Relationships between structural social capital, knowledge identification capability and external knowledge acquisition

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Abstract

Purpose – The purpose of this paper is to analyze the mediating effect of the identification of valuable external knowledge on the relationship between the development of inter-organizational ties (structural social capital) and the acquisition of external knowledge.

Design/methodology/approach – Using a sample of 87 firms from Spanish biotechnology and pharmaceutics industries, the authors have tested the proposed mediation hypothesis by applying the partial least squares technique to a structural equations model.

Findings – The study results show that those firms with stronger, more frequent and closer inter-relationships are able to increase the amount of intentionally acquired knowledge, partly due to the greater level of development of their knowledge identification capability. Thus, firms with a higher capability to recognize the value of the knowledge embedded in their inter-organizational networks will be more likely to design better strategies to acquire and integrate such knowledge into their current knowledge bases for either present or future use.

Originality/value – This research contributes to knowledge management and social capital literature by means of the study of two key determinants of knowledge acquisition – structural social capital and knowledge identification capability – and the explanation of their relationships of mutual influence. The paper thus tries to fill this literature gap and connects the relational perspective of social capital with the knowledge-based view from a strategic point of view.

Keywords Knowledge management, High-tech industries, Structural social capital,
Knowledge identification capabilities, External knowledge acquisition

Paper type Research paper

1. Introduction

External knowledge acquisition is a highly relevant knowledge management (KM) process owing to its strategic importance and its contribution to a company's competitive advantage (Fey and Birkinshaw, 2005). In dynamic environments, firms continuously attract and integrate external knowledge to their business processes since it is both complex and inefficient to develop alone all the knowledge that they need to be able to compete successfully (Liao and Marsillac, 2015). Nevertheless, management scholars have not yet

analyzed this process in depth, especially when compared to other KM processes, such as knowledge creation or sharing (Park, 2010). Moreover, we agree with Patterson and Ambrosini (2015) that there are gaps in the KM literature concerning the identification of the main antecedents of external knowledge acquisition and their implication in the identification of the most valuable knowledge for firms' competitive purposes. This is a very relevant issue since companies must develop the most adequate strategies oriented toward the subsequent acquisition of valuable knowledge and integrating it into their existing knowledge base (Zack, 1999).

Social capital as an antecedent of external knowledge acquisition processes is a new line of research that has been growing in recent years (see e.g. Yli-Renko *et al.*, 2001; Presutti *et al.*, 2007; Ebers and Maurer, 2014). Specifically, this paper focuses on the structural dimension of social capital (i.e. the configuration of the relationship networks of a firm) as an antecedent of external knowledge acquisition in organizations which carry out their activities in technology/ innovation-intensive industries such as biotechnology or pharmaceuticals. Although a number of research papers have tried to analyze the influence of structural social capital on knowledge acquisition processes (see e.g. Krackhardt, 1992; Maula *et al.*, 2001; Yli-Renko *et al.*, 2001; Presutti *et al.*, 2007; Zhou *et al.*, 2014), in our view a clear agreement is lacking in two essential aspects. The first of these refers to the structural characteristics that a firm's network should have to optimize its knowledge acquisition processes. The second has to do with the array of variables involved in the relationship between structural social capital and the success of knowledge acquisition processes, especially when a firm is trying to find and acquire complex pieces of knowledge (i.e. how can a firm design and/or select the most advantageous knowledge acquisition strategy?).

In this regard, this paper suggests that a firm's capability to identify valuable knowledge (Patterson and Ambrosini, 2015) is a key aspect to understanding the processes of external knowledge acquisition. Furthermore, knowledge identification, along with the assessment of its potential value, is a necessary step to ensure a company undertakes the most effective knowledge absorption process (Cohen and Levinthal, 1990). Our paper will thus try to fill this literature gap on social capital, absorptive capacity and external knowledge acquisition in dynamic environments.

External identification and value recognition of knowledge for a firm require the existence of a background within the environment from which such knowledge originates (Cohen and Levinthal, 1990). If a company does not have such a background (e.g. expertise, know-how, technology, competences) to assess the strategic potential of new external knowledge, it will be very problematic to either acquire or integrate new external knowledge correctly (Zack, 1999). Therefore, this paper poses that the development of "strong" links with agents in a network is an essential determinant of a firm's background which will enable it to identify new and valuable knowledge. Thus our approach differs slightly from the "potential" absorptive capacity perspective (see e.g. Zahra and George, 2002; Jansen *et al.*, 2005; Jiménez-Barrionuevo *et al.*, 2011) by considering a firm's network itself as a source of learning that can be used to identify valuable knowledge, instead of considering other types of variables such as R&D efforts or internal technology development to create absorptive capacity (see e.g. Cohen and Levinthal, 1990; Stock *et al.*, 2001; Tsai, 2001; Zahra and Hayton, 2008).

From this perspective on social capital as being an antecedent of knowledge acquisition, the main aim of this paper is to analyze the role of a firm's identification capability as an outcome of structural social capital, i.e. as a mediating variable, for the development of an optimal external knowledge acquisition process. Consequently, we contribute to KM and social capital literature through the study of two key determinants of knowledge acquisition – structural social capital and knowledge identification capability – and the clarification of their relationships of mutual influence.

