Learning in inter-organizational networks: an individual perspective

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ABSTRACT

This paper emphasizes the role of individuals in explaining firm learning through network. Focusing on firm learning as the extent to which key individuals involved in the alliance learn, we consider learning as the process of acquisition or creation of new knowledge through interactions between individuals. We assume that individual experiences are subsequently converted to organizational properties (physical capital, routines and organizational culture). Thus, we develop and test a model linking the social network theory to the learning theory. We aim to explain the personal relationships as an important determinant of the absorptive capacity of individuals in inter-organisational networks (ION). Our empirical work show that weak and heterogeneous ties between key individuals in an ION are central mechanisms that influence the firm's ability to capitalize on external information through the ability of individuals to access, assimilate, transform and utilize information (e.g., absorptive capacity). Nevertheless, indirect ties does not show a positive impact on absorptive capacity as it was hypothesised. Our findings add to the literature on the role of individuals in inter-firm learning either on focusing on personal relationships or by stressing his own information processing capabilities.

Keywords: Inter-organizational network, individual's absorptive capacity, personal network, PLS analysis

1 Introduction

Absorptive capacity is a dynamic capability relating to knowledge creation and utilization that enhances a firm's ability to gain and sustain a competitive advantage. Past research show that interactions and connections of firms with external organizations would reinforce their absorptive capacity and thus, improve inter-organizational learning (Kalkstein, 2007; Lee, Fayard, Kettinger, & Leitch, 2009; Lofstrom, 2000; Ma, Yao, & Xi, 2009; Noblet & Simon, 2010).

From a strategic perspective, research have focused either on the organizational mechanisms facilitating the absorption of external knowledge by firms or on the set of inter-organizational processes that allows the collaborating firms to systematically identify and transfer valuable know-how. However, the need to manage knowledge in inter-firm relationships through a social lens has been relatively neglected. This led to an under-socialized vision of inter-firm learning, widening the gap between the strategic perspective and the social perspective when studying inter-organizational networks (ION).

In addition, as we could note, conceptualization of absorptive capacity, although they are quite supplied and different (ex. Cohen and Levinthal, 1990; Lane and Lubatkin, 1998; Todorova and Dursin, 2007; Zahra and George, 2002), do not grant a place to individuals within the firm. To our knowledge, previous works on individual's absorptive capacity are still rare (ex. Deng, Doll, & Cao, 2008; Park, Suh, & Yang, 2007). However, the comprehension of the organization and its behavior requires the knowledge of its members and passes by a comprehension of their own behaviors.

In order to fill these two theoretical gaps, our objective is to re-examine a social determinant of inter-organizational learning capacity by privileging an individual perspective. For this reason,

we undertook to analyze the aspects of the personal network which determine the absorptive capacity of individuals within an ION context.

We seek to answer the following research question: to what extent personal networks of firm members can influence their individual absorptive capacity in an inter-organizational network context?

Our research contributes to fueling the elementary literature highlighting the importance of interpersonal relationships in the strategic alliance success (Adobor, 2006; Hu & Korneliussen, 1997; Lofstrom, 2000; Ma, Yao, & Xi, 2009). Thus, we offer an original conceptualization of external antecedents of absorptive capacity in an inter-organizational context.

To test our research question, an investigation was carried out through face-to-face questionnaires administrated to people in firms that are members of export consortia in Tunisia. The collected data were analyzed by the structural equations approach based on PLS techniques available in XLSTAT-PLSPM software (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005).

The paper delineates the strategic role of weak ties, indirect ties and heterogeneous ties in impacting knowledge acquisition, assimilation, transformation and exploitation from external partners.

The findings have also some important implications for employees and managers on how to obtain superior learning from external sources.

In the next section, we discuss the existing literature and build up our hypotheses. Then, we present our data collection, analysis variables and results. Finally, we discuss our contribution to the literature and shed light on consequences of our study.

2 Theoretical gaps in the literature on absorptive capacity

In their seminal work, Cohen et Levinthal (1990) argue that one of the most important ways for people to learn new ideas is to combine these ideas with what they already know in order to identify the value of new resources, to assimilate them and to apply them to commercial ends. They call this capacity: absorptive capacity. Later, other articles have added to the original concept proposed by Cohen and Levinthal (1990) (For a literature review see for example: Easterby-Smith, Graça, Antonacopoulou, & Ferdinand, 2010 and Volberda, Foss, & Lyles, 2009).

As we can see it, literature reviews show that absorptive capacity underwent, since its appearance, several attempts of reconceptualization as well as many practical applications on different levels of analysis such as the firm, co-operative relationships, countries, etc.

In the following paragraph, we carry out some distinctions in existing absorptive capacity conceptualizations highlighting the need to focus attention on social and human dimensions when conceptualizing absorptive capacity and its determinants in an ION context.

2.1 *Capability view vs. relational view of absorptive capacity*

The conceptualization of absorptive capacity can be divided into two categories. A first category of research considers absorptive capacity as the organizational mechanisms that facilitate the acquisition, assimilation, transformation, and exploitation of relevant internal and external knowledge. Kalkstein (2007) labeled this category by the “capability view” of absorptive capacity (e.g., Lane et al, 2006; Lee et al., 2009; Lofstrom, 2000; Zahra and George, 2002; Lin, Fang, Fang, & Tsai, 2009).

