaheer & Soda, 2009).

Building and maintaining brokerage capacity is a difficult task (Burt, 2001; Sasovova & al., 2010). Literature on boundary spanning, for instance, argues that actors engaged in boundary spanning need to possess specific capabilities including communication skills, empathy and the ability to manage conflicts (Williams, 2003), and the brokerage literature points to self-monitoring (Burt, 1992; Oh & Kilduff, 2008), and to persuasion, advocacy, and team building (Kidwell, 2013) as necessarily skills for knowledge brokerage.

Organization climate also influences knowledge brokerage activities (Hammami & al., 2013). An organization's innovation orientation and overall climate characterized by high autonomy will positively impact the effectiveness of brokers. Firms wanting to enhance knowledge brokerage should highlight their innovation orientation, for instance by encouraging new ideas and sharing of a common mission (Worren, Moore & Cardona, 2002), and ensure that knowledge brokers are able to self-organize their knowledge and their communication network.

Finally, from a temporal perspective, the creation and initial conditions of the brokering organization, conceptualized as ‘knowledge brokerage imprinting’ (Hsu & Lim, 2013), have been shown to influence knowledge brokers' effectiveness. Imprinting comprises the founder's ‘choice of analogical reasoning and other forms of exploratory search at the origin of the venture’ (Hsu & Lim, 2013, p. 9). Where founders have implemented knowledge brokering routines from the outset, organizations have, for example, been found to be able to sustain long-term innovation trajectory advantages as compared to initial non-brokers (Hsu & Lim, 2013). Furthermore, initial knowledge brokers are able to effectively use their internal communication channels and to renew their knowledge brokering capacity.

Knowledge Acquisition

Knowledge acquisition involves acquiring knowledge from various communities and fields. In order do so, employee of knowledge broker firms have to span multiple boundaries on a daily basis. Knowledge acquisition for transfer facilitators focuses primarily on understanding the social structure and the core activities of the spanned communities. In addition, innovating knowledge brokers acquire a lot of technical knowledge in order to thoroughly understand the activities of actors in each field they connect to.

Levina & Vaast's (2005) empirical work on information systems implementation in two organizations highlighted the role of legitimacy in boundary spanning: boundary spanners need at least a 'peripheral understanding of each practice, providing it with some sense of legitimacy' (2005, p.353). Legitimacy is a complex issue involving both the disruption of power relationship and the exchange of capital. Being necessarily members of multiple communities, broker's legitimacy as a necessary condition for knowledge acquisition is both critical and difficult to achieve as they need to avoid two opposite tendencies described by Wenger (1998, p. 110) as 'being pulled in to become full members and being rejected as intruders'. Brokers need both to establish their legitimacy and to establish and control distance in order to acquire and to deliver new knowledge.

Knowledge brokers must be ready to engage in continuous learning (Hargadon, 2002; Hammami & al., 2013). Knowledge sources vary and include both codified forms of knowledge (Hammami & al., 2013) and unstructured learning through community participation (Hargadon, 2002; Pawlowski & Robey, 2004). Some forms of knowledge, however, are more difficult to access than others. Polanyi (1958) introduced the concept of 'tacit knowledge' and suggested that tacit knowledge is highly personal, difficult to capture, articulate and communicate. Nonaka (1995) developed this notion further by addressing the relationship between tacit and explicit knowledge, and showed how learning is achieved through social interaction. An organization's knowledge is not always explicit, but also embedded, for example, in organizational culture (Weber & Camerer, 2003), and can therefore be acquired though participation in the specific organization's everyday interactions. After crossing social boundaries, knowledge brokers therefore often participate in a target community's life for an extended period of time, and engage in social interaction to acquire implicit organizational knowledge.

Knowledge Integration

Brokers must integrate new knowledge before transferring it back to field members (Hammami & al., 2013; Cillo, 2005). For knowledge brokers to facilitate transfer, integration primarily involves interiorizing knowledge about the structure of the targeted communities and about the knowledge to be transferred. This requires thorough knowledge on the level of the broker 'of the perspectives of each user group, an ability to situate the meaning and significance of information in its context and to communicate those meanings and their significance to other groups (Pawlowski & Robey, 2004, p. 660). In this process, knowledge

brokers can recombine and manipulate knowledge in order to make it accessible and understandable for the knowledge users. The knowledge broker also decides how knowledge should be packaged and presented, thus adapting the knowledge to be transferred.