The structure of the paper is as follows. First, we show the main conceptual aspects and the main hypothesis of our research study. Next, we describe the research methodology and the results obtained from the statistical analyses that were applied in order to test the hypothesis. Finally, we set out the discussion and main conclusions of the paper along with possible research lines to be followed in the near future.

2. Theory and hypotheses

2.1 Inter-organizational structural social capital and external knowledge acquisition

Knowledge acquisition is a mechanism by which a firm intentionally incorporates new technologies, ideas and know-how to its existing knowledge base from the external environment. Such acquisition is especially important in dynamic and innovative environments where organizations need to continuously access a wide range of highly specialized technologies, expertise and capabilities that are difficult to be developed internally by a single firm (Iansiti, 1997). As knowledge is widely recognized as an essential strategic asset (Grant, 1996), firms need to manage it in order to gain competitive advantages (Alavi and Leidner, 2001).

Moreover, in the recent years the external or inter-organizational perspective of social capital has focused on companies' external links as being the determinant factors to explore and exploit new opportunities and competitive advantages (Teng, 2007). Social capital is a collection of assets that derive from, are embedded in, and are accessible from a firm's networks of relationships (Nahapiet and Ghoshal, 1998). This definition of social capital includes different aspects of the social context such as interactions and social links – structural social capital, trusted relationships, relational social capital, and systems of shared values that facilitate the interactions between individuals located in a specific social context – cognitive social capital (Nahapiet and Ghoshal, 1998). Of the three dimensions of social capital (structural, relational, and cognitive), it is the structural one which has attracted more attention from social capital theories (Presutti et al., 2007). Moreover, structural social capital has generated controversy regarding its potential to achieve business results such as, for instance, product innovation or economic profitability (Filieri et al., 2014).

Several studies show the influence of aspects related to links in organizational networks – contact frequency, interaction types – on the willingness of companies to acquire and transfer external knowledge (see e.g. Uzzi, 1997; Lane and Lubatkin, 1998; Maula et al., 2001; Yli-Renko et al., 2001; Inkpen and Tsang, 2005; Presutti et al., 2007; Mu et al., 2008; Zhou et al., 2014). Nevertheless, the results obtained in these research studies are inconsistent with the theoretical statement on a positive and strong connection between structural social capital and knowledge acquisition, especially for tacit and complex knowledge types (Maula et al., 2001; Yli-Renko et al., 2001; Mu et al., 2008; Zhou et al., 2014). On the one hand, authors such as Burt (1992) and Presutti et al. (2007) assert that a highly dense inter-organizational network integrated by strongly connected agents is likely to provide similar information, and therefore knowledge acquisition implies obtaining redundant benefits. Similarly, existing roots in these kind of relationships can lead organizations to acquire knowledge from agents which are already known (Uzzi, 1997), which suggests that situations of "blindness" or "short-sightedness" with regard to knowledge acquisition can arise (Inkpen and Tsang, 2005).

On the other hand, another line of research suggests that densely connected networks provide organizations with opportunities to access expertise, information and experiences that are complex in nature and, thus highly valuable (Hansen, 1999; Maula et al., 2001; Inkpen and Tsang, 2005; Zhou et al., 2014). The reason behind the positive effects of possessing strong inter-organizational links on knowledge acquisition are based on their role for facilitating knowledge transfer from one firm to another (Hansen, 1999; Inkpen and Tsang, 2005). Therefore, when knowledge is highly specific and difficult to codify, its acquisition and

transfer should be developed within a context of close interactions (Maula *et al.*, 2001). Similarly, frequent and intense interactions allow companies to develop routines for the exchange of complex information and non-articulated knowledge (Nahapiet and Ghoshal, 1998). Consequently, cohesive relational bonds would make flows of high-quality information and the transfer of tacit knowledge easier for firms in the network (Zhou *et al.*, 2014).

This paper proposes knowledge identification capability as a possible solution to this controversy by considering it as a mediating variable in the relationship between structural social capital and external knowledge acquisition. We will develop this argument extensively in the next section.

2.2 The mediating role of knowledge identification capability in the relationship between structural social capital and external knowledge acquisition

Research literature on absorptive capacity[1] typically recognizes a firm's identification capability – i.e. the search and recognition of external valuable knowledge (Patterson and Ambrosini, 2015) – as an inherent element in the knowledge acquisition process, with both concepts forming the so-called "potential absorptive capacity"[2] (Zahra and George, 2002). This supposes that knowledge acquisition automatically starts once a firm identifies valuable knowledge; but, in fact, it rarely happens this way in practice (Todorova and Durisin, 2007). For example, Zahra and George (2002) focus on the intensity, speed and effort through which a firm obtains external knowledge as being the key elements of the potential absorptive capacity, ignoring aspects related to the design and implementation of strategies for such acquisition.

Alternatively, following the work of Todorova and Durisin (2007) or Patterson and Ambrosini (2015), this paper considers that (valuable) knowledge identification is an indispensable previous step for knowledge acquisition to be successfully developed by a firm, and would be the first phase in the process of knowledge absorption. Moreover, this paper proposes the consideration of the capability of external knowledge identification as a mediating variable in the relationship between structural social capital and knowledge acquisition, with the aim of overcoming the aforementioned issues. In this regard, this paper considers that such a variable would be a fundamental mechanism with which to guide structural social capital toward the acquisition of the most valuable knowledge for an organization.

