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Intermediary Institutions and Embeddedness in Technology Networks

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ABSTRACT

A wide literature in strategic management is dedicated to the study of technology networks as a locus of innovation. They shape an organizational field in which strategic alliances leverage firm capabilities to generate new knowledge and access complementary assets. Much less attention, however, has been focused on the role played by other particular players - that we label 'intermediary institutions' - in the institutional foundation of those networks. In the present paper, our intent is to highlight the choice made by alliance partners, members of a same technology network, to have recourse to services proposed by 'intermediary institutions' in order to ease their alliance relationships. We propose an analysis of the impact of this choice on the institutional design of the network as a whole. We argue that by backing up a firms' alliance activities, 'intermediary institutions' deepen the relational, structural and cognitive embeddedness of the firm within its network. In turn, reinforced embeddedness helps go beyond the conflict between 'trying to learn' and 'trying to protect', typical of technology networks, and so enhances the viability of the network as a whole.

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INTRODUCTION

Albeit a wide literature in the field of business economics and strategic management is dedicated to the inter-organizational networks, the great majority of papers have been focused on the inter-firm relationships within the networks. By comparison, the role of other players than firms in the network and their contributions to its functioning have received limited attention (Provan and Kenis 2006; Provan et al. 2007). Following the organizational economics reasoning, however, we suppose that their *raison d'être* follows efficiency purposes: without them, the network on a whole would be very unlikely to strive and even to survive in some cases.

In this study we thus examine the role of 'intermediary institutions' in technology networks. As pointed out by Howells (2006), these institutions refer to third parties, bridgers, brokers and other forms of intermediaries: examples in technology networks are industry federations, chambers of commerce, auditing firms, incubators, technology transfer offices or technology brokers. In this theoretical contribution, we argue that services developed by 'intermediary institutions' increase firms'embeddedness within the technology network. Therefore, they substantially help reduce the tensions between 'trying to learn' and 'trying to protect' which are inherent to corporate inter-organizational relations. The positive externalities within the networks are supported by the firms as long as they are superior to the costs they create. To the best of our knowledge, this paper is one of the first attempts to explain the economic rationale behind these intermediary institutions.

The paper proceeds as follows. In the first section, we examine the internal conflict that technology strategic alliances face - namely the conflict between 'trying to learn' and 'trying to protect', and show how relational, structural, and cognitive embeddedness contributes to dealing with this internal conflict. In the second section, we develop propositions regarding the impact of

support services offered by 'intermediary institutions' on the relational, structural, and cognitive embeddedness of the firm within its network.

EMBEDDEDNESS AND CONFLICT BETWEEN 'TRYING TO LEARN' AND 'TRYING TO PROTECT' IN TECHNOLOGY NETWORKS

Internal conflict of technology strategic alliances: 'trying to learn' versus 'trying to protect'

Although firms realize numerous benefits by participating in strategic alliances, alliances have to deal with challenging tensions between 'trying to learn' and 'trying to protect', which are particularly prevalent in learning alliances (Gulati and Singh 1998; Kale, Singh and Perlmutter 2000). Tensions stem from the fact that, on one hand, firms participate in alliances to learn know-how and capabilities from their alliance partners and, on the other hand, firms want to protect themselves from the behavior of their partners which have similar incentives (Kale et al. 2000). Indeed, during the value creation process, each partner of a technology alliance has to expose proprietary assets to the other(s). Any firm has opportunities to learn from its partner(s). Consequently, beyond usual concerns on the real efforts of each partner within the alliance (free riding), these absorption and learning issues raise concerns on the externalities generated by the cooperation; i.e. independent redeployments of new assets or competences into other projects and dilution of specific corporate competitive advantage.

As a result, on the one hand, alliance partners will try to get new information and knowledge from the other parts that could be used for other purposes than the cooperation's ones themselves. Since partners do not 'unlearn', they will try to build on their new skills and capabilities and exploit them in other projects. On the other hand, each alliance partner will prefer to protect its

own assets and competences which are core; otherwise it will be at risk to loose the basis of competitive advantage. In other words, the perspective of value appropriation inhibits the process of value creation but value appropriation is meaningless without value creation upstream.

