Development of inter-firm network management activities: The impact of industry, firm age and size

Abstract

This article investigates the structural characteristics of firms that promote activities involving partners who coordinate with each other to achieve common or individual goals. The article also aims to verify empirically whether these activities generate advantages for companies embedded in relationships by examining the effects of industry, age and size on inter-firm network management activities (INMAs) in a sample of Spanish companies operating in several industries and belonging to networks. The results show differences according to the life cycle stage: growth or maturity. Only the relation between INMA and performance has been confirmed in both samples. The findings point to the need to consider the industrial environment when analysing firms' networking decisions because the situations they face differ in mature or growing industries.

Keywords

Industry, age, size, networking, performance

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Introduction

Relationships are often regarded as the foundations for success in a more global, uncertain and competitive environment (Morgan & Hunt 1994), and networks constitute the frameworks for all activities that take place in business relationships (Mattsson 1997). This paper specifically focuses on the firm's network, which directly influences the flow of resources across the firm's boundaries. The firm's network consists of its set of direct, dyadic, informal ties and the relationships between these ties, with the firm at the centre of the network as the focal actor (Hite & Hesterly 2001). Informal ties comprise relationships defined as implicit, personal, generic, and not fixed by any legal arrangement (Rank 2008). Formal ties which prevail in strategic networks (Jarillo 1988) are defined as being explicit, impersonal, and functionally specific relationships among firms (Rank 2008).

Researchers have considered two main perspectives in order to study firms' networks and their effects: the structural and the managerial perspectives. The structural perspective examined how the structure of networks and quality of ties affected resource flow and influenced business behaviour (Batjargal 2006; Hoang & Antoncic 2003). Traditionally, this perspective used three dimensions: the first dimension focused on the structure of the network and the properties of the position occupied by the agent in the network (structural dimension), the second dimension summarized the characteristics of the agent's relations, such as confidence and longevity of the link, (relational dimension), and the third dimension measured the value of the resources that networked agents are able to provide (resources dimension) (Batjargal 2006; Hoang & Antoncic 2003). The key intuition in this research is that better socially embedded connected firms have access to valuable resources, because the

structure and quality of their network connections shape information access and lead to accelerated trust formation (Burt 1992, 2000).

The managerial perspective on networks highlights the importance of what entrepreneurs do to create and shape their business networks. This perspective draws on the fundamental assumption that the mere presence in a network does not create value for firms; rather the value of a network is only realized through the owner–manager's positive use of the resources contained within the network (Johanson & Vahlne 2009). For researchers in this perspective the management of the business network and the management in business networks are key elements in determining firms' network competence and performance. Consequently, scholars have focused on how managers' networking efforts can influence their business networks through churn in their composition. By churn Vissa and Bhagavatula (2012) refer to the change in business network composition caused by the entry of new network contacts and exit of existing network contacts. The importance of having the right counterparts has been emphasised and, for these researchers, network management mainly consists of allocating resources to different relationships (Ritter, Wilkinson & Johnston 2002). Different relationship-specific tasks, such as exchange and coordination aimed at initiating, using, developing, routinizing, and dissolving a relationship, have been pointed out (Hoang & Antoncic 2003; Ritter, Wilkinson & Johnston 2004; Slotte-Kock & Coviello 2009). Additionally, the benefits of having a central position in a network have also been highlighted (see for example Hoang and Antoncic 2003 for a review). Network management has been associated to the process of becoming an insider in a relevant network of an industry (Johansson &Vahlne 2009; Hoang & Antoncic 2003; Slotte-Kock & Coviello 2009). And lastly, different stages in the process of network evolution have been identified (Hoang & Antoncic 2003; Slotte-Kock & Coviello 2009). Over time networks become too complex to be adapted and aligned to different firms' resource challenges (Hite & Hesterly 2001), and

network management is focused on how relationships change and why change occurs (Slotte-Kock & Coviello 2009).