The second category of research refers to absorptive capacity by the set of inter-organizational processes that allows the collaborating firms to systematically identify and transfer valuable

know-how. Kalkstein (2007) calls this category: the “relational view” of absorptive capacity (e.g., Grünfeld, 2003; Kim & Inkpen, 2005; Lane & Lubatkin, 1998; Malhorta, Gosain, & El Sawy, 2005). This approach of absorptive capacity is largely dictated by the relational view of the firm (Dyer & Singh, 1998). In this perspective, many works were carried out following the article of Lane & Lubatkin (1998) on specific absorptive capacity. The majority of works examining the absorptive capacity in strategic alliances borrow this approach.

Although useful for understanding inter-organizational relationships, the relational approach shows some flaws to explain the mechanisms through which inter-firm interactions lead to the creation of a competitive advantage. In this vein, works have developed within the social network approach to show that the competitive advantage of firms comes from knowledge resources embedded within social relationships with other firms (Uzzi & Lancaster, 2003). These studies argue that knowledge resources are socially constructed and organizational learning involves a complex social process in which different units interact with each other (Bartol & Zhang, 2007; Mu, Peng, & Love, 2008; Walter, Lechnner, & Kellermanns, 2007).

In particular, some authors suggest that through social attachments, inter-organizational relationships tend to increase the absorptive capacity of firms by reducing efforts and cognitive costs (Uzzi & Lancaster 2003). Still further, former works show that interpersonal relationships developed within inter-organizational networks create a context inside of which acquired knowledge can be valued, assimilated and exploited (Yli-Renko, Autio, & Sapienza, 2001).

In the light of this theoretical background, we consider that interpersonal relationships are of great importance for inter-firm learning (Jiang, 2005; McFadyen, 2003; Singh, 2005; Zhang, Wong, & Soh, 2005). Personal ties can be a driving force behind resources obtained from inter-firm networks. Because of the facilitative role of personal network in various inter-organizational

contexts, it becomes reasonable to establish a relationship between the complexity of the inter-organizational learning process and individual capacities within a firm.

2.2 *Individual vs. organizational absorptive capacity*

Despite the diversity of absorptive capacity conceptualizations, we found that the study of the individual's capacity absorptive, key element of the firm did not cause as much enthusiasm from researchers. Former work often mobilizes individuals only for explaining their effect on the organizational absorptive capacity without talking about their own absorptive capacity (Dali, 2008). Yet, in order to sit the foundations of organizational absorptive capacity, Cohen and Levinthal (1990) were interested in the individual aspect and more particularly in the cognitive structures of the individual.

Similarly, Lane and Lubatkin (2006) point the lack of interest given to the role of individuals in the development, the deployment and the maintenance of the absorptive capacity. Recently, scholars call to focus the attention on the individual level (Chauvet, 2007; Dali, 2008) arguing that the primary basis of the firm's ability to capitalize on external information rests on the ability of individuals to access, assimilate and utilize information (Cohen & Levinthal, 1990).

Our objective, in this paper, is to propose an original conceptualization of the individual's absorptive capacity based on those carried out on the organizational absorptive capacity. We will borrow the four dimensions suggested by Zahra and George (2002) and we will empirically test them at the individual scale and in an ION context.

Thus, we carry out a double shift vis-à-vis the original conceptualization of Zahra and George (2002) developed initially at the firm level:

- We will apply this conceptualization at the individual level

- We consider this conceptualization in the context of strategic partnerships

This choice of the Zahra and George (2002) dimensions seemed to us the most adequate since this decomposition, even if it were presented at the organizational level, stick more to the individual's behavior comparing to other conceptualizations (Dali, 2008). Besides, Zahra et George (2002) argue that social integration mechanisms facilitate the free flow of information, allowing the firm to develop either its potential absorptive capacity (acquisition and assimilation capacities) or its realized absorptive capacity (transformation and exploitation capacities).

Therefore, our approach does not suppose that individuals are completely detached from their environment and from organizations in which they evolve. But rather, we try to highlight some characteristics and aspects that are specific to these individuals and that are likely to influence their behaviors.

In spite of the growing consensus that personal networks matter, however, the specific effects of different elements of personal network structure and content on inter-organizational organizational remain unclear. This question finds its origins within a larger debate in the literature on social networks. This debate has arisen over the form of network structures that can appropriately be regarded as beneficial to firm performance (Ahuja, 2000).

3 The set of hypotheses: the impact of personal relationships on individual's absorptive capacity

To test the impact of interpersonal relationships, we are interested with the personal network that consists of the set of people with whom an individual maintains contacts. For example, they can be partners, customers, suppliers, etc. While referring to previous work, we have brought out five relevant dimensions of personal networks. These dimensions concern the network size, network density, indirect contacts, strength of ties and range of ties (BarNir & Smith, 2002; Greve, 1995;

Jenssen and Koenig, 2002; McEvily and Zaheer, 1999; Ostgaard and Birley, 1994; Rodan and Galunic, 2004).