Hierarchy and Embeddedness in Technology Networks

Several ways to cope with these tensions have been explored in the literature. First, the transaction cost literature on strategic alliances suggests that this problem can be mitigated by the choice of more hierarchical modes of governance (e.g., Williamson 1991; Oxley 1999). Basically, when partners cannot set up an agreement on value appropriation, they will opt for an equity agreement (equity joint venture). In that case, the strategic alliance is governed by a bilateral hierarchy, which is more able to closely coordinate and monitor the partners inside the alliance via enhanced communication, organizational routines, and necessity for continuous collaboration (Kogut 1988). Such solution, however, suffers from limitations: (1) it implies that partners support bureaucratic costs; (2) it does not allow controlling for partners' behavior outside the alliance; and (3) it remains depending on the external credibility to enforce the decisions of partners in case of conflicts.

Second, as pointed out by Kale et al. (2000), the inter-organizational network literature investigates the mechanism of social embeddedness in alliances. Social embeddedness has been introduced in economic sociology by Granovetter (1985) and has been extensively studied by Gulati (e.g., Gulati 1995; Gulati 1998; Gulati and Garguilo 1999; Gulati and Singh 1999). Following Nahapiet and Goshal (1998), we differentiate social embeddedness in relational embeddedness, structural embeddedness and cognitive embeddedness. These three types of

embeddedness enable to balance the tensions between learning and protecting knowledge in technology networks (Figure 1).

First, relational embeddedness is relative to the quality and depth of a dyadic tie (Granovetter 1985,1992; Uzzi 1996,1997; Jones, Hesterly and Borgatti 1997). As explained by Jones, Hesterly and Borgatti (1997), it captures the degree to which exchange parties consider one another's need and goals (Granovetter 1992) and the behaviors exchange parties exhibit, such as trust, confiding, and information sharing (Uzzi 1997). Relational embeddedness resulting from prior cohesive ties between alliance partners allows to mitigate the tensions between 'trying to learn' and 'trying to protect' since prior cohesive ties increase the mutual trust, respect, and friendship for subsequent cooperation (Podolny 1994; Burt and Knez 1995; Gulati 1995; Gulati and Gargiulo 1999). So as shown by Kale et al. (2000), relational capital facilitates learning through close interactions between alliance partners. Simultaneously, it creates a strong deterrent effect on potential opportunistic behavior aimed at unilaterally absorbing or stealing information or know-how that is core or proprietary to its partners.

Second, structural embeddedness reflects the extent to which *"a dyad's mutual contacts are connected to one another"* (Granovetter 1992). In other words, structural embeddedness means that parties may have relationships with the same third party, and are therefore indirectly linked (Granovetter 1985, 1992; Uzzi 1996,1997; Jones et al. 1997). The underlying tenet of the structural embeddedness dimension is that inter-firm networks cannot be validly decomposed into independent 'bilateral monopolies' (Baker 1990; Simsek, Lubtakin and Floyd 2003). The study of the influence of social relationships on the firm behaviors requires to go beyond the firm dyads as unit of analysis (Granovetter 1992) and the focus of analysis shifts from direct communication to indirect channels for information and reputation effects (Gulati and Gargiulo 1999). Structural embeddedness enables to mitigate the tensions between 'trying to learn' and 'trying to protect'

for reasons that have notably been stressed by Gulati and Gargiulo (1999). When two firms share common ties, it signals that both are considered as suitable and trustworthy by the same firms. Moreover, common third-party ties contribute to creating a reputational lock-in and opportunistic behavior may be reported. This spiral effect serves as an effective deterrent (Raub and Wessie 1990; Burt and Knez 1995).