Knowledge brokers with the purpose of innovating, in addition of understanding the underlying social structure, have to recombine acquired knowledge to propose novel solutions. This process reflects the principal cognitive aspect of brokerage and mainly relies on analogical reasoning. As we have argued before, analogical reasoning involves transferring a solution from a well-known to a hitherto unknown domain, suggesting the broker's ability to redefine current problems. In this sense, analogical reasoning represents the central component of knowledge recombination. Hargadon (2002), for instance, highlights the importance of collective mind and collective creativity in this process, suggesting that the collective pooling of experiences and individual expertise are the most effective way to achieve successful knowledge recombination. By consistent pooling, broker organizations can develop non-obvious analogies and propose innovative solutions. Moreover, over time broker organizations become better at knowledge integration as they ‘learn how to learn’ (Hargadon, 2002) and develop both integration routines and their organizational absorptive capacity.

Knowledge Translation

Knowledge brokers act in fragmented environments marked by multiple boundaries. In order to enable knowledge transfer, knowledge brokers must translate knowledge in order to make it understandable for target organizations. If the source is not able to frame knowledge in a language that the recipient can understand, knowledge assimilation is both difficult and costly (Borgatti & Cross, 2003). The key capability is to ‘frame the interests of one community in terms of another community's perspective’ (Brown & Duguid, 1998, p. 36).

For knowledge brokers to facilitate knowledge transfer, it involves interacting with defined knowledge users to explain and clarify the knowledge to be transferred. For knowledge brokers as innovators, the knowledge transfer is equally important. However, this process is more complex. These brokers, firstly, need to identify potential recipients and only then they have to make knowledge both understandable and accepted. Networks play an important role in innovative knowledge brokerage because knowledge brokers rely on their social networks to select partners that could be useful and interested in the new knowledge (Kidwell, 2013),

analyzing the external environment in search for potential opportunities and how to address them.

Successful knowledge translation depends on several factors. Cillo (2005), for instance, suggested evaluating the complexity of knowledge and cognitive distance between actors. Some knowledge is more difficult to replicate and to transfer, for instance, familiar knowledge, for instance, is easier to assimilate than new and uncommon knowledge (Szulanski, 1996). The complexity of knowledge translation depends on cognitive distance, which allows distinguishing several types of knowledge brokerage activities (Cillo, 2005). Differences in knowledge processing are the result of how actors have developed along different paths and in different environments (Nooteboom & al., 2007). When knowledge is not complex and actors are cognitively close, knowledge brokers engage, for example, in a pure transfer of market information. In this case, the knowledge broker does not have to engage in much translation and can transfer knowledge directly. However, when cognitive distance between actors is important and knowledge is complex, the broker must manipulate and package knowledge in order to make it understandable.

The ample literature on knowledge transfer provides some additional ideas about other factors that influence the knowledge translation process. For example, Reagans & McEvily (2003) highlighted that recipient absorptive capacity matters. Furthermore, social relations among actors play an important role in facilitating knowledge transfer (Tsai, 2001). In a seminal, early study, Hansen (1999) noted that ‘weak ties’ facilitate the search for knowledge and as a result reduce the time of project development when knowledge could be codified. However, when knowledge is complex and difficult to codify, stronger ties facilitate repeated interactions and knowledge acquisition. Finally, shared vision and cultural distance are important cognitive elements influencing knowledge transfer (Inkpen & Tsang, 2005; Mowery, Oxley & Silverman, 1996).

In practice, knowledge transfer is based on communication. In a recent empirical study, Ward & al. (2012) highlighted some techniques that knowledge brokers applied to effectively transfer knowledge. They used short reports to summarize acquired knowledge and to ‘turn research evidence into everyday talk’. Knowledge brokers also actively intervened in knowledge exchange activities between members with different backgrounds and facilitated communication, helping to build capacity among community members.