Research literature on organizational networks reveals various examples of social networks playing an important role in the identification and understanding of the value of external knowledge for a firm or groups of firms. For example, Tripsas (1997) found that organizations with previous social relationships are more efficient at identifying and recognizing new knowledge during periods of aggressive competition and change than those firms with fewer relationships. Similarly, the study developed by Hughes *et al.* (2014) showed a positive relationship between the intensity of the relationships in a firm's network and its ability to understand new useful knowledge for decision making on the development of new products and projects.

Moreover, Smith *et al.* (2005) highlighted the way that certain structural features of a network of relationships influenced the value identification of specific pieces of knowledge inside such a network. These authors found that the strength of the links between the members of an organization positively affects its capacity to access groups or people with specialized expertise, to emphasize with these agents and to anticipate the value of the knowledge exchanges. Furthermore, they found that the network links provide access to resources and are a powerful source of information and learning on the types of knowledge that may be the most valuable for a firm (Nahapiet and Ghoshal, 1998). The more intense the links that a firm has in the network, the more its exposure to newer and more complex knowledge will be (Zaheer and McEvily, 1999; Stuart and Sorenson, 2007). Close interactions

also increase a firm's exposure to a more diverse understanding and interpretation of the meaning and relevance of knowledge and taking that knowledge on board (Zaheer and McEvily, 1999).

Indeed, the positive effect of possessing strong, frequent and close inter-organizational links – all of which characterize dense networks – on valuable knowledge within the firm's network is also supported by the theories based on social exchange and transaction costs (e.g. Blau, 1964; Landry *et al.*, 2002). For example, following the theory of social exchange, when a company gets higher benefits than those expected from a relationship with another firm, it generates a feeling of commitment that motivates the company to develop new exchanges in the future (Blau, 1964). From our point of view, having strong, frequent and close links with other agents in a network will enhance the visibility and access to know-how, technologies, assets and expertise for a firm, provided that the benefit that such a firm gets or perceives from a relationship with any other company is higher than the cost of developing and maintaining such a relationship.

Similarly, from the transaction costs theory, a firm that builds strong, close and frequent links with other agents in an inter-organizational network will be able to reduce the cost of the information search for new knowledge (Landry *et al.*, 2002). A firm will be willing to develop and maintain a network when the benefit from identifying (and subsequently acquiring) knowledge in the network is higher than the cost of developing relationships and establishing links. In this regard, Granovetter (1985, p. 540) points out that the effort and cost associated with building a network can be compensated by: access to valuable information at a lower price than in the market; obtaining reliable information, since agents with stable relationships have economic motives behind their information exchange as there exist expectations for future transactions; and the establishment of social relations that entail strong expectations of trust and non-opportunistic behaviors deriving from the maintenance of long serving economic relationships.

Moreover, once an organization has the possibility of identifying potential valuable knowledge owing to the configuration of its structural capital, the next step would be oriented to acquire such knowledge. Authors such as Cohen and Levinthal (1990), Lane and Lubatkin (1998), Todorova and Durisin (2007) and Patterson and Ambrosini (2015) agree that identifying knowledge value is an undisputable previous stage for a firm in order for the process of external knowledge acquisition to be developed optimally.

Research literature on KM highlights the specific aspects that influence the identification and acquisition of external knowledge by an organization (see e.g. Almeida *et al.*, 2003; Segarra, 2006). For example, in a study in technological industries, Almeida *et al.* (2003) consider that before a firm acquires external knowledge it should explore its environment to search for useful knowledge from a technological point of view. Almeida *et al.* (2003) also point out that such exploration can only exist if a company has previously developed its exploration capabilities, which depend on those internal efforts dedicated to learning from the development and implementation of proprietary technologies within the firm. Similarly, other authors emphasize the importance of possessing search capabilities in order to get information and novel ideas, which once acquired and integrated into the existing company knowledge base, will improve the firm's organizational performance (Voudouris *et al.*, 2012). Other studies indicate specific instruments to contribute to such knowledge search. For instance, Ebers and Maurer (2014) discuss the role of gatekeepers[3], who are individuals or specialized teams dedicated to finding and connecting the firm to external agents with the aim of being able to identify knowledge from a large variety of sources.

Generally speaking, there is not a great amount of empirical evidence on the relationships between identification capability and external knowledge acquisition. An exception is Patterson and Ambrosini's (2015) research, a qualitative study of 38 biotechnological firms in the UK. In this study, the authors find evidence of a positive

relationship between specific efforts to identify valuable technological knowledge and the assimilation level of such knowledge by the companies within the sample.