Third, cognitive embeddedness refers to the proximity in the representation, interpretation, and systems of meaning among firms *(*Abrahamson and Fombrun 1994; Nahapiet and Ghoshal 1998*;* Simsek et al. 2003). Cognitive embeddedness also contributes to mitigating the tensions between 'trying to learn' and 'trying to protect' since it fosters a network culture notably based on converging expectations (Williamson 1991), an idiosyncratic language to summarize complex routines and information (Williamson 1975, 1985) and to define broad rules for action under uncertainty (Camerer and Vepsalainen 1988).

Insert Figure 1 about here

While some arguments can be found in the existing literature to explain how these three attributes of social embeddedness contribute to balancing the tensions between 'trying to learn' and 'trying to protect', this issue has received very limited attention. In our opinion, stressing the role played by 'intermediary institutions' at this level gives new insights into how social embeddedness of alliance partners within a technology network helps mitigate tensions within the network as a whole.

LINK BETWEEN INTERMEDIARY INSTITUTIONS AND EMBEDDEDNESS IN TECHNOLOGY NETWORKS

In this section, we examine the impact of 'intermediary institutions' on the firm's embeddness in its technology network. We consider 'intermediary institutions' as entities that offer service(s) to firms aiming at facilitating their alliance activities. Examples of 'intermediary institutions' in technology networks are collective research centers, industry federations, chambers of commerce, auditing firms, incubators, technology transfer offices or technology brokers. Ten support services in the innovation process have been identified by Howells (2006): (1) foresight and diagnostics, (2) scanning and information processing, (3) knowledge processing, generation, and combination, (4) gate keeping and brokering, (5) testing, validation, and training (6) accreditation and standards, (7) regulation and arbitration, (8) protecting the results, (9) commercializing and exploiting the outcomes, (10) assessment and evaluation.

While these ten support services are essentially dedicated to support a specific strategic alliance, they impact on the technology network in which the alliance is embedded due to the organizational mechanisms they implement. Through their support services, 'intermediary institutions' have the ability to strongly influence the innovation culture and content of the network (i.e. which innovation approach to foster), to reinforce the reputational lock-in within the network, to reduce the information asymmetry among the members of the network, to implement a formal or informal dynamic of control within the network, to propose coordination tools to network's members, and to impose a formal or informal regulation via procedures such as arbitration and collective sanctions.

Starting from the ten functions of intermediary institutions, we develop propositions about the link between intermediary institutions and the firm's relational, structural and cognitive

embeddedness within its technology network. Thereby we differentiate five groups of support services of intermediary institutions:

(I) Intermediary institutions involved in (1) foresight and diagnostics, (2) scanning and information processing, (3) knowledge processing, generation, and combination

These support services respond to the firms' potential need for help to *"identify what they might need from partners or even more generally what their innovation and business strategy should be"* (Howells 2006). In that respect, some 'intermediary institutions' provide firms with scanning and technology intelligence advices in order to help firms identify where they should be searching and seeking information in the first place. They are involved in support services relative to technology foresights and forecasting, and articulation of needs and requirements. They are dedicated to complementing corporate technology intelligence and search support services. The third support service goes further than foresight, diagnostics and scanning and consists either in combining the collected information from foresight, diagnostics and scanning with the firm's specific knowledge or in generating in-house research and technical knowledge to combine with the firm's knowledge (Howells 2006).

When guiding firms at these preliminary levels, 'intermediary institutions' have the ability to strongly influence the content of networks in terms of *which innovation approach* to foster within networks. This allows them to favor, at the same time, a network innovation culture through convergence of expectations and idiosyncratic language to summarize complex routines and information. A consistent innovation culture will be determining to ease and enhance the future collaboration within the network.

The first class of support services reinforces the cognitive embeddedness within the technology network. A consistent innovation culture contributes to harmonizing the representations, interpretations, and system of meaning among firms, and so to fostering the cognitive embeddedness (Nahapiet and Ghoshal 1998; Provan et al. 2007). The earlier the intervention of 'intermediary institutions' in the innovation process, the stronger their ability to influence the network innovation culture, and so the higher the cognitive embeddedness.

Proposition 1: 'intermediary institutions' involved in foresight and diagnostics, scanning and information processing, and/or knowledge processing, generation, and combination have a positive impact on the cognitive embeddedness.