Knowledge brokerage outcome

The outcome can be considered at two levels: at the external level and at the level of the knowledge broker. On one hand, knowledge brokerage can result in successful knowledge transfer and in eventual innovation process implementation. On the other hand, from the knowledge broker's perspective, this activity expands its knowledge base by searching, learning and adapting knowledge. The knowledge broker puts disconnect actors in contact. By doing so, broker fills existing structural holes and alters its position in the network, thus losing its advantageous position. However, the literature suggests that this is not always the case. Indeed, closing structural holes to create helpful synergies may lead the actors to reciprocate by referring the broker to their own contacts, thus expanding the social network of the broker (Baker, 1994).

DISCUSSION AND CONCLUSION

As we have highlighted throughout this paper, the roles and activities of knowledge brokers vary and need to be conceptualized by taking various settings and types of knowledge into account. The principal aim of this article was to develop an integrative framework. We have identified two types of knowledge brokerage that correspond to two principal roles in the prior literature: knowledge brokers as facilitators of knowledge transfer, and knowledge brokers as innovators. The first type of brokerage aims at facilitating knowledge flows. The knowledge broker's role is mainly that of an intermediary connecting existing actors and knowledge. The second type reaches aims at innovation, requiring a more complex and knowledge intensive brokerage process. Both forms of brokerage depend on environmental fragmentation and require social ties and specific capabilities on the type of broker. Whereas both types of knowledge brokerage differ in their purpose, and in the complexity and intensity of knowledge assimilation, they both respond to the same underlying logic of the knowledge brokerage process. Therefore, considering that the activities of the knowledge broker as an innovator include the knowledge brokers' knowledge transfer facilitator functions, can these two types of brokers be regarded as levels of brokerage? If so, can brokers taking the knowledge transfer facilitator role innovate? Which competences and resources are needed? These questions need a further theoretical and empirical elaboration.

Our overall process model (see Figure 1) highlighted the context of knowledge brokerage, assuming that the environmental fragmentation and the specific social position of the

knowledge broker influence the feasibility and the nature of the core processes of knowledge brokerage, acquisition, integration, and translation. Knowledge acquisition describes how knowledge brokers access different communities and obtain different types of knowledge (Hargadon, 1998, 2002; Pawlowski & Robey, 2004). Knowledge integration in our model refers to the cognitive aspect of knowledge brokerage where the acquired knowledge is manipulated and recombined (Hargadon, 1998, 2002; Hammami & al., 2013). Finally, knowledge translation describes the communicative process by which knowledge is reframed for every particular target context in order to ensure successful implementation. For each of these processes, we have identified conditions and mechanisms ranging from the management of the knowledge broker's position to the development of specific strategies for crossing social boundaries. Finally, our model points to several outcomes of knowledge brokerage that involve both successful knowledge implementation and the evolution of the broker's position.

The evolution over time of the broker's position warrants further discussion. Knowledge brokers bridge disconnected fields and fill structural holes. In doing so, they reduce network fragmentation and increase network density. In the long run, this could put the knowledge broker's position in jeopardy and eventually make its role superfluous. However, the act of connecting disparate network actors is not necessarily self-sacrificing, because it may, over time, also create more indirect advantages (Obstfeld, 2005). Despite that insight, it is not clear if such indirect advantages will be significant enough to compensate for a loss of the direct advantages a broker initially incurs.

Several other aspects addressed in our model and discussed in this paper point towards opportunities for future research. First, in spite of some hints in the more practitioner-oriented literature, empirical studies concerning the specific skills, organizational characteristics, and personality traits needed for effective knowledge brokerage are largely missing, and we suggest that future research could identify the specific skills necessary to effectively engage in these two types of knowledge brokerage. Similarly, organizational support plays an important role in stimulating knowledge brokerage. In their recent study, Hammami & al. (2013) demonstrated that organizational climate can promote willingness and motivation to broker and transfer knowledge. However, we know much less about other organizational factors such as organizational culture or organizational identity. A common hypothesis about organizational culture is that if an organization possesses a ‘strong culture’ it will perform at a higher level of productivity (e.g., Marcoulides & Heck, 1993). Similarly, organizational

identity provides organizational members with a shared way of interpreting events in their organizational life (Dutton & Dukerich, 1991). On the other hand, we would expect both strong culture and identity to be negatively associated with the ability to cross organizational and epistemic boundaries, and therefore question their association with successful brokerage. Empirically, we would invite research to address the balance of identity and openness required for effective knowledge brokerage.