In this vein, Greve (1995) advances that a higher number of contacts in a personal network increases the possibilities of receiving diversified information. Also, Ahuja (2000) examine the role of direct ties on the firm innovation performance and suggest that the number of direct ties a firm maintains provide three substantive benefits that are likely to impact its innovation performance. They are: knowledge sharing, complementarity, and scale.

Transposed to the case of the individual, we think that collaboration constitutes the context of social interactions that facilitate bringing together complementary individual skills from different firms. By tapping into the developed competencies of other individuals, one can enhance his own knowledge base and thereby improve his learning performance. Consequently, projects that engage a large number of individuals generate significantly more knowledge than smaller projects.

Social networks allow not only knowledge acquisition but also novel resource combinations by making new possibilities more salient (Blyler & Coff, 2003).

Generally stated, we suggest that: as personal networks develop, individuals can enhance their ability to acquire, assimilate, transform and exploit external knowledge. We set out the first hypothesis of our research as follow.

Hypothesis #1: Personal network size positively impacts the individual's absorptive capacity in an inter-organizational network context.

Moreover, personal network can be characterized by the degree of the connection that defines the network density. Ahuja (2000) and Padula (2008) point two contradictory effects of connections between partners. From the perspective of the structural hole theory, ego networks in which

actors have no or few links with each other are preferred to networks in which actors are densely tied to each other. The reason is that: ego networks rich in structural holes implies access to mutually unconnected partners and, consequently, to many distinct information flows.

Conversely, in closed networks, in which ego's partners are highly connected to each other, opportunistic behavior is less likely to arise because of the social constraints associated with dense networks (Ahuja, 2000). Indeed, the threat of reputation loss with respect to multiple partners will discourage firms from behaving opportunistically with any partner. This constraint can facilitate large relationship-specific investments that help maximize the benefits from collaboration.

Besides, the large quantity of information in a dense network improves communication between members and increases the similarity of their knowledge stocks (Burt, 2001; Reagans & Zuckerman, 2001). We suggest that highly interconnected relations are an important condition for knowledge sharing. It supports the development of inter-organizational routines which facilitate, in their turn, the acquisition, the assimilation, the transformation and the exploitation of knowledge by partners. So we propose that:

Hypothesis #2: Personal network density is positively related to the individual's absorptive capacity in an inter-organizational network context.

Although direct contacts are easier to reach, indirect contacts can be a source of different information and allow, consequently, an access to more diversified resources which ego needs (Greve, 1995). Indirectly connected individuals are not in contact, but their relationship is mediated by mutual third-party friends.

Thus, a firm's partners bring the knowledge and experience from their interactions with their other partners to their interaction with the focal firm and vice versa (Gulati & Gargiulo, 1999). A

firm's linkages therefore provide it with access not just to the knowledge held by its partners but also to the knowledge held by its partner's partners (Gulati & Garguilo, 1999). Ahuja (2000) suggest that within an inter-firm technology linkage network, a firm's indirect ties serve as a mechanism for knowledge spillovers and contribute positively and significantly to its innovation output.

In terms of gaining less redundant information this may be an advantageous position, because the focal person or her closest contacts act like linking pins among clusters. It is particularly advantageous to the extent that the focal person can exploit the resources of different clusters through indirect contacts (Greve, 1995). Similarly, it is recognized that information at the origin of innovations, is often located apart from the immediate environment of the researcher.

Knowledge of the networks of primary contacts (indirect contacts) gives access to a larger variety of resources, increasing the probability of successfully acquire, assimilate, transform and exploit external knowledge.

Hypothesis #3: Indirect contacts are positively related to the individual's absorptive capacity in an inter-organizational network context.

Next, repeated interactions between network members increase exchanges between them. By intensifying the activities and the routines of sharing knowledge, social interactions enhance the relative capacities of individuals to absorb external knowledge which are communicated to them by the members of their network and this, thanks to the development of specific heuristic for the treatment of this knowledge (Bouty, 2000; Lane & Lubatkin, 1998; Yli-Renko et al., 2001).

Accordingly, Yli-Renko et al. (2001) suggest that the repeated interactions with other firms increase the capacity of the firm to evaluate and to acquire relevant knowledge from these firms.

In addition, the more the person interacts with her colleagues, the more the opportunity to learn is high. From this point of view, the strong ties are more important for the access to new ideas.

Moreover, Dali (2008) found that the frequency of the contacts of employees with customers remains an external source among other of knowledge which determines the individual absorptive capacity. As suggested by Simon and Noblet (2010) who call for more interest in this variable, we propose that the strength of ties in a personal network would be positively related to the individual's absorptive capacity.

Hypothesis #4: The strength of ties is positively related to the individual's absorptive capacity in an inter-organizational network context.

Finally, the diversity of an individual's background provides him a more solid base for learning (Cohen & Levinthal, 1990). Indeed, the heterogeneity of information and knowledge exposes individuals to different points of view, increases the probability of discovering new opportunities and increases the potential of creation and implementation of novel ideas (Rodan & Galunic, 2004).

In this same vein of ideas, Smith, Collins and Clark (2005) suppose that the access to various knowledge increases, in its turn, the possibility of combination and exchange of new information and also increases the probability that the firm profits from this process.