Bearing in mind all the above ideas, we consider that establishing strong, frequent and close links – structural social capital – has an important influence on the way a firm is able to take advantage of external knowledge (by acquiring it) when this firm has previously developed knowledge identification capabilities. Due to its identification capabilities, a firm will have a wider range of previously identified knowledge from its inter-organizational network, which will enable it to prioritize the acquirement of new specific knowledge, depending on its current and future necessities[4]. Knowledge acquisition will be faster and more effective for firms with highly developed identification capabilities from the exploitation of its structural social capital. In other words, the development of higher levels of structural social capital will allow a firm to acquire knowledge that is highly valuable if this firm is able to previously build and develop capabilities in order to identify this knowledge value. From these arguments, we propose the following hypothesis:

H1. A company's capability to identify external knowledge value will have a mediating effect in the relationship between its inter-organizational structural social capital and external knowledge acquisition.

3. Methods
3.1 Population, data collection and sample
This study selected Spanish biotechnological and pharmaceutical industries on which to carry out the empirical analysis. The first reason for selecting firms in these industries was that they develop innovation-intensive activities for which external knowledge acquisition is a key process (Marca España, 2015). Moreover, indicators such as internal R&D expenditure – €533.8 million for the biotechnological industry and €953.4 million for the pharmaceutical industry in 2014 – or the number of R&D employees – 9,795 for biotechnology and 4,496 for pharmaceutical activities in 2014, show the relevance of these industries for the Spanish innovation system[5].

Furthermore, scientific and technological advances are frequent and constant in both sectors, and firms need to upgrade continuously their pools of knowledge (Owen-Smith *et al.*, 2002). They are industries that share common features in relation to the discoveries and developments of new complex drugs, such as inter-organizational networks through which resources and knowledge are regularly exchanged (DeCarolis and Deeds, 1999). Another feature is that there are close relationships between the industries, since frequently their activities are vertically integrated, such as product development (biotechnology) and marketing (pharmaceuticals) (Schilling, 2009).

This study used SABI database (system for accounting information analysis in Spanish and Portuguese firms) to compile company data and information. Thus, we used a search criterion based on the Spanish industry classification CNAE-2009, obtaining a population of 735 firms. Subsequently, we launched an online survey, for which a questionnaire was drawn up by the authors of the study. This questionnaire included questions about the firm's absorptive capacity, its relational capital and different types of performance. Regarding the measures for the study variables, we used Likert scales ranging from 1 to 7[6], which had been used and validated in previous studies and were easy to adapt to the context of our research. Other objective measures were also included (e.g. profitability, investment in R&D).

Previous to launching the survey, we developed a pre-test for two firms to analyze its reliability[7]. The self-administered questionnaire was then sent to firms via an e-mail invitation to participate and links to the electronic questionnaire in two stages (December 2014 and February 2015). During the fieldwork, 111 questionnaires were received.

In total, 24 of these questionnaires were considered invalid owing to inconsistencies in responses or through being incomplete. The final sample thus consisted of 87 firms representing a response rate of 11.84 percent, which may be considered acceptable, as it is similar to rates used by other similar organizational studies in which participation is not incentivized (e.g. Maula *et al.*, 2001; Parra *et al.*, 2010; Foss *et al.*, 2013) (Table I).

In order to assess sample biases, we applied *t*-tests to representative variables – Table II. This test[8] allows the researcher to test hypotheses related to the average of some relevant variables between two groups (Wilden *et al.*, 2013). In this case, age and size (number of employees), previously selected as the control variables, were used to compare firms that answered the questionnaire with those that did not. We did not find significant differences in relation to either size or age.

As the study has a cross-sectional design, the Harman test was used to assess the existence of a common variance for our data set. We applied an exploratory factorial analysis (principal components with varimax rotation), and the results showed the existence of four factors with eigenvalues above one, explaining 67.5 percent of the total variance. As the first factor explains only 37.4 percent of the total variance, common variance does not seem to be a significant issue for our research (Podsakoff and Organ, 1986).

3.2 Measures

Inter-organizational structural social capital. With the purpose of establishing an accurate measurement scale for structural social capital, multi-item scales validated in previous studies were considered by the authors (e.g. Yli-Renko *et al.*, 2001; Maula *et al.*, 2001; Inkpen and Tsang, 2005). We finally selected and adapted five items referring to the strength, frequency and closeness of links of a firm with other firms in a network, with an acceptable reliability level (Cronbach's $\alpha = 0.908$).

Identification capacity of valuable knowledge. To measure this variable, we considered nine items taken and adapted from the studies of Segarra (2006) and Jansen *et al.* (2005). Such items reflect the relevance of a firm's monitoring activities in order to identify the valuable knowledge (Cronbach's $\alpha = 0.860$).

External knowledge acquisition. In this case, the study included eight items taken from the studies on knowledge acquisition by Fey and Birkinshaw (2005), Díaz *et al.* (2006) and Valmaseda and Hernández (2012). The measure aims to represent different intentional options that a firm might have to acquire external knowledge[9] in one of two ways: by developing

Population	735
Geographical scope	Spain
Sample size	87 firms
Unit of analysis	Firm or business unit
Data collection method	Online survey
Response rate	11.84%
Sampling error	9.87%; $p = q = 0.5$
Confidence level	95%

Table I.
Research specifications

	t	Sig. (bilateral)	SE differences
Age	1.159	0.247	8.6262
Size	1.119	0.263	17.7843

Table II.
T-test for means equality when equal variances are supposed

strategic alliances or collaboration agreements (three items, $\alpha = 0.734$), or by contractual arrangements with other agents, public or private (five items, $\alpha = 0.739$).