A major critique of this research is that nearly all of them treat relationships as unconnected and derive strategies for the individual relationship and not for the network (Ritter et al. 2004). Focusing on individual's networking activities can only help us to understand how firms obtain private benefits, that is, the benefits a firm can earn unilaterally by picking up skills from its partner and applying them to its own activity (Khanna, Ranjay & Nohria 1998). Common benefits accruing to each partner in a network from the collective application of the learning that all the firms go through as a consequence of being part of the same network (Khanna et al. 1998), can also be important. But, with the exception of the work by Ritter et al. (2002, 2004), less is known about the way firms in a network actively co-develop management activities to effectively materialize common benefits. These authors, on the basis of task classifications in general management literature, suggested four network management tasks to effectively co-manage business networks: planning, organizing, staffing, and controlling (Ritter et al. 2002, 2004). Ritter et al. (2004) recognise that in business networks, firms participate in a self-organizing process in which strategy can emerge in a bottom–up manner from the micro-interactions taking place among firms involved (Wilkinson &Young, 2002), however they discuss the importance of managing for a planned network strategy (Ritter et al. 2004). Their main argument for the deliberate/planned network strategy is the need to integrate the contributions from different actors in the network in order to develop common benefits (Ritter et al. 2004). However, there are other situations in which firms cannot plan their network strategy. They cannot select their network partners or cannot influence their behavior. In these situations, the network management tasks identified by Ritter et al are not entirely appropriate (Ritter et al. 2002, 2004; Ritter & Gemünden 2003). In these situations all firms in a network will be simultaneously involved

in its ongoing management, and the resulting strategy is coproduced by their actions. In this work, we focus specifically on this situation which has not been addressed in the literature; precisely because in business networks where informal ties prevail it is more usual for firms to face situations where it is difficult a priori to identify their network strategy. Consequently, in this paper we propose slightly different network management tasks to the ones proposed by Ritter et al. (2002, 2004). We examine the following tasks below: inter-firm knowledge sharing, resource sharing, coordination, conflict resolution and adaptation between network members. We refer to these network management tasks as inter-firm network management activities (INMAs). Thus, our first supposition in this paper is that INMAs help create an effective co-working environment that enables firms to use the potential shared benefits of networking to enhance their own performance by facilitating their adaptation to customer needs. We adopt a marketing focus (Helfert, Ritter & Walter 2002) placing network firms 'customers satisfaction as an important element in determining common benefits. We are aware that other strategic elements may influence common benefits and justify the development of INMAs like, for example, technological learning, but they lie outside the scope of this work. Given the lack of research in this area, our first research question is:

RQ1: Do INMAs influence firm performance?

Inspired by the contingency perspective (Covin & Slevin 1989; Miller & Friesen 1982; Miles & Snow 1978; Chandler 1962), in this research we argue that a company's ability to engage in INMA will depend, in part, on its organizational resources. INMA tend to be resource-consuming activities, therefore the development of INMA will be, to some extent, limited by its resource base. Firms with abundant resources may have a greater capacity than those with sparse resources to engage in INMA. Although different variables have been defined as proxies of firm's resources (e.g. Covin & Slevin 1989), as others before in the network context we use size and age (Håkansson 1982). However, a

negative effect may be also identified if we use these variables. Bigger and older firms usually develop routines that diminish their flexibility to respond to changes required by INMA to adapt to customer needs (Autio, Sapienza & Almeida 2000). Thus, our second research question is:

RQ2: Do firm age and size contribute to the development of INMAs?

The contingency perspective in management also argues for the need to consider environmental characteristics as important determinants of management activities (Chandler 1962) and has received substantial empirical support (Walter, Kellermanns, Floyd, Veiga & Matherne 2013). Past research makes it clear that the nature of industries evolves over time through their life cycle (e.g., Grant 2010; Levitt 1965). Contingency theory suggests that the management elements that determine firm adaptation to customer needs will be reconfigured as the life cycle shifts from one stage to another. Although the literature contains a significant body of research supporting this influence (Karniouchina, Carson, Short & Ketchen 2013), none of these studies have accounted for the potential effects of changes in life cycle stages on co-management activities such as INMAs. Consequently, our third research question is:

RQ3: Do industry life cycle stages influence the development of INMAs?

By highlighting the importance of INMAs this study extends previous network management research mainly focused on relationship-specific tasks and cross-relational tasks (Ritter et al. 2004) to include insights into how firms in a network develop conjoint bottom-up management activities. Moreover, gaining additional insights into how firms contingency variables (size and industry life cycle stages) can contribute to the development of INMAs will enable us to better understand firms' networking activities from a managerial perspective.