The addition or suppression of knowledge or interpretation of existing knowledge in a different way leads to the transformation of knowledge and consequently the absorption of this knowledge. Moreover, Kraatz (1998) argue that the extent and the heterogeneity of social ties of an actor determine his access to various kinds of information and thus affect his capacity to recognize and to answer the threats of the environment. Thus, we formulate the last hypothesis of this research as follows.

Hypothesis #5: The range of network ties is positively related to the individual's absorptive capacity in an inter-organizational network context.

Figure 1 summarizes our conceptual model.

Insert Figure 1 about here

Our model, thus built, differs from those which we checked in our review of the literature, mainly in two points.

- We try to propose an original conceptualization of the absorptive capacity which is based on the work of Zahra and George (2002) and which allows us to integrate at the same time the individual and the inter-organizational levels. The conceptualization of Lane and Lubatkin (1998) although it takes into account the specificity of inter-firms relationships, it largely overlooks the facts that knowledge resides in and between individuals within the firm, particularly when knowledge is tacit. However, without individuals' valuable internal and external social ties, firms would be unable to acquire, recombine, and release resources, making them maladapted to a volatile environment.
- Our model is based, at the same time, on a large side of sociology (social network) and on the learning theory (dynamic capabilities). These two fields are often studied separately within the ION context. Indeed, research on ION show a gap between two divergent perspectives: the strategic perspective (based on the Resource-based View) and the social network perspective (based on social network approaches).

In the next section, we describe the methodology of our research. Our conceptual model will be concretely examined using a sample of firms.

4 Research model and methodology

In our model, we proposed that the individual's absorptive capacity is influenced by some characteristics of the personal network (Figure 1). As indicated in Figure 1, our model hypothesizes that Network size, network density, strength of ties; indirect ties and the range of ties have a direct effect on absorptive capacity (Hypothesis 1 to 5).

4.1 *Data collection and measure of variables*

The research methodology adopted to test our model is the quantitative study based on a collection of information via a face-to-face questionnaire.

The unit of analysis is key-individuals in firms that are members of export consortia in Tunisia which consist of a form of inter-firm grouping that organizes temporary projects bringing together firms belonging to various activities and having various skills. The export consortia in Tunisia are composed, mainly, of SMEs. During the investigation (conducted from February 2008 to July 2008), Tunisia counted 13 active consortia located in various geographical areas of Tunisia and working in various industries. 74.5% of the requested companies include less than 115 employees. The size of the consortia varies from 3 to 20 firms. Export activity in Tunisia is known by its continuous changes and its fast development. That is why, firms in export consortia are important consumers of information and knowledge. This fact underlines the relevance of our sample for the study of the absorptive capacity concept.

Face-to-face interviews were carried out with individuals that are the most involved in their firms' participation in the consortium. The names of the contacted firms are available in a database, made-up by an UNIDO expert in Tunisia. In addition, the database mentions the people that are the best placed in each firm to answer the questions which reference to their participation

in a consortium. This approach to select the respondents is the same followed by McEvily and Zaheer (1999). It consists in selecting key-respondents having knowledge in the organizational field thanks to the position that they occupy. In addition, the database was supplemented by the contacted respondents during our investigation.

A preliminary version of the questionnaire was tested through a pilot study with nine key-individuals in firms belonging to various industries. Then, their comments and suggestions were taken into account in a revised version. The final questionnaire was tested with 55 people during face-to-face interviews.

4.2 *Operationalization of variables*

The operationalization of variables described is based on the theoretical discussion and previous studies. The wording of items has been adapted to the specific context of our study, i.e. inter-organizational relationships.

Independent and dependent variables, are measured either with a single item (network size, network density, indirect ties, range of ties) or with multi-items (strength of ties and absorptive capacity). Six-point Likert scales are used for absorptive capacity. Four-point Likert scales are used for personal network variables (i.e. the network density, the indirect ties, the strength of ties and the range of ties). The network size was measured with the number of persons with whom ego has a contact.

Table 1 provides the definition of the constructs and the expected signs between dependent and independent variables as described by our hypotheses.

Insert Table 1 about here

4.2.1 Measuring absorptive capacity

In many studies, R&D spending has been used as a surrogate measure of absorptive capacity (e.g., Cohen & Levinthal, 1990; George et al., 2001). This assumes that there is no differentiation between the two as a cause and an effect.

Other researchers argued that R&D spending may lead to absorptive capacity, but may not necessarily indicate the degree of current actual absorptive capacity. Thus, the constructs that Szulanski (1996) used to operationalize the variable focused on commonalities of language and of knowledge base. Similarly, Lane and Lubatkin (1998) used questions addressing commonalities of operations, of knowledge base and of problem solving in their measurement of absorptive capacity. In their survey of IT-related absorptive capacity, Boynton et al. (1994) asked questions related to managerial IT knowledge and IT management process effectiveness. Based in large part on the studies of Szulanski (1996) and Lane and Lubatkin (1998), Priestley and Samaddar (2005) defined the four sub-constructs of absorptive capacity to be the four commonalities of language, base knowledge, processes and problem solving.

In order to rectify the content deficiencies in the literature on absorptive capacity, some authors attempt to specify its theoretical domain and dimensionalization (e.g., Camison & Forès, 2010). In an effort to measure this variable, we have used empirical works of Jansen et al (2005), Priestley and Samaddar (2005), Chauvet (2007) and Lane and Lubatkin (1998).