Recently, Ahuja, Zaheer & Soda (2012) emphasized the extensive body of knowledge on network outcomes and on how network structures contribute to the creation of outcomes at different levels of analysis, but also stressed that less attention has been paid to understanding how and why organizational networks emerge, evolve, and change. We observe a similar situation in the knowledge brokerage literature. Most studies consider the broker's network position as static, and the broker's ties as relatively stable. In real life, and as suggested by our model, however, social networks are dynamic, ties are created and dismantled, some are weakened, and some others strengthened. As the social network is the main source of knowledge for the knowledge broker, it is important to understand these dynamics. Moreover, the critical question, how an organization moves, over time, into a position that allows it to engage in effective brokerage is not yet treated in the literature. What strategies do knowledge brokers use to create a valuable network and how do they develop and defend their positions as brokers? Based on our ideas above, we strongly invite future research to address these questions.

To conclude, this paper has combined various streams of literature on the topic of knowledge brokerage, proposed an integrative, dynamic process model and identified several opportunities for future theoretical and empirical research. We believe that ever more fragmented societies and economies provide steadily increasing opportunities for knowledge brokerage as well as an increasing need for empirically grounded knowledge enabling the design of effective brokerage roles in the future.

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REFERENCES

Ahuja, G., G. Soda et A. Zaheer (2012), The genesis and dynamics of organizational networks. Organization Science, 23: 2, 434-448.

Ancona. D. G.et D. F. Caldwell (1992), Bridging the Boundary: External Activity and Performance in Organizational Teams, Administrative Science Quarterly *37:4*, 634-665.

Argote, L., B. McEvily et R. Reagans (2003), Managing knowledge in organizations: An integrative framework and review of emerging themes, Management science, 49: 4, 571-582.

Baker, W.E. (1994), Networking smart: How to build relationships for personal and organizational success, New York: McGraw-Hill.

Borgatti, S. P. et R. Cross (2003), A relational view of information seeking and learning in social networks, Management science, 49: 4, 432-445.

Brass, D.J., J. Galaskiewicz, H.R. Greve et W. Tsai (2004), Taking stock of networks and organizations: A multilevel perspective, Academy of Management Journal 47, 795–817

Brown, J. S. et P. Duguid (1998), Organizing knowledge, California management review, 40: 3, 91.

Brown, J. S. et P. Duguid (2001), Knowledge and organization: A social-practice perspective, Organization science, 12: 2, 198-213.

Burt, R. S. (1992), Structural Holes, Cambridge: Harvard University Press.

Burt, R. S. (2001), Structural holes versus network closure as social capital, Social capital: Theory and research, 31-56.

Burt, R. S. (2004), Structural holes and good ideas, American journal of sociology, 110: 2, 349-399.

Canadian Health Services Research Foundation (2003), The theory and practice of knowledge brokering in Canada's health system, Ottawa: Canadian Health Services Research Foundation, www.chsrf.ca/brokering/pdf/Theory_and_Practice_e.pdf.

Carlile, P.R. (2004), Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge across Boundaries, Organization Science, 15: 5, 555-568

Chesbrough, H. et A. K Crowther (2006), Beyond high tech: early adopters of open innovation in other industries, R&D Management, 36: 3, 229-236.

Cillo, P. (2005), Fostering Market Knowledge Use in Innovation: The Role of Internal Brokers, European Management Journal, *23*:4, 404-412.

Cohen, W. M., et D. A Levinthal (1990), Absorptive capacity: a new perspective on learning and innovation, Administrative science quarterly, 35:1, 128-152.

Conklin, J., E. Lusk, M. Harris et P. Stolee (2013), Knowledge brokers in a knowledge network: the case of Seniors Health Research Transfer Network knowledge brokers. Implementation Science, *8*:1, 1-10.

Dahl, D.W. et P. Moreau (2002), The influence and value of analogical thinking during new product ideation, Journal of Marketing Research, 39; 47-60.