(II) Intermediary institutions involved in (4) gatekeeping and brokering

This support service consists of matchmaking and brokering collaborative deals for the client firm(s) on the one hand, and in providing contractual advice, on the other hand (Howells 2006). The main difficulty firms may face in determining with whom to ally is to obtain information about the competencies, needs, and reliability of potential partners (Van de Ven 1976; Stinchcombe 1990; Gulati and Gargiulo 1999). As pointed out by Gulati and Gargiulo (1999), because of imperfect information within networks, partners experience high search costs and opportunism risks. 'Intermediary institutions' contribute to mitigating this difficulty since they may serve as formal or informal repositories of information about players' resources, capabilities and needs on the one hand, and about players' reputation, on the other hand.

First, regarding the information about players' resources, capabilities, and needs, the role of 'intermediary institutions' is to collect and disseminate it. They thus enable firms to gather

superior information on each other (Gulati 1995; Gulati et al. 2000) and to identify potential partners and learn about their resources and capabilities. Second, obtaining information about players' reputation is particularly crucial within technology networks since the assets are often characterized by high relationship-specificity and represent sunk costs that have little value outside of the particular exchange relationship. Therefore, the continuity of the relationship within technology networks is highly valued and, in the presence of opportunism, the relationship-specificity poses a serious safeguarding problem. 'Intermediary institutions' may allow to avoid allying with recurrent opportunistic partners since they may have a higher ability to collect, convey information, and to publicize defaults under the rules within the network[3] (Hadfield 2000).

This group of support services reinforces the structural embeddedness within the technology network. As a result, 'intermediary institutions' allow to complement information stemming from structural embeddedness about competences, needs, and reliability of firms. Indeed, when considering the structural embeddedness, the focus of analysis is indirect channels for information and reputation effects (Gulati and Gargiulo 1999). In this line, 'intermediary institutions' may be considered as additional nodes that develop for themselves numerous direct and indirect links since intermediaries are at the nexus of a web of multiple vertical and horizontal relationships (Howells 2006).

We can therefore suggest, on the basis of the network centrality arguments (Freeman 1979; Krackhardt 1990; Gulati and Gargiulo 1999), that the more central the informational position of these intermediary institutions is, the more accurate their own representation of the existing network is, the more efficient their impact on the decisions about new cooperative ties can be.

[3] They can serve as repositories of players' reputational information regarding, for instance, the debts unpaid or the low-quality goods delivered.

Central organizations have a larger 'intelligence web' through which they can learn about collaborative opportunities, hence lowering their level of uncertainty about partnerships (Gulati 1999). Given the informational benefits 'intermediary institutions' get from being in a central position, they allow firms to go beyond their proximate direct and indirect ties.

Proposition 2: 'intermediary institutions' involved in gate keeping and brokering have a positive impact on the structural embeddedness.

(III) Intermediary institutions involved in (5) testing, validation, and training

This support service involves (1) testing, diagnostics, analysis and inspection, (2) prototyping and pilot facilities, (3) scale-up, (4) validation, and (5) training. At this level of the innovation process, 'intermediary institutions' may put at the firms' disposal their specialist facilities and/or may perform activities such as diagnostics, testing, prototyping, and training dedicated to facilitating the inter-firm collaboration (Howells 2006).

This group of support services reinforces the relational embeddedness in the technology network. Beyond the purpose of facilitating and supporting the inter-firm collaboration, those support services contribute to controlling the activities carried out by each party and its task performance on behalf of the other parties. This second purpose enables firms to mitigate risks from behavioral uncertainty and to reduce direct measurement costs (Eisenhardt 1985) of outputs and/or behaviors of other parties. As a result, testing, validation, and training support services correspond to coordination and control tools, which contribute to building trustworthy relationships favoring the consideration of one another's need and goals, the information sharing, and so the relational embeddedness.

Proposition 3: 'intermediary institutions' involved in testing, validation, and training have a positive impact on the relational embeddedness.