Furthermore, this study also provides suggestions for researchers when considering variables like industry life cycle, company age and size as control variables. In short, we propose a conceptual model to explain firm performance that relates age, size and industry life cycle with INMA and INMA with firm performance. The following section presents the theoretical background and the relationships between the structural factors studied and INMA. Then, the method for analysing our hypotheses is explained, followed by a discussion of the results. Finally, the conclusions, the implications, the limitations and proposed future research developments are presented.

Inter-firm network management activities and firm performance

In business networks where informal ties prevail, the managerial challenge is that the firm mainly has to cope with managing interactions taking place in multiple relationships, which may be with partners not entirely of the firm's choosing and have been in operation for some time. Therefore, each partner has a history that exerts an influence on how things are done (Ritter et al. 2004). In these situations, firms need to develop different cross-relational tasks to the ones proposed by Ritter et al. We have identified five INMAs firms in a network need to perform to successfully meet customer`s needs: inter-firm knowledge sharing, resource sharing, coordination, adaptation and conflict resolution (Helfert et al. 2002).

Inter-firm knowledge sharing is defined as the set of activities performed jointly by firms in the network enabling them to obtain valuable information from their customers and conjointly develop solutions for improving their offerings. These activities enable network partners to streamline the flow of customer information across organizational boundaries (Shih, Hsu, Zhu & Balasubramanian 2012), in turn improving firm's agility and adaptability to new customer needs (Robson, Skarmeas & Spyropoulou 2006). Knowledge

sharing within a network allows a firm to acquire information about its relationship partners, including their resources, needs, capabilities, strategies, and other relationships (Johanson & Vahlne 2009). Such information sharing activities allow organizations to expand their customer knowledge pool, deliver value-added products or services, detect emerging opportunities and capture business benefits in a hypercompetitive business environment (Shih et al. 2012). The process of creating knowledge is not separate from the other activities in business relationships; rather it is embedded in them. Knowledge accrues not only from the firm's own activities, but also from the activities of its partners, and since those partners also have other relationship partners with whom their activities are coordinated, the firm is indirectly engaged in a knowledge creation process that extends far beyond its own horizon. Thus a network of business relationships provides a firm with an extended knowledge base (Kogut 2000). Effective knowledge sharing activities enable network partners to streamline the flow of customer and market information, money, and products across organizational boundaries, in turn improving the agility, adaptability, and predictability of the network. These activities are a critical factor for collaborative resource coordination, allocation and integration across different members of the network (Kim, Umanath, Kim, Ahrens & Kim 2012).

In addition to these practices, business networks offer their members a portfolio of services designed to overcome the competitive weaknesses of individual firms. Services shared among members could range from negotiating and purchasing from suppliers, marketing, personnel development, to financial services, quality management, inventory optimization and market research. Each network is able to define the services most relevant to its members (Wegner & Padula 2010).

Inter-organisational coordination refers to synchronisation of partners' actions (Mohr & Nevin 1990). Network coordination can be seen as routines for integrating network

activities (Löfgren, Tolstoy, Sharma & Johanson 2008). IMP project studies show that relationships usually involve a number of managers who work together to coordinate their firms' activities and create interrelated routines (Cunningham & Homse 1986). This coordination comprises the establishment, use and control of formal rules and procedures and the exertion of informal influence (Helfert et al. 2002). Grandori and Soda (1995) cite a set of practices that involve the planning, communication and evaluation of strategies. These functions must be modified to suit the dynamics of networks, which are kept in operation by constant negotiation processes. Moreover, evaluation of the results provides information that feeds back to the management of the network and should result in changes (Wegner & Padula 2010). Awareness that the network partner may face disadvantages in return for defective behaviour motivates the actor to fulfil the implicit and explicit rules of networking (Fink & Kessler 2010).

Adaptation refers to the activities firms must adopt to meet partners' special needs or the ability to adapt to new circumstances (Helfert et al. 2002). Adaptation processes include relationship-specific investments in areas such as technology, products/services, manufacturing processes, logistics, administration, employee qualification or financing (Hallén, Johanson & Seyed-Mohgamed 1991; Claycomb & Frankwick 2010). Harrigan (1988) showed that partnerships are more likely to succeed when partners possess complimentary missions and resource capabilities. Compatibility in terms of resources is the key issue for performance outcomes. Therefore coordinating and adapting the activities of a network will help to make resource compatibility a source of superior performance.