Through a process of pre-testing and piloting, a total of 9 measurement items were developed to test absorptive capacity, including 7 previously validated measurement items and 2 measurement items newly developed for this study. Selected items showed a satisfactory loading vis-à-vis the constructs they are supposed to measure in previous work.

Table 2 in the appendix identifies the items used to assess absorptive capacity and their origin.

Insert Table 2 about here

4.2.2 Measuring personal network

To assess personal network dimensions, we were referred to a set of previous work and we have brought out five relevant dimensions of personal network: network size, network density, indirect contacts, strength of ties and range of ties (BarNir & Smith, 2002; Greve, 1995; Jenssen & Koenig, 2002; McEvily & Zaheer, 1999; Ostgaard & Birley, 1994; Rodan & Galunic, 2004).

The network size was measured by the number of people with which the respondent has a contact within the consortium. For the remaining network variables: “density of the network”, “indirect contacts”, “strength of ties” and “range of network ties”, a name generator was developed to invite the respondent to cite up to five people of her/his consortium who are more important for her/him, compared to the others, in the achievement of her/his work. For each cited person, the respondent has to give a grade to each network variable. An average score is calculated to obtain only one value per respondent on each manifest variable (Burt, 1992; Chollet, 2005).

To measure the density of the network, we referred to the measurement used by Greve (1995). For that, we asked each respondent to indicate to which extent the members of her/his primary network know each other.

We measured the indirect contacts on a four-point scale, by asking each respondent on her/his degree of knowledge of the contacts of alter (Greve, 1995).The strength of ties was measured by two indicators. It is about the frequency of the interactions and the emotional distance between egos and alters (Chollet, 2005). Several variables in the literature indicate the range of the

network ties. We are interested with the similarity of knowledge between network members (Rodan & Galunic, 2004).

Table 3 in the appendix identifies the items used to assess personal network and their origin.

Insert Table3 about here

4.3 *Data Analysis and descriptive results*

To test our hypotheses, we used the structural equations approach based on the PLS-PM technique (Partial Least Squared-Path Modeling) available in XLSTAT software (Tenenhaus et *al*., 2005). The techniques based on PLS enabled us to effectively treat samples from 30 to 100 observations.

4.3.1 The Measurement Model: description of the data

The descriptive statistics are about information on the data and information on the model created.

4.3.1.1 Information on the data

To describe data, we check for: 1) the unidimensionality of the blocks of manifest variables, 2) the convergent validity and 3) the discriminant validity of the constructs.

4.3.1.1.1 The unidimensionality of the blocks of manifest variables

The most important element to check is the unidimensionality of blocks of manifest variables in the reflexive case.

Network size, indirect ties and the range of network ties were measured by single items. No Cronbach's alpha was calculated for these variables. The density variable was isolated from the analysis since answers obtained for the "density" variable were concentrated (68%) out of the first two alternatives ("know well" and "know little") indicating that for 68% of observations,

density is maximal (equal to 1). We considered as not useful to introduce this variable into analysis.

The strength of ties was operationalized by two items (Table 3) measuring the frequency of interactions and the emotional distance. The calculated Cronbach's alpha is in the lower part of its threshold (.621). But Rho of Dillon-Goldstein is higher than 0.7 (.841). Moreover, the first Eigen value calculated for the block of manifest variables is much larger than the second (1.451 and 0.549 respectively). The construct is quite unidimensional.

Absorptive capacity is a four dimension construct. A PCA (with an Oblimin rotation) carried out shows that it is a latent variable with four dimensions. We specify that absorptive capacity is the only formative variable in our model. All the other variables are reflexive.

Finally, we add that two observations were removed because of the high number of missing values.

4.3.1.1.2 Convergent and discriminant validity

These two validities describe how well the measurement items relate to their constructs. Convergent validity is assessed by ensuring that the average variance extracted (AVE) by a construct from its indicators should be at least .5 (Fornell & Larcker, 1981). We can also ensure that item loadings should be at least .50 (Sharma, 1996).

To assess discriminant validity, we check that the average variance extracted (AVE) by a construct should be greater than the square of that construct's correlation with other constructs (Fornell & Larcker, 1981; Barclay et al., 1995). We also ensure that items should load more highly on the intended construct that on another construct.

As recommended, both two conditions of validity were satisfied. 1. The AVE is greater than 0.5 for the two multi dimensional constructs (absorptive capacity and strength of ties) (Table 4). Also, all items exhibited loadings greater than .50, except for the assimilation capability item that shows a loading of 0.388 (Table 5). We decided to keep this item since it represents an important facet of the absorptive capacity. 2. The AVE is greater than the square of the construct's correlation with other constructs (Table 4) and no item loaded higher on another constructs than the one intended (Table 5).

Insert Table 4 & 5 about here

Taken together, the items overall demonstrated acceptable discriminant and convergent validity.

4.3.1.2 Information on the model

To evaluate the quality of adjustment of the model, we referred to GoF (Goodness of Fit). The absolute value of the GoF is very close to that of its bootstrap estimation: 0.551 and 0.568 respectively. This absolute value of the GoF is difficult to interpret. The relative GoF and those based on the internal and external models are very high (.933; .962 and .969 respectively). These values tend to reflect a good quality of adjustment of the model to the data.