Control variables. For control variables this study took into account firm age, (natural logarithm from the year of foundation to 2014); firm size (natural logarithm of number of employees in 2014 (2014); and the firm's main industry focus (biotechnology or pharmaceuticals). These variables have been widely used in studies about knowledge acquisition (see e.g. Maula *et al.*, 2001; Yli-Renko *et al.*, 2001; Jansen *et al.*, 2005; Parra *et al.*, 2010). Regarding age, older companies may benefit from their accumulated experience to achieve knowledge acquisition. On the other hand, those organizations with a larger size are likely to have more resources to invest in acquiring external knowledge and developing knowledge identification capabilities (Yli-Renko *et al.*, 2001; Parra *et al.*, 2010). Finally, biotechnological and pharmaceutical firms may have different incentives to choose from among the existing options for external knowledge acquisition (e.g. licenses, mergers & acquisitions, alliances) owing to their structural characteristics.

4. Statistical analysis and results

The hypothesis was tested by using a structural equations model through partial least squares (PLS). PLS is a statistical tool of multivariate analysis, that is used for modeling latent constructs considering non-normality conditions for data and small sample sizes (Hair *et al.*, 2013). The PLS path method is typically applied in two stages. First, the measurement model is analyzed; second, the structural model is calculated and the hypotheses are tested.

4.1 Measurement model

We estimated study's measurement model using a confirmatory factor analysis in order to assess reliability – individual items, constructs and validity – convergent, discriminant of item measurements. The results (shown in Tables III and IV) confirm that the measurement model is reliable and valid.

Individual item reliability is measured through the analysis of standardized loadings (λ) or simple correlations of items with their own construct, meaning that shared variance between a construct and its items is higher than the error variance. Individual item reliability is acceptable when the value of its standardized loading is at least 0.707 (Chin, 1998; Hair *et al.*, 2013).

For construct reliability, we examined the composite reliability in order to analyze the degree of consistency with which the measure of an item belongs to the same latent variable (Cepeda and Roldán, 2004). Nunnally (1978) suggests a composite reliability index of 0.7 as a benchmark for modest reliability in early research stages, and a stricter value of 0.8 for later research stages.

Convergent validity implies that a set of items represents one unique underlying construct. It can be established through the analysis of the average variance extracted (AVE), which should be greater than the threshold limit of 0.5 (Fornell and Larcker, 1981).

Finally, discriminant validity indicates to what extent a construct is structurally different of other constructs of the research study. An accepted method to measure discriminant validity is to check that the AVE for a construct is higher than the variance that the construct shares with the rest of the model constructs (Fornell and Larcker, 1981).

4.2 Structural model

Through the analysis of the structural model, we tested the proposed mediation hypothesis of the study by analyzing path coefficients (β) and the determination coefficient (R^2) as the basic indicators.

| | Items Outer loadings | Reliability Constructs IFC | Convergent AVE | Validity Discriminant Fornell and Larcker criterion[b] | | | |
				DIR_ACQ	COOP	ID_C	ST_SC
DIR_ACQ[a]	0.783	0.806	0.580	0.762			
DIR_ACQ2	0.763						
DIR_ACQ3	0.775						
DIR_ACQ4	0.747						
COOP	0.893	0.850	0.654	0.407	0.809		
COOP1	0.845						
COOP2	0.815						
COOP3	0.765						
ID_C1		0.894	0.584	0.294	0.512	0.764	
ID_C1	0.754						
ID_C2	0.715						
ID_C3	0.812						
ID_C4	0.809						
ID_C7	0.725						
ID_C8	0.765						
ST_SC		0.932	0.733	0.350	0.506	0.451	0.856
ST_SC1	0.837						
ST_SC2	0.839						
ST_SC3	0.932						
ST_SC4	0.870						
ST_SC5	0.797						

Table III.
Measurement first-order model

Notes: [a]Items DIR_ACQ1, DIR_ACQ5, ID_C5 and ID_C6 were removed as they did not satisfy the individual item reliability criterion; [b]values in italics are the square root of AVE. The other values are the correlations between constructs

| | Construct reliability IFC | Convergent AVE | Validity Discriminant Fornell and Larcker criterion[a] | | |
			KW_ACQ	ID_C	ST_SC
KW_ACQ	0.826	0.705	0.840		
ID_C	0.894	0.584	0.509	0.764	
ST_SC	0.932	0.733	0.519	0.451	0.856

Table IV.
Measurement second-order model

Notes: [a]Values in italics are the square root of AVE. The other values are the correlations between constructs

We used bootstrapping analysis to calculate the direct and indirect effects in the model (Hayes and Scharkow, 2013). Bootstrapping results should fulfill four conditions according to Baron and Kenny (1986) (Table V). First, the direct effect between structural social capital and external knowledge acquisition is strong and highly significant ($\beta = 0.539$, $p < 0.001$)[10]. Similarly, both direct effects between structural social capital and identification capability ($\beta = 0.451$, $p < 0.001$), and knowledge identification capability and external knowledge acquisition ($\beta = 0.318$, $p < 0.001$) are significant. Finally, the path coefficient of the relationship between structural social capital and external knowledge acquisition was reduced when the mediating variable was introduced in research model, although it remained significant ($\beta = 0.396$, $p < 0.001$).