The use of constructive conflict resolution mechanisms extends the notion of coordination because these mechanisms address extraordinary, non-standard situations, which are bound to occur in every long-term relationship (Ruekert & Walker 1987).

Interaction/network theory declares that organizations linked by cooperative interaction

processes employ other non-contractual processes associated with conflict, coexistence, collusion and competition (McLoughlin & Horan 2000). In relationships characterized by a desire to establish and maintain long-term, collaborative efforts, managers favour productive conflict resolution mechanisms because they are less volatile. Constructive conflict resolution requires a timely reaction to conflict, a readiness to compromise and a sense of justice. Constructive mechanisms contribute to a relationship, strengthen each firm's identification with the other, and increase cooperation. Firms developing long-term, collaborative relationships engage in joint problem solving because integration satisfies more fully the needs and concerns of both parties (Claycomb & Frankwick 2010). Joint problem solving to resolve conflict leads to mutually satisfactory solutions, thereby enhancing relationship success (Mohr & Spekman 1994).

Successful relationships tend to exhibit processes characterized by high levels of joint participation, cooperation, effective communication, and productive conflict resolution. Consequently, in this paper we propose that network-driven performance is associated to the development of INMAs.

H_1: INMAs enhance network members' performance.

Size, Age and INMA. The development of INMA requires companies to have sufficient human and organizational resources and these resources are usually associated to firm size and age (e.g. Greiner 1972).

Large firms are more resource-rich than small and medium enterprises. Large firms may also have a longer-term view towards investments, allowing them to keep operating to assess their viability, even if they are incurring losses. Institutional theory emphasizes institutional environments which include cognitive and sociological elements, such as shared norms, standards, and expectations (DiMaggio & Powell 1991; Scott 1995).

This institutional environment is an underlying driving force behind organizational activities because of an organization's desire for legitimacy (Martinez & Dacin 1999). Large size tends to legitimate organizations, to the extent that large size is interpreted by external stakeholders as an outcome of an organization's prior success (Baum & Oliver 1991). From an institutional perspective, large firms tend to attract disproportionate attention from the public. Large firms are arguably more concerned than small and medium enterprises about the downside effect on their reputation associated with the dissolution of their alliances. To maintain a favourable public image, large firms may hesitate to terminate unprofitable relationships. The dependence of SMEs' on large partners for resources and legitimacy gives the large partners bargaining power over the SME partners and places them in a position to influence network management. From an institutional perspective, profitability is less visible than survival because it is difficult for the public to obtain financial information. So, in terms of their public image, large firms are more concerned about network survival (Lu & Beamish 2006). Therefore, factors from either economic or social perspectives point to increased efforts from large companies to contribute positively to network management (Lu & Beamish 2006).

Although the literature review reiterates that networks and relationships are important for firms of all sizes because they enable firms to link activities and tie resources together (Coviello & Munro 1995; Chetty 2003), they seem especially important for small firms, who face many more challenging obstacles to survival and growth than larger firms, primarily due to the constraints on their organizational resources and capacity (Luo, Zhou & Liu 2005). Largeness promotes insularity (March 1981), complacency and inertia (Hannan & Freeman 1984), and resistance to adaption (Aldrich & Auster 1986). Small firms' greater flexibility, response speed (Katz 1970), and tendency to constantly monitor the environment for threats and opportunities (Aldrich & Auster 1986) usually enhances swiftness of strategy

implementation and customer understanding. Small firms have also been found to make active use of inter-organizational relationships to facilitate growth (Coviello & Munro 1995) by, for example, outsourcing key marketing activities traditionally held within the organization. Coviello, Brodie and Munro (2000) demonstrate that smaller firms are more relational than larger firms in their approach to marketing communication and primary customer contact, investment in marketing resources, and the level at which marketing activities are conducted in the firm. Therefore, smaller firms appear to place more emphasis on direct relationships with other players in a network. This behavior added to the constraints of small companies will foster the development of coordination, adaptation and knowledge sharing routines in their inter-firm networks, while the independency and resource availability of large firms will discourage sharing activities that are perceived to be developed more efficiently in an independent way. Small firms' lack of power in inter-firm networks will encourage them to promote conflict resolution mechanisms that improve the network atmosphere, while large firms will be more tempted to use the power of their size inside the network. Finally, small firms will take more advantage of network resource availability than large firms who usually have less need for those resources. Consequently,

H_2: Company size has a negative influence on inter-firm network management activities.