(IV) Intermediary institutions involved in (6) accreditation and standards work, (7) regulation and arbitration

'Intermediary institutions' generally play a key role in setting standards and norms, which formally drive the collaboration within the network. Second, 'intermediary institutions' are privileged vectors to diffuse values and foster a network culture (Jones 1996; Jones et al. 1997). These formal and informal regulations may lead to formal and/or informal schemes of collective sanction(s). As defined by Jones et al. (1997), collective sanctions are produced by group members against other group members because they violated the norms or the values of the network. Sanctions can go from rumors to exclusion and sabotage. Collective sanctions make the opportunism more costly since opportunistic behaviors damage not only the specific alliance in which one behave opportunistically, but also the other current and potential alliances (Blumberg 2001).

In addition, some 'intermediary institutions' may provide arbitration mechanisms. When opting for arbitration, parties voluntary agree to refer their dispute to an impartial third person and agree, in advance, to be bound by the decision of that person (Bonn 1972). These mechanisms enjoy sources of efficiencies over the public courts (Richman 2004; McMillan and Woodruff 2000; Hadfield 2000), and that is particularly true in the case of innovation. First, arbitrators are more expert and specialized than public courts and are chosen on the basis of their expertise regarding the subject matter in dispute. Second, specialized rules are tailored to the

idiosyncratic needs and transactional challenges of firms having recourse to a specific 'intermediary institution'. The principles guiding the dispute resolution process rest on custom rather than on law. Third, specialized procedures are used to act more swiftly, at lower costs, and with more nuances than public courts. They permit greater flexibility and higher speed in business relationships. Fourth, the arbitrator can consider information that could not be introduced in public court (Bonn 1972).

This group of support services reinforces the relational embeddedness within the technology network. The support services of accreditation, regulation, and arbitration may strongly impact on the network development. As pointed out by Sydow and Winderler (1998), the network development is not only the result of the use of resources, the use of rules and norms produced as steering mechanisms also drives the development of network. However, the influence of these rules on the network development is determined by the meaning the individual firms attach to them and so by the meaning, goals, and value of all firms within the network (Lipparini and Lomi 1999). These formal or informal rules and norms may support bilateral relationships and magnify their quality and depth since they contribute to increasing trust, confiding, information sharing, and to diminishing the uncertainty associated with future partnerships.

Proposition 4: 'intermediary institutions' involved in accreditation, and/or regulation and arbitration have a positive impact on the relational embeddedness.

(V) Intermediary institutions involved in (8) protecting the results, (9) commercialization, (10) evaluation of outcomes

The services (8 and 9) are respectively associated with protecting and commercializing the outcomes of innovation and collaboration (Howells 2006). They consist respectively in providing IP advice and management, and in identifying market opportunities, developing business plans and assessing and providing filtering capability for funding. The tenth support service is relative to the assessment and evaluation of 'post innovation' (Howells 2006). These support services reinforces the cognitive embeddedness within the technology network. When guiding firms at these downstream stages in the innovation process, 'intermediary institutions' have the ability to influence current and future content of networks in terms of *which innovation approach* to foster. This stems from the fact that they help both firms and the network to gain legitimacy, on the one hand (support services 8 and 9), and they work for assuring a continuous updating of the network innovation content (support service 10), on the other hand.

Proposition 5: 'intermediary institutions' involved in protecting the results, commercialization, and/or evaluation of outcomes have a positive impact on the cognitive embeddedness.

Table 1 provides a synthetic view of the five propositions. 'Intermediary institutions' strongly contribute to reinforcing the social embeddedness of firms within their technology network. Search costs and opportunistic behaviors are substantially lowered for firms in the network (by comparison with a world without any intermediary institutions). Firms within the network are less exposed to the tensions between 'trying to learn' and 'trying to protect' and are more focused

on their innovative effort. Without being directly innovation producers, intermediary institutions are thus active supports in innovative processes.

Insert Table 1 about here

CONCLUSION

The aim of the present paper was to shed light on the critical role played by 'intermediary institutions' in balancing the conflicting objectives between 'trying to learn' and 'trying to protect' in technology networks. We argue that the choice made by a firm to have recourse to support services offered by 'intermediary institutions' for its alliance activities reinforce its relational, structural, and cognitive embeddedness, and so mitigates the tensions between learning and protecting inside its strategic alliances.