Dobbins, M., P. Robeson, D. Ciliska, S. Hanna, R. Cameron, L. O'Mara et S. Mercer (2009), A description of a knowledge broker role implemented as part of a randomized controlled trial evaluating three knowledge translation strategies, Implementation science, 4: 23, 1-16.

Dutton, J. E. et J. M. Dukerich (1991), Keeping an eye on the mirror: Image and identity in organizational adaptation, Academy of management journal, *34*: 3, 517-554.

Fleming, L., S. Mingo et D. Chen (2007), Collaborative brokerage, generative creativity, and creative success, Administrative Science Quarterly, *52*: 3, 443-475.

Friedland, R. et R. R. Alford (1991), Bringing society back in: Symbols, practices and institutional contradictions, Chicago: University of Chicago Press.

Gassmann, O., M. Daiber et E. Enkel (2011), The role of intermediaries in cross-industry innovation processes, R&D Management, 41: 5, 457-469.

Goel, A. K. (1997), Design, analogy, and creativity, IEEE expert, *12*: 3, 62-70.

Gould, R. et R. Fernandez (1989), Structures of mediation: A formal approach to brokerage in transaction networks, Sociological Methodology,19, 89-126.

Hammami, H., N. Amara et R. Landry (2013), Organizational climate and its influence on brokers' knowledge transfer activities: A structural equation modeling, International Journal of Information Management, 33, 105–11.

Handley, K., A. Sturdy, R. Fincham et T. Clark (2006), Within and Beyond Communities of Practice: Making Sense of Learning Through Participation, Identity and Practice, Journal of management studies, 43: 3, 641-653.

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

Hargadon, A. et R. I. Sutton (1997), Technology brokering and innovation in a product development firm, Administrative science quarterly, 716-749.

Hargadon, A. (1998), Firms as knowledge brokers, California management review, *40*: 3, 209-227

Hargadon, A. B. (2002), Brokering knowledge: Linking learning and innovation, Research in Organizational behavior, *24*, 41-85.

Hsu, D. H. et K. Lim (2013), Knowledge Brokering and Organizational Innovation: Founder Imprinting Effects, Forthcoming in Organization Science.

Inkpen, A. C., et E. W. Tsang (2005), Social capital, networks, and knowledge transfer, Academy of management review, *30*: 1, 146-165.

Kidwell, D. K. (2013), Principal investigators as knowledge brokers: A multiple case study of the creative actions of PIs in entrepreneurial science, Technological Forecasting and Social Change, *80*: 2, 212-220.

Kim, L. (1998), Crisis construction and organizational learning: Capability building in catching-up at Hyundai Motor, Organization science, 9:4, 506-521.

Klerkx, L. et C. Leeuwis (2009), Establishment and embedding of innovation brokers at different innovation system levels: Insights from the Dutch agricultural sector, Technological Forecasting and Social Change, 76:6, 849-860.

Lakhani, K. R., L. B. Jeppesen, P. A. Lohse et J. A. Panetta (2008), The value of openness in scientific problem solving, Harvard Business School Working Paper No. 07-050.

Landry, R., M. Lamari et N. Amara (2003), The extent and determinants of the utilization of university research in government agencies, Public Administration Review, 63: 2, 192-205.

Lave, J. (1988), Cognition in practice: Mind, mathematics and culture in everyday life, Cambridge: Cambridge University Press.

Levina, N. et E. Vaast (2005), The emergence of boundary spanning competence in practice: implications for implementation and use of information systems, MIS Quarterly, 29: 2, 335-363.

Lomas, J. (2007), The in-between world of knowledge brokering, BMJ: British Medical Journal, *334*:7585, 129-132.

Marcoulides, G. A. et R. H. Heck. (1993), Organizational culture and performance: Proposing and testing a model, Organization science, *4*: 2, 209-225.

Mowery, D. C., J. E Oxley et B. S. Silverman (1996), Strategic alliances and interfirm knowledge transfer, Strategic management journal, *17* , 77-91.

Nelson, R. R. (ed.) (1993), National Innovation Systems: A Comparative Analysis, Oxford: Oxford University Press.

Nelson, R. R. et S. G. Winter (1982), The Schumpeterian tradeoff revisited, The American Economic Review, *72*: 1, 114-132.