4.3.2 The structural modeling: the test of hypothesis

The structural model is assessed by examining the significance of the path coefficients and the value of the coefficients of determination (i.e. variance accounted for by the antecedent construct). Figure 2 provides the results of the structural model analysis. As recommended by Chin (1998), bootstrapping (with 500 subsamples) was performed to test the statistical significance of each path coefficient using t-tests. Our structural model shows significant paths between three personal network variables and absorptive capacity.

Insert Figure 2 about here

The results show that the strength of ties of personal networks has the highest impact on absorptive capacity (Table 6). It is moreover a negative impact. Hypothesis 4 which predicts a positive impact of strength of ties on absorptive capacity is rejected. Results also show that indirect contacts have a significant and negative effect. This is also contradictory with the prediction of hypothesis 3 which is rejected. In addition, the range of network ties has a positive impact on absorptive capacity, which enables us to accept hypothesis 5. Finally, the network size has a non-significant impact on absorptive capacity. Hypothesis 1 is not supported.

Insert Table 6 about here

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5 Discussion

The present paper has examined the absorptive capacity developed via personnel networks of key-individuals in SMEs members of export consortia in Tunisia.

5.1 *Linking personal network to absorptive capacity*

In this study, we predicted that the strength of ties is positively associated with individual's absorptive capacity. Contrary to what was hypothesized, our results support the importance of weak ties for the individual's absorptive capacity development. In this perspective, Bhagavatula et al. (2010) found, in the sector of handloom in India, that the more weak ties the individual has, the greater the number of opportunities that he identifies. The negative impact of the strength of ties is in line with the theory of the strength of weak ties (Granovetter, 1982). According to Granovetter (1982), information redundancy that characterizes strong ties, is suitable for the new

information search. Also, according to Granovetter (2005), individuals with few weak ties will be deprived from information from distant parts of the social system. These individuals will be confined to information and opinions of their friends. Similarly, Dali (2008) found that the high frequency of the contacts with customers would not produce a positive effect on the individual absorptive capacity.

The originality of this result is that it allows strengthening the relevance of the theory of the strength of weak ties assumptions in a context (ION and particularly export consortia in Tunisia) where there are many reasons to believe that cohesion between actors, and consequently strong ties, is responsible for inter-firm learning.

Besides, findings show a significant and negative impact of indirect ties established by individuals on their absorptive capacity. This impact, although contrary to our predictions, reflects an interesting idea since it has the same sign as the effect of the strength of ties. The effect of indirect contacts is similar to that of strong ties. This finding is different from that of Ahuja (2000) who finds that the effect of indirect contacts is similar to that of weak ties. We think that the explanation of this difference can be found in the density of networks studied. In this vein, Greve (1995) explains that in networks with high density, indirect contacts tend to be those with which ego is already connected. In this case, indirect contacts are associated with a redundancy similar to that of strong ties. Conversely, in networks with low density, indirect contacts do not belong to the already established contacts of ego. In this case, indirect contacts tend to be non-redundant ones and have an effect similar to that of weak ties. In our sample, since the majority of personal networks studied are dense, indirect ties are likely to have a similar effect to that of strong ties (i.e. a negative effect).

This second result underlines that it is necessary to put into perspective the impact of indirect ties on actors learning by considering the density of their network. Thus, our study reveals an overlap between the dimensions of the personal network that should be taken into account in future research.

Furthermore, we have predicted and found a positive impact of the range of ties on the absorptive capacity suggesting that a network of heterogeneous actors is suitable for the development of absorptive capacities of these actors. Similarly, in previous research, it was found that firms having a network with a various content can acquire heterogeneous information that help them discover entrepreneurial opportunities in a turbulent environment (Ma, Yao, & Xi, 2009).

Therefore, at the inter-organizational level, Mu, Peng and Love (2008) argue that, through the interaction with persons who hold diverse types of knowledge, individuals gain access to different ideas and mobilize these ideas by discussing and using them, ultimately transforming the promising ones into adapted good practices for better achieving their work.

This third result highlights the relevance, for the development of the individual's absorptive capacity, of complementarity between his knowledge base and knowledge he acquires from other members of his network. This complementarity was underlined by Cohen and Levinthal (1990) in their seminal work and was supported in other studies (e.g., Reuer & Koza, 2000). The latter consider complementarity and specific partner resources as a prior condition to collaboration.

5.2 *Linking inter-organizational networks to absorptive capacity*

Moreover, in addition to the impact of the personal network on absorptive capacity dimensions, our research exhibits the importance of IONs for the development of the absorptive capacity of the network members.

The important role of absorptive capacity in export consortia can be explained as follow. When organizations are engaged in similar operational routines, as would be the case in an export consortia, it is logical to conclude that they would have developed a common base of knowledge related to these routines, they would experience and solve problems in a similar fashion and the network members would have developed a common language to describe their respective tasks. These commonalities would be expected to foster absorptive capacity, in part because they facilitate deeper and more meaningful communication.