INMA development requires professionals with experience, and also internal organizational processes to provide support. For example, a firm can only become involved in the joint development of activities to exchange information on customers if it has previously developed internal customer information management processes to facilitate the exchange of that information with other network members.

Nevertheless, another effect is also possible. Time, as signified by the age of firm, impacts on its strategy and its ability to change. Time is history and represents the specific, dated context of a firm. Boeker (1989) demonstrates that both the age of the firm and its history limit the available strategic spectrum. He also shows that firms with one specific dominant strategy are unlikely to change it, even if performance is poor. This type of analysis matches the notion of organizational inertia as identified by Hannan and Freeman (1984). Companies' reluctance to change in adulthood is likely to be a barrier to network adaptation activities. Conflict will probably arise in the relationships, making coordination among partners more difficult and, consequently, reducing knowledge sharing routines. Inertia also makes it difficult to find satisfactory ways of solving inherent conflict in networking. Young companies usually need resource availability which encourages them to find partners to cover that need. Thus young firms will be more willing to maintain knowledge sharing routines particularly focused on market demands, coordinate them, adapt to their partners and establish conflict resolution mechanisms. Therefore, young firms will have a higher propensity to contribute to inter-firm network management activities than mature firms.

H_3: Company age has a negative influence on inter-firm network management activities.

Industry life cycle stage and INMAs. The structure of an industry evolves continually, driven by technological, economic and competitive changes. Industry life cycle is commonly used to study industries (Grant 2010; Miles, Snow & Sharfman 1993; Levitt 1965) because it provides a criterion for classifying industries according their stage of development. The process of choosing a classification scheme and putting industries into different categories leads to consideration of what is important in an industry and the aspects in which industries are similar and where they differ. In fact, life cycle stage may negatively

affect the amount of strategic variety found in an industry (Miles, Snow & Sharfman 1993). Following similar research (Andersson 2004), our study focuses on the growth and maturity stages of an industry's life cycle. When considering the effect of industry life cycle on enhancing INMAs, a central issue is that the strategic objective underlying firms' network activity is to improve their adaptation to their customers' needs. Building on past theory and research, we expect that INMAs focused on customers' satisfaction will be important in both stages, but that their relative importance will vary according to the industry life cycle stage. In growth stages firms will motivate their INMAs in order to reduce technological uncertainty; but in mature stages businesses will focus their networking efforts on how to improve business offerings to meet new customer demands.

In growth stage periods by definition almost no dominant competitive strategy or product standards exist (Miles et al. 1993). This period is characterized by high technological uncertainty; consequently, until a dominant technological design emerges, there are advantageous conditions for establishing informal technological networks (Pyka 2000). In this context, the firm's networking activities do not focus mainly on customers and how to develop new offers to satisfy their needs, but on technological factors to reduce technological uncertainty.

The growth stage is characterized by accelerating market penetration as technical improvements and increased efficiency open up the mass market (Levitt 1965). Increasing market saturation causes the onset of the maturity stage. Once saturation is reached, demand is wholly for replacement (Grant 2010). In the later stages market knowledge becomes critical for avoiding company decline. In this situation inter-firm knowledge sharing, resource sharing, coordination, adaptation and conflict resolution activities concentrated on consumers' needs merit special effort. In order not to fall behind one's competitors, it is important to obtain the latest market information. It is also important

to gain access to sophisticated and demanding buyers (Porter 1980). Thus, the progression of this stage will foster cooperation inside the network focused on discovering new customer demands. As the industry advances toward its end customer focused INMAs gain value. Decreasing sales will give rise to the need to discover and adapt to new customer demands. Therefore,

H_4: Industry effects on INMAs will be stronger in the maturity stage than in the growth stage.

Methodology

The purpose of this study is to analyse the role of INMAs in firm performance. Additionally we study the influence of firm size, age and industry life cycle stage on the development of INMAs. As such, the current study involves a multi-industry empirical examination of firms. Data were gathered from a sample of Spanish companies operating in several industries and belonging to an inter-firm network. According to Grant (2010) it is likely that an industry will be at different stages of its life cycle in different countries. Therefore it is advisable to restrict the analysis to only one country, in order to allow comparisons between industries.