To complement this analysis, we applied a percentile approach, both for direct and indirect effects. None of the relationships of the research model has a confidence interval

that contains a zero value; therefore they are significant for these effects (Chin, 2010). There is thus only a partial mediating effect of the identification capability of valuable knowledge in the relationship between structural social capital and external knowledge acquisition.

The determinant coefficient (R^2) indicates the degree of variance that it is explained by the relationships in the model. This analysis allows the researcher to accept or refuse the proposed hypotheses, considering the significance of the standardized regression coefficients (Chin, 1998). Figure 1 shows that structural social capital explains 41.5 percent of external knowledge acquisition variance and 20.4 percent of identification capability variance. Authors such as Falk and Miller (1992) suggest that this value should be at least 10 percent for the model to be considered to have sufficient predictive power. Lower values of R^2, even being significant, provide limited information and accordingly, the hypotheses would have non-significant predictive power. Following this assumption, our model seems to show predictive power (Chin, 1998).

We used an additional criterion, the Stone-Geisser-test (Q^2), to assess the predictive relevance of the dependent constructs. Dependent variables will generally be relevant with a positive Q^2 coefficient (Chin, 1998; Hair *et al.*, 2013). Consequently, and given that all constructs of the research model have positive values for Q^2 (Table VI), we consider that their predictive value is relevant.

Finally, with regard to the control variables, as shown in Figure 1, only firm size and age have a significant effect on external knowledge acquisition. While the size effect is positive ($\beta = 0.265$, $p < 0.01$), age influence is negative ($\beta = -0.200$, $p < 0.01$), with both relationships being significant. The result of age on external knowledge acquisition could

Effect	Relationship	Type	Path coefficient (β)	t	Confidence interval of 95%	Hypothesis contrasting
Total	ST_SC → KW_ACQ	Direct	0.539***	8.549	0.451-0.646	Partially supported
Mediation	ST_SC → KW_ACQ	Direct	0.396***	5.066	0.265-0.520	
	ST_SC → ID_C	Direct	0.451***	4.570	0.303-0.622	
	ID_C → KW_ACQ	Direct	0.315***	3.538	0.175-0.463	
	ST_SC → ID_C → KW_ACQ	Indirect	0.142**	2.732	0.070-0.238	

Notes: *$p < 0.05$ ($t_{(0.05;\ 4,999)} = 1.6479$); **$p < 0.01$ ($t_{(0.01;\ 4,999)} = 2.3338$); ***$p < 0.001$ ($t_{(0.001;4,999)} = 3.1066$)

Table V.
Mediation hypothesis contrasting

Notes: *$p < 0.05$ ($t_{(0.05;\ 4,999)} = 1.6479$); **$p < 0.01$ ($t_{(0.01;\ 4,999)} = 2.3338$); ***$p < 0.001$ ($t_{(0.001;\ 4,999)} = 3.1066$)
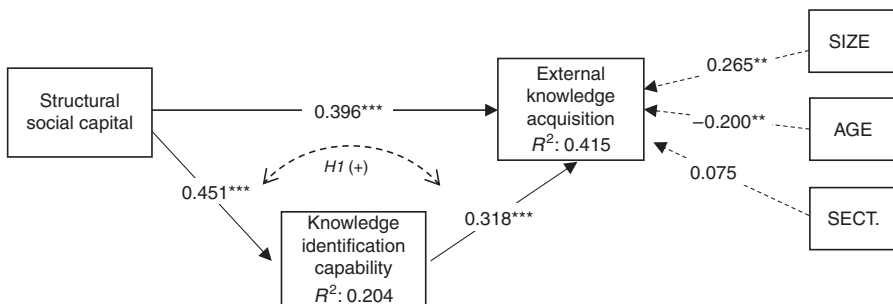
Figure 1.
Research model and results

be explained by arguing that younger firms usually have more need to acquire external knowledge than older firms, which have accumulated a longer knowledge background.

However, the inclusion of age, size and industry belonging in the research model does not affect the significance of the relationships between structural social capital, identification capability of valuable knowledge and external knowledge acquisition. Similarly, the effect of each control variable on the identification capability as a mediating variable was considered, but it was not significant in any case. For this reason and for simplicity purposes, we decided not to include them in the graphic model.

5. Discussion and conclusions

The purpose of this research has been to study the relationship between structural social capital, external knowledge acquisition and a firm's capability to identify external valuable knowledge. Given its strategic relevance in the last few years, the study of the external knowledge acquisition process has been of great interest amongst scholars in business management. However, the identification of the antecedents of knowledge acquisition continues to be one of the challenges that the discipline of KM faces nowadays. With this in mind, this study proposes that inter-organizational structural social capital and the capacity for identifying valuable knowledge are two essential antecedents of external knowledge acquisition. Therefore, one of the theoretical contributions of this paper has been to try to connect the relational perspective of social capital with the knowledge-based view from a strategic point of view.