This finding is interesting since it is argued in previous research that different types of network are likely to experience different absorptive capacities. In that vein, Priestley (2003) stated that firms in a franchise network are more likely to have a higher absorptive capacity compared to firms in a coopetive network (cooperation between competitors). This is due to the high centrality in franchise network allowing a greater standardization and consequently more sharing routines and more similarity concerning knowledge bases, languages, processes and problem resolution. The empirical tests show that only firms operating within a coopetive network demonstrate a greater level of inter-organizational absorptive capacity than will independent organizations operating outside of a network.

Although our study does not aim to compare different forms of networks, we add to this literature by suggesting that firms within an export consortium enjoy some level of individual absorptive capacity and this, through authorizing the circulation of weak and heterogeneous ties between individuals in the consortium.

Studying different types of networks allow understanding how should firm organize to take advantage from knowledge spillovers from its partners. This meets the practical need for a theory that links different types of organizational networks with their respective level of absorptive

capacity which is critical for both researchers and practitioners. Understanding such linkages will enrich the theory that attempts to explain strategic leveraging of knowledge-based relational rent (Dyer & Singh, 1998) among differently networked firms. Such development in theory can make a way for normative prescriptions for preferential choice of some network type over no network, given a strategic goal. Stated differently, the finding that the factors of knowledge sharing-absorptive capacity- vary with inter-organizational network type provides initial evidence that how a firm organizes outside of its own boundaries can influence these same factors, sometimes not in a similar way or not for the same reason.

5.3 *Theoretical and practical implications*

The theoretical implications of this research are three-fold. First, an attempt has been made to extend the field of inter-organizational learning by focusing on the role of personal interactions between firm members. In doing so, we hope to be able to bridge the strategic and the social perspectives when studying IONs, by blending in a single model the social network theory and the learning theory. Second, our research highlights the importance of the personal network as an external determinant of individual's absorptive capacity. Third, we offered an original conceptualization of absorptive capacity that takes into account the individual and the inter-organizational dimensions at the same time. This conceptualization meets the need for the integration of different levels of absorptive capacity conceptualizations as it was pointed by emergent literature (e.g. Dali, 2008; Kalkstein, 2007).

In the light of our results, we propose some recommendations to employees and managers in firms' members of export consortia. Our research gives practical insights on how individuals in firms embedded in IONs can design their personal relationships to take advantage of other sources of knowledge spillovers. Our research answers the precautions of managers in the

management of their employees. It enables them to identify the point on which it would be necessary for them to stress in order to help themselves and their collaborators to build and to increase their absorptive capacity. Given the limited resources of their firms, specifically in R&D, managers can promote informal interactions in order to improve the absorptive capacity of key individuals in their firm. For example, they can encourage them to regularly approach employees in other firms of their consortium and organize special meetings where are presented innovating projects produced by others. These meetings can be precursory new ideas and facilitate the identification of information and knowledge that are likely to produce innovations.

The major research limitation of this study was the non consideration of organizational variables that would moderate the influence of personal relationships on individual's absorptive capacity. In doing so, we did not mean to disconnect individuals from their organization; we just looked to emphasize the importance of the individual's absorptive capacity, taking into account the effect of some of the individual characteristics and attributes. Future research could fill this void by considering, for example, the role of incentives and organizational culture in promoting external learning and, consequently, leveraging the impact of external relationships on individual's absorptive capacity.

6 Conclusion and perspectives

Our research brings some brief replies to the general questioning: to what extent a program for export collaboration like export consortium can be used to address a broad circle of companies and help raise their level of dynamic capabilities, including better absorptive capacity?

We have shown that individual's absorptive capacity is dictated, at least partly, by the interpersonal interactions. Moreover, our research supports that, like other forms of IONs, export

consortia in Tunisia allow firms to speed the development of their capacities by acquiring and exploiting knowledge developed by network partners. In particular, these networks provide firms with new opportunities in order to assimilate relevant information, internalize skills and develop new capabilities. Stated differently, we argue that interpersonal relationships embedded in inter-organizational networks would create cohesion of actors in the network and occasions of share and exchange of ideas and information. In this case, export consortia can be assimilated to a process in which individuals absorb knowledge from other actors in their network and filter this specific knowledge. Then, they assimilate them through internal learning mechanisms and finally, combine new knowledge with other information and resources in order to create new products, services or processes.

In addition, our research gives insights on what configurations of personal relationships are best suited to benefit from IONs. We propose that a network of weak but diverse ties is more appropriate for the development of routines allowing individuals to learn from their partner in an export consortium. Besides, in a dense network, one should not concentrate on his indirect contact, in order to achieve this type of inter-organizational learning.

We conclude that personal networks and inter-organizational networks complement each other in fueling individual's absorptive capacity.