This paper is a first attempt to explicitly address the *raison d'être* of these particular governance mechanisms that contribute to designing the institutional foundation of technology networks. However, further research is necessary to empirically evaluate and generalize our results. In addition, we can derive the following implications for future research. First, management studies on networks need to adopt a broader view than investigating the dyadic structure of inter-organizational alliances. Apart from few exceptions (Provan et al. 2007), this is a very underexplored research issue. A better understanding of network governance would be also useful for decision makers. We are in a time of public policies claiming that innovation is at the first rank and many projects are launched to back up clusters, regional initiatives, innovation platforms, etc. More research findings at the network level could help to establish successful

strategic initiatives. The present contribution on the institutional intermediaries is an effort in that direction.

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Figure 1 Social embeddedness and the limitation of conflicts in technology strategic alliances

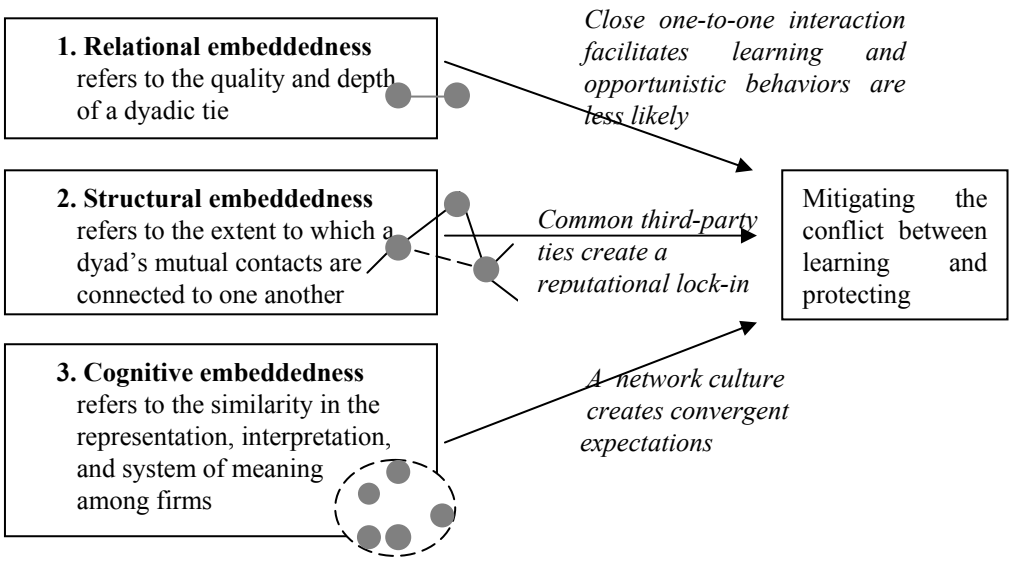
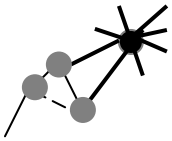
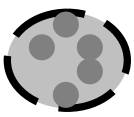


Table 1 Social embeddedness and support services of the 'intermediary institutions' in the innovation networks

Embeddedness Reinforced	**Organizational Mechanisms**	**Support services of 'intermediary institutions' in the innovation process** (based on Howells 2006)
Relational embeddedness 	Coordination tools + Control mechanisms	5. Testing, validation, and training
	Arbitration mechanisms + Collective sanction mechanisms	6. Accreditation and standards
		7. Regulation and arbitration
Structural embeddedness 	Information asymmetry reduction mechanisms + Reputation mechanisms	4. Gatekeeping and brokering
Cognitive embeddedness 	Content definition mechanisms	1. Foresight and diagnostics
		2. Scanning and information processing
		3. Knowledge processing, generation, and combination
	Content definition mechanisms	8. IP: Protecting the results
		9. Commercialization: exploiting the outcomes
		10. Assessment and evaluation