The effect that the structural social capital has on the acquisition of external knowledge – particularly when knowledge is complex and tacit – has given rise to the emergence of studies with opposing arguments and divergent empirical results with regard to the intensity that inter-organizational relationships should exert in order to increase or reduce such acquisition (Yli-Renko *et al.*, 2001; Presutti *et al.*, 2007; Zhou *et al.*, 2014). Hence, a contribution of this study has been to consider a firm's capability to identify valuable knowledge as a mediating variable in this relationship. Nevertheless, the obtained results only partially support the hypothesized mediating effect. Thus, the results support there being both a direct and an indirect effect – via identification capability – of structural social capital on external knowledge acquisition. Consequently, the development of a high level of structural social capital will directly allow organizations to acquire a greater amount of external knowledge (than those firms that have a low level of structural social capital). As a result, we can state that the stronger, more frequent and closer the inter-organizational links of a company are, the higher the level of available knowledge will be, as this kind of links increase the likelihood that agents will carry out and complete market transactions or cooperative agreements to acquire knowledge. This idea of positive links is consistent with the findings of Maula *et al.* (2001) and Yli-Renko *et al.* (2001), that repeated and intense interaction facilitates the acquisition of external knowledge, especially when firms deal with technical issues for which complex and tacit knowledge is needed and such knowledge only can be found in networks of specialized innovative companies. In any case, a firm must intentionally invest to create such networks and at the same time build capabilities that allow it to identify and subsequently acquire the kind of knowledge that it requires to develop competitive advantages through its realized absorptive capability (Zahra and George, 2002).

Dependent variable	R^2	Q^2
KW_ACQ	0.415	0.159
ID_C	0.204	0.399

Table VI.
Predictive power
of the model

When we introduce the capability to identify valuable knowledge into the model, this variable contributes to explain in a better way the acquisition of external knowledge and reaffirms its importance as a driving mechanism of structural social capital toward the acquisition of valuable knowledge. In this regard, apart from increasing the aforementioned variance, we observe that the direct effect of structural social capital on the acquisition of knowledge is significantly lower. A possible explanation of this result is that the capability to identify valuable knowledge directly affects the acquisition of knowledge, as was suggested in the research of Patterson and Ambrosini (2015). In this regard, whether a company develops to a greater extent than others this capability to identify and assess the value of knowledge their network's partners possess, may be dependent upon the decision about which acquisition method would be better for the acquisition of specific pieces of knowledge. For example, in the case of both the pharmaceutical and the biotechnical industries, it often occurs that when there is no need to possess a specific kind of knowledge immediately, companies fund research works in various institutions with the aim of obtaining development licenses and the commercialization of the research results. On the contrary, when a patent or non-licensed technology is needed urgently, companies usually opt for either buying shares or establishing cooperative agreements based on the exchange of resources that could be of interest to all the parties involved in the process (Hansen, 1999). The ability to identify valuable knowledge could thus enable a firm to establish different forms of acquisition depending upon their availability and the urgency or necessity that the company has to acquire such knowledge.

On the other hand, the relationship between inter-organizational structural social capital and the capability to identify valuable knowledge within a company has not been extensively studied in the literature. This becomes a challenge when trying to establish the factors that could be highly influential in the generation of incomes using inter-organizational networks by innovative companies in highly dynamic and complex contexts (Liao and Marsillac, 2015). In this regard, this paper has also contributed to the line of research on social capital and KM, as it has shown the influence of these relationships on the intentional acquisition of external knowledge. Therefore, the existence of high levels of strength, frequency and closeness of structural social capital would entail a higher development of the capability to identify and understand the role/value of external knowledge for a company, as has been suggested in the analyzed literature (Zaheer and McEvily, 1999; Adler and Kwon, 2002; Smith *et al.*, 2005; Stuart and Sorenson, 2007; Hughes *et al.*, 2014), especially in industries dealing with complex technologies, know-how and expertise such as biotechnology or pharmaceutical activities. (Hansen, 1999).

The results obtained could produce a series of interesting prescriptive implications for company managers linked to high-tech industries. Organizations must understand that "good" management of their inter-organizational structural social capital may allow companies to develop dynamic capacities related to the identification and acquisition of unique and complex knowledge, so that they can expand, reconfigure and adapt their own resources to changes in their environment (Teece *et al.*, 1997; Eisenhardt and Martin, 2000). Moreover, in order for the company to make the best strategic use of the knowledge acquired from the inter-organizational networks, it is crucial that the development of cohesive links with the agents of these organizations be oriented to the improvement of the capability to identify valuable knowledge. In this sense, organizations could improve their level of acquisition selecting a method of acquisition that better matches their necessities and particular circumstances, which are dependent upon the availability of the knowledge that has previously been identified as valuable. Finally, if a company is able to adequately manage its network of inter-organizational relationships, the development of internal capabilities allowing it to identify and access valuable assets held by other agents will be enhanced (Castro and Roldán, 2013).