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Table 1: Definition and expected signs of variables

Variable	Definition	Expected sign
Dependent variable		
• Absorptive capacity	The ability to acquire, assimilate, transform and exploit external knowledge	
Independent variables		
• Network size	Number of people belonging to other firms in an ION, with whom the respondent has a contact	+
• Network density	The extent to which alters know each other	+
• Indirect ties	The extent to which ego knows the most important personal contacts of his alters	+
• Strength of ties	Frequency of discussion and degree of friendship with alters	+
• Range of ties	The degree of similarity of areas of expertise between alters	+

Table 2: Absorptive capacity measures[1]

Variable	Absorptive capacity	Indirect origins of items
Acquisition capability		
ACQUI 1	Acquisition of the basic knowledge related to the joint project in the consortium	Lane and Lubatkin (1998)
ACQUI 2	Acquisition of other knowledge not related to the joint project in the consortium	Lane and Lubatkin (1998)
Assimilation capability		
ASS 1	Use of the same terminology as the consortium members	Priestley and Samaddar (2005)
ASS 2	Comprehension of the terms used by the consortium members	Priestley and Samaddar (2005)
Transformation capability		
TRAN 1	Discovery of new solutions thanks to consortium members	Chauvet (2007)
TRAN 2	Discussing with the consortium members about implications of the market trend and new products development	Jansen et al (2005)
Exploitation capability		
EXPL 1	Better understanding of the way in which activities should be performed thanks to interactions with consortium members	Jansen et al (2005)
EXPL 2	Better use of resources thanks to interactions with consortium members	Developed
EXPL 3	Access to information that are targeted to ones needs thanks to interactions with consortium members	Developed

[1] All items were measured on a six-point scale on which 1 was "strongly disagree" and 6 was "strongly agree."

Table 3: Personal network measures[2]

Variable	Personal network	Indirect origins of items
Size	Size	Burt (1992), Greve (1995)
Density	Density	Burt (1992), Greve (1995)
IND CONT	Indirect contacts	Ahuja (2000), Greve (1995)
Strength of ties		
Frequency	Frequency of interactions	Burt (1992), Chollet (2005)
Emo. Dist	Emotional distance	Burt (1992), Chollet (2005)
Range of ties		
KNOW SIM	Knowledge similarity	Rodan et Galunic (2004)

[2] The items for the personal network were developed from generally accepted network measures, as documented in works such as Chollet (2005).

Table 4: Discriminant validity (Square correlations < AVE):

	Strength of ties	Range of ties	Indirect contacts	Network size	Absorptive capacity	Average Communalities (AVE)
Strength of ties	**1**	0,018	0,231	0,091	0,347	**0,698**
Range of ties	0,018	**1**	0,012	0,046	0,015	
Indirect contacts	0,231	0,012	**1**	0,041	0,291	
Network size	0,091	0,046	0,041	**1**	0,122	
Absorptive capacity	0,347	0,015	0,291	0,122	**1**	**0,557**
Average Communalities (AVE)	**0,698**				**0,557**	**0**

Table 5: Cross-loadings (Manifest variables)

	Strength of ties	Range of ties	Absorptive capacity	Indirect contacts	Network size
FREQUEN	**0,955**	0,073	-0,625	0,457	-0,246
EMO DIST	**0,695**	0,231	-0,258	0,338	-0,312
KNOW SIMIL	0,136	**1,000**	0,122	0,109	-0,215
AQUI	-0,438	0,107	**0,752**	-0,474	0,183
ASS	-0,387	0,036	**0,388**	-0,189	0,009
TRAN	-0,558	0,021	**0,882**	-0,463	0,368
EXPL	-0,422	0,205	**0,857**	-0,463	0,281
IND CONT	0,480	0,109	-0,539	**1,000**	-0,203
SIZE	-0,301	-0,215	0,349	-0,203	**1,000**

Table 6: Path coefficients (Absorptive capacity):

Latent variable	Value	T	Pr > |t|
Strength of ties	-0,443	-3,543	0,001
Range of ties	0,230	2,083	0,042
Indirect contacts	-0,278	-2,237	0,030
Network size	0,081	0,731	0,468

Figure 1: The theoretical model

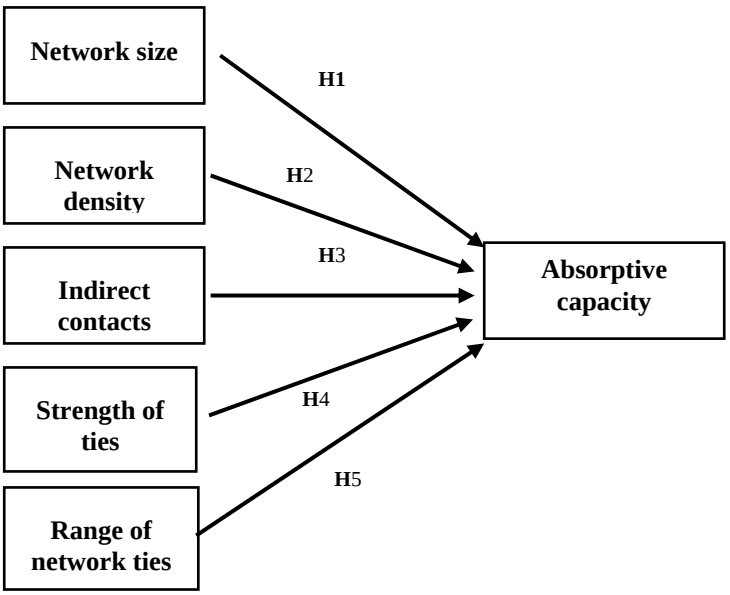

Figure 2: Structural equation modeling of the impact of personal network on absorptive capacity in IONs