Firms were selected from the Dun & Bradstreet 2010 Database. Companies had to belong to a network; understanding network as informal relationships among at least three independent companies, in such a way that all the companies have focal relationships with and know the other companies and their activities inside the network (Schoonjans, Van Cauwenberge & Bauwhede 2013). Additionally, firms could not be subsidiary or affiliated companies. Only independently owned and operated firms were included in our sample. This process gave a total population of 9439 companies. The field research was carried out during

the second quarter of 2010 and the final sample consisted of the 400 companies that responded to the questionnaire.

For the field research, interviewee collaboration was requested, together with confirmation of the e-mail address. After the questionnaire had been sent out, follow-up contact was made by telephone to increase the response rate. The questionnaire was posted on the Internet and an e-mail with a link to it was sent to each manager. Table 1 summarizes the main characteristics of the sample.

[Insert Table 1 about here]

To test for non-response bias, the responses of early and late respondents were compared. Analysis of the t-test showed no significant differences ($p = 0.05$ level), indicating an absence of non-response bias (Armstrong & Overton 1977).

Measuring Instruments

The current study relies on previous research for items to measure key constructs. Items were adapted from previous studies by changing words and sentences to enhance understanding in the Spanish context. Table 2 displays specific items used to measure the constructs and their respective factor loadings and t-values.

[Insert Table 2 about here]

Industry's life cycle stage. Beal and Lockamy (1999) used the following measures to identify industry life cycle stage: (1) growth in the industry's sales during the past five years; (2) level of demand for the industry's products; (3) stage of development of the industry's products; (4) level of diffusion of information about the industry's products; (5) plant capacity of the industry's firms over the past five years; (6) current price levels of the industry's products; (7) growth in the different types of distribution channels for the

industry's products over the past three years; and (8) level of the industry's advertising expenditures over the past three years. Following their procedures, each author, based on individual analyses of the respondents, assigned an industry life cycle stage to each of the firms: growth or maturity. Then a value from 1 to 5 that assessed which phase of the stage the industry was in (1 being the earliest and 5 the latest) was assigned to each company. 119 firms were assigned to the growth stage and 279 firms to the maturity stage. Two firms could not be assigned due to missing data.

Company age. Company age was measured by subtracting the year of the field work (2010) from the year of incorporation.

Company size. Company size was measured through number of employees.

Interfirm Network Management Activities. An adaptation of the scale proposed by Helfert et al. (2002) was used.

Company performance. In situations where firms are hesitant to provide objective performance data, collecting subjective data provides researchers with a better ability to understand the values that a manager may place on performance (Hult et al. 2008). There is evidence to suggest that subjective and objective measures are positively associated (Shoham 1998) and that subjective measures of performance can accurately reflect objective measures (Lumpkin & Dess 2001). Furthermore, management assessments of a firm's performance appear to be guided more by their subjective perceptions than by objective measures (Madsen 1989). These arguments would seem to support the adoption of subjective measures to assess international performance. Furthermore, Johnson and Kaplan (1987) outlined the limitations of economic measures and proposed that a selection of non-economic indicators should be employed. These measures should be based on organizations' strategies, and include measures of manufacturing, marketing, research and development. Thus, to

measure international performance, we adopted a subjective approach in order to improve the response rate. Globally, seven items were used to measure recent performance.

Validity and reliability of the scales

Since the aim of our analysis is to describe the validity of indicators as measurement instruments of INMA and performance scales, the confirmatory initial model was adjusted following the indications of Jöreskog and Sörbom (1993). Items INMACon3 (Δ = -.13, t= -3.96 p<.001) and INMAIks3 (Δ = .14, t= 2.68 p<.01) were eliminated from the scale because they did not reach a lambda of 0.5. The validity analysis results show good fit indexes. Table 2 displays the list of items, their sources, their respective standardized factor loadings and t-values, and results of reliability and validity tests. The positive and significant loadings confirm convergent validity of our measures. Results also show alpha reliability, composite reliability and average variances extracted.

In order to test the discriminant validity between the scales the confidence interval test was used (Anderson & Gerbing 1988). According to this test, the value "1" should not appear in the confidence interval of the correlations between the scales in the same level of analysis. Table 3 shows the results of this test, which were satisfactory in all cases.

[Insert Table 3 about here]

Results and Discussion

To test the conceptual model, we use a structural equation modelling approach. In order to test hypothesis 4, the sample was divided in two parts according to whether the companies were in the growth or maturity stage of their industry life cycle. This procedure also enables hypotheses 1, 2 and 3 to be tested in two different industrial contexts and evaluate if there is any difference in the relations proposed according to industry life cycle stage. Consistent with prior research (Marks & Kamins 1988) the INMA measurement

scale was narrowed down averaging the items in the construct. Table 4 shows the descriptive statistics and correlations and Figure 1 displays the results of the structural models analyses.

[Insert Figure 1 about here]

The results show differences according to the life cycle stage considered. Only the relation between INMA and performance has been confirmed in both samples. This finding points to the need to consider the industrial environment when analysing firms' networking decisions because the situations they face differ in mature or growing industries. As expected, the results show a positive relation between INMA and performance in both cycle stages (Δ = .38, t= 3.31 p<.001 for growth stage and Δ = .43 t= 5.98 p<.001 for maturity stage). This result supports H1 and underlines the importance of firms getting involved in the development of INMAs to manage their networks. This finding contributes to the literature on firm's network management (Möller & Halinen 1999; Ritter et al 2002, 2004: Ritter & Gemünden, 2003) by showing the importance for firms of developing cross-relational management tasks which do not necessarily respond to a strategy planned by top management. Ritter et al (Ritter et al., 2002, 2004; Ritter & Gemünden 2003) recognize that in some situations it may not be possible a priori to determine the firm's network strategy, because it will emerge out of the interactions between firms in the network. This situation, however, has not been specifically contemplated by these authors. We have also confirmed the influence of developing INMAs on firm performance regardless of the life cycle in the industry in which the firm is operating. Thus the results encourage us to propose that INMAs could be included in the firm's network management capability construct developed by Ritter and colleagues (Ritter et al. 2002, 2004; Ritter & Gemünden 2003). The network management capability is referred to "as the firm's capability to mobilize and coordinate the resources and activities of other actors in the network" (Möller & Hallinen 1999, p. 417). Ritter et al (2002; 2004) analyze the degree of network management capability through the

development of relationship-specific and cross-relational management tasks. Our findings also encourage us to consider INMAs when analyzing a firm's network management capability because they focus on non-deliberate aspects of network management. The importance of our proposal is justified by the influence of INMAs on the performance of firms in the network. Furthermore, it could also be thought that in the cases of firms that can define a priori their network strategies, the development of INMAs would aid the introduction of these strategies when firms involved in a network have different goals. A firm's network management ability can only be understood in an ongoing, firm-wide process (Ritter et al 2004). Consequently, and based on seminal Mintzberg's studies, we argue that the firm`s real network strategy will be the outcome of deliberate, intentional or rational cross-relational management tasks and of the result of developing INMAs to align its deliberate network strategy with the rest of network members (Mintzberg & Quinn 1991).

Furthermore, the development of INMAs can be viewed as a network-specific competence which varies among networks and can be an important source of competitive advantage for the network as a whole and for each firm in the network.

The findings in this work are also in line with those reported by Prashantham and Young (2011). These authors point out the importance of tie strength in the processes of assimilating and exploiting new knowledge. Our results, however, also show that stronger ties influence the processes of acquiring and transforming new knowledge. In fact, as argued in this work, the development of INMAs helps to improve firms' information bases and facilitates their transformation. In contrast, Prashantham and Young (2011) indicate that in these stages of developing new knowledge weak ties would be more influential. In short, our findings appear to indicate that it is the development of INMAs that influences firms' absorption capacity, understood as a firm's capacity to uptake and integrate new external knowledge (Zahra & George 2002), rather than tie strength. However, we want to emphasize

that our results only point in this direction, because in this work we have not tested the relationship between the development of INMAs and a firm's absorption capacity.

Our hypothesis 2 proposed the existence of a negative effect of company size on inter-firm network management activities. The results of the analyses show that the relationship has been confirmed in the firms classified as being in the growth stage (Δ = -.21, t= -2.03 p<.05) but not in the case of the companies in the maturity stage (Δ = .14, t = 1.08). According to the results in growing industries bigger companies discourage the development of INMAs. When the market is growing, big companies rely on the advantages of their size to make the most of good market conditions, promoting insularity and resisting interaction to other network members. This result is consistent with a large part of the literature on networks which demonstrates their importance in bridging information gaps (Slote-kock & Coviello 2009; Freeman, Hutchings, Lazaris & Zyngier 2010), in providing small and medium sized-firms with market and technology knowledge (Slote-kock & Coviello 2009; De Clercq, Sapienza, Yavuz &Zhou 2012), and in facilitating these firms' growth (Hite & Hesterly 2001). Our results, however, do not allow us to confirm the same pattern of behavior in the case of firms in mature industries.

Hypothesis 3 suggests the existence of a negative effect of company age on INMAs. Our results do not show that age can facilitate INMAs in any of the stages. Consequently, H_3 cannot be confirmed. Contrary to what is commonly accepted in networking literature the development of INMAs does not appear to need the support of internal organizational processes. Companies' reluctance to change in adulthood either hinders or fosters network adaptation activities. Young companies' need for resources does not appear to encourage them to participate in inter-firm network management activities more than mature firms. This result, in line with the findings in Hite and Hesterly (2001) shows the importance of informal networks regardless of firm age. However, Hite and Hesterly (2001)

point out that firm age does influence the structural characteristics of networks, whereas our study indicates that firm age cannot be considered an antecedent of the development of INMAs.

The results of our study confirm the influence of the development of INMAs on the performance of firms in a network regardless of the life cycle of the industry where they operate. Our results are not so conclusive, however, for the analysis of whether industry life cycle can be considered a contingent variable that influences which firms become involved in developing INMAs. Thus in the growth stage, the relation between position in that stage and INMA shows a negative and significant effect, thereby indicating that this stage in the industry life cycle has a negative influence on inter-firm network management activities. The results seem to suggest that when the market is growing companies focus on obtaining the advantages of the stage. In the growing stages individuals in firms are relevant resources and their interpretation of the environment is important (Maignan & Lukas 1997). The search for efficiency in production and distribution is the determinant that guides networking in those industries. In the maturity stage, however, there is no significant relation with INMA. Consequently H_4 is only partially confirmed. This result could be due to the fact that firms in a mature industry do not introduce new resources into the market.

Conclusions

Evidence shows that business networks generate valuable benefits. INMA constitutes an additional objective for firms involved in business relationships, as a way of obtaining benefits in the shape of high levels of performance. Additionally, INMA goes further than the leader company in the network and involves the participation of all members in the activities needed to develop network management and obtain its benefits.

Most previous research has focused on industry, age and size as control variables that should not be influencing the effect of the variables studied. Our research has considered these variables as factors that directly foster or inhibit the development of INMA and so, the study indicates the need for future networking studies to consider the influence of these variables in their hypotheses.

According to our results, added benefits of networking could be obtained by adopting co-management activities. It is to be expected that developing INMA helps companies to extend their customer knowledge base. In a general sense, INMA development requires partners in a network to know each other's capabilities and share the same vision of the collaboration process as they work towards the common goal. Companies in networks not only share new market and customer information, but also share procedures that may help them to integrate the new knowledge in their knowledge base and exploit it. Therefore, a future line of research would be to explore the implications of INMA development for companies' absorption ability to further our understanding of the importance of networks in companies' success.

This study shows the importance of INMAs in a firm's network capability, because they are related to the problems firms have to face when rolling out their network strategy. But the development of INMAs is also a network-specific capability which varies among networks. From our research we can conclude that the development of INMAs can be an important source of competitive advantage for the network as a whole. This capability has received relatively scant programmatic attention within network theory; therefore we suggest that future research in this area is needed to better understand the value of different types of networks. Different kinds of networks are typically assumed to function differently and have different capacities for extracting resources (Hite & Hesterly 2001; Lechner, Dowling & Welpe 2006). Hite and Hesterly (2001) have distinguished between identity-based networks

and calculative networks. Identity-based networks involve some type of personal identification with the other actor that motivates or influences economic actions. Calculative networks are primarily motivated by expected economic benefits. Different types of calculative networks can also be identified by the economic goals. Lechner et al. (2006) suggest that reputational networks, co-opetition networks, marketing networks and technological networks are most important types of calculative networks.

From a managerial point of view, considering the structural factors analysed in our research could help firms to be aware of the forces that are driving their decisions and review the behaviours that, as in the case of being in the industry life cycle growth stage, are moving the company away from capabilities that could provide them with superior performance.

The