As far as limitations of the study are concerned, first, the cross-sectional nature of the empirical study makes it difficult to analyze the relationships between social capital and knowledge acquisition over time (Hughes *et al.*, 2014). In this regard, it was necessary to work on the premise that the development of social capital, the patterns of acquisition of knowledge and the evolution of the capability to identify valuable knowledge remain constant over time. Another limitation of the study arises from not having established specific relationships between structural social capital and the dimensions of the deliberate acquisition of knowledge (i.e. cooperation; hiring). In this regard, it should be borne in mind that this research focused on the study of relationships of a generic type. Future studies may focus on specific acquisition strategies depending on the characteristics of the interactions, their frequency and their density. Furthermore, the distinction between types of knowledge (e.g. tacit vs explicit), which adds value to the epistemological dimension, has not been taken into consideration (Nonaka and Takeuchi, 1995). For example, the issue of the transferring of explicit knowledge between businesses is very different to acquiring and transferring tacit knowledge between organizations.

In order to address the previous limitations, what may be of interest for further study would be the analysis of the effect that particular characteristics of the network of external relationships for a company may have on the acquisition and transfer of knowledge, depending on whether it is tacit or explicit, or even simple or complex. Furthermore, the replication of the study in other types of contexts (low-tech; other countries) or the inclusion of new industries with similar characteristics (high-tech) could be used to validate the model and evaluate the suggested relationships between variables. Finally, the development of a longitudinal study would contribute to the analysis of the effects of change within a network and the configuration of strategies for knowledge acquisition that are developed by a company.

The aforementioned areas of further study, along with other possibilities, would help to unravel the complex relationships within a company's networks and the use of such networks to achieve further innovation in intensive technological sectors.

Notes

1. Absorptive capacity is a firm's ability to identify the value of new external knowledge, assimilate it, transform it and exploit it in an effective manner (Cohen and Levinthal, 1990).

2. The distinction between potential and realised absorptive capacity proposed by Zahra and George (2002) is the first study that shows absorptive capacity as a dynamic capability, and it is the most commonly accepted concept by the strategic management literature.

3. Gatekeepers are information managers with decision capacity in both a proactive and reactive way. Ebers and Maurer (2014) consider that these individuals (or teams) are essential agents who contribute to a firm's absorptive capacity, since they work as the links between suppliers and receivers of expertise and information for a firm.

4. Not all the agents that are able to generate valuable knowledge for a firm are willing to share or commercialize it.

5. Data from ASEBIO (2015) and www.ine.es

6. We have reversed the order of some scales in order to avoid non-response biases as far as possible (see Table AI).

7. A draft of the questionnaire was first sent to the scholars of the Department of Business Administration from the University of Castilla-La Mancha who have an extensive publication record in knowledge management and/or intellectual capital. The second test was developed through several in-depth interviews with CEOs of two biotechnological companies. Those items whose response seemed to be problematic (wording, understanding) were deleted or changed from the original questionnaire by the authors.

8. The *t*-statistic, with its bilateral level of significance, provides information about the rate of compatibility between the equality of means hypothesis and the difference between the observed population averages. Its value should be higher than 0.05 in order to assume the hypothesis of equal averages.

9. Owing to the difficulty of measuring non-intentional knowledge acquisition, this research only deals with intentional knowledge acquisition.

10. As every hypothesis of the research model specifies the relationship direction, one-tail student *t*-test (*n*−1 grades of freedom, being *n* the subsamples' number) was used for determining their significance.

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Appendix

Construct	Item		Source
External knowledge acquisition	*Cooperation*		Fey and Birkinshaw (2005), Diaz *et al.* (2006), Valmaseda and Hernández (2012)
	COOP1	My company usually develops alliances and/or cooperation agreements with universities	
	COOP2	My company usually develops alliances and/or cooperation agreements with customers and suppliers	
	COOP3	My company usually develops alliances and/or cooperation agreements with participants in the development of joint research projects promoted by government institutions	
	Direct knowledge-purchase		
	DIR_ACQ1	My company has equities in technological development firms	
	DIR_ACQ2	My company hires staff with professional experience	
	DIR_ACQ3	My company hires external consultants	
	DIR_ACQ4	My firm acquires technological licenses	
	DIR_ACQ5	My company acquires complex technology incorporated into equipment or specialized machinery	
Identification capability of valuable knowledge	ID_C1	My company has the ability to seek information within its environment	Segarra (2006), Jansen *et al.* (2005)
	ID_C2	My company has the ability to anticipate competitors movements	
	ID_C3	My company has the ability to anticipate customers necessities	
	ID_C4	My company has the ability to keep in touch with external institutions and specialized sources	
	ID_C5	My company has personal, equipment and specialized services for environment monitoring	
	ID_C6	My company has problems to recognize changes in our market/products[a]	
	ID_C7	My company understands new opportunities to satisfy our customers quickly	
	ID_C8	My company interprets changes in market pull quickly	
	ID_C9	My company knows intuitively which areas can use acquired technology or external knowledge	

Table AI.
Research items

(*continued*)

Construct	Item		Source
Inter-organizational structural social capital	EST_SC1	My company usually acquires knowledge from our inter-organizational contacts' network	Yli-Renko *et al.* (2001), Maula *et al.* (2001), Inkpen and Tsang (2005)
	EST_SC2	My company personally meets contacts who acquire external knowledge	
	EST_SC3	My company maintains narrow inter-relationships with contacts who acquire external knowledge	
	EST_SC4	My company maintains frequent inter-relationships with contacts who acquire external knowledge	
	EST_SC5	My contacts frequently acquire knowledge from among themselves	

Note: [a]Item with inverted coding

Table AI.

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