Nonaka, I. (1995), The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation: How Japanese Companies Create the Dynamics of Innovation. New York: Oxford university press.

Nooteboom, B., W. Van Haverbeke, G. Duysters, V. Gilsing et A. Van den Oord (2007), Optimal cognitive distance and absorptive capacity, Research Policy, 36: 7, 1016-1034.

Obstfeld, D. (2005), Social networks, the tertius iungens orientation, and involvement in innovation, Administrative science quarterly, 50: 1, 100-130.

Oh, H. Nt M. Kilduff (2008), The ripple effect of personality on social structure: self-monitoring origins of network brokerage, Journal of Applied psychology, 93:5, 1155-1164.

Polanyi, M. (1958), Personal Knowledge: Towards a Post-Critical Philosophy, Chicago: University of Chicago Press.

Reagans, R. et B. McEvily (2003), Network structure and knowledge transfer: The effects of cohesion and range, Administrative science quarterly, *48*: 2, 240-267.

Robeson, P., M. Dobbins et K. DeCorby (2008), Life as a knowledge broker in public health, Journal of the Canadian Health Libraries Association, 29:3, 79-82.

Russell, D. J., L. M Rivard, S. D. Walter, P. L. Rosenbaum, L. Roxborough, D. Cameron et L. M. Avery (2010), Using knowledge brokers to facilitate the uptake of pediatric measurement tools into clinical practice: a before-after intervention study, Implementation Science, 5:1, 92.

Sasovova, Z., A. Mehra, S. P. Borgatti et M. C. Schippers (2010), Network churn: The effects of self-monitoring personality on brokerage dynamic, Administrative Science Quarterly, 55:4, 639-670.

Spender, J. C. (1996), Making knowledge the basis of a dynamic theory of the firm. Strategic management journal, 17, 45-62.

Stuart, T. E., S. Z. Ozdemir et W.W. Ding (2007), Vertical alliance networks: The case of university–biotechnology–pharmaceutical alliance chains, Research Policy, *36*: 4, 477-498.

Szulanski, G. (1996), Exploring Internal Stickiness: Impediments to the Transfer of Best Practice within the Firm, Strategic Management Journal, 17, 27-43.

Teece, D. J., G. Pisano et A. Shuen (1997), Dynamic capabilities and strategic management. Strategic management journal, 18: 7, 509-533.

Tsai, W. (2002), Social structure of "coopetition" within a multiunit organization: Coordination, competition, and intraorganizational knowledge sharing, Organization science, 13:2, 179-190.

Tsai, W. et S. Ghoshal, 1998), Social capital and value creation: The role of intrafirm networks, Academy of management Journal, *41*: 4, 464-476.

Verona, G., E. Prandelli et M. Sawhney (2006), Innovation and virtual environments: towards virtual knowledge brokers, Organization Studies, *27*:6, 765-788.

Ward, V., S. Smith, A. House et S. Hamer, (2012), Exploring knowledge exchange: a useful framework for practice and policy, Social Science & Medicine, 74:3, 297-304.

Weber, R. A. et C. F. Camerer, (2003), Cultural conflict and merger failure: An experimental approach, Management Science, *49*:4, 400-415.

Weick, K. E. (1995), What Theory Is Not, Theorizing Is, Administrative Science Quarterly, 40:3, 385-390.

Wenger, E. (1998), Communities of practice: Learning, meaning, and identity, New York: Cambridge university press.

Williams, P. (2003), The competent boundary spanner, *Public administration*, 80:1, 102-124

Winch, G. M. et R. Courtney (2007), The organization of innovation brokers: An international review, *Technology analysis & strategic management*, *19*:6, 747-763.

Worren, N., K. Moore et P. Cardona (2002), Modularity, strategic flexibility, and firm performance: a study of the home appliance industry, Strategic Management Journal, *23*: 12, 1123-1140.

Zaheer, A. et G. Soda (2009), Network evolution: The origins of structural holes, Administrative Science Quarterly, *54*:1, 1-31.

Zaheer, A., B. McEvily et V. Perrone, (1998), Does trust matter? Exploring the effects of interorganizational and interpersonal trust on performance, Organization science, *9*: 2, 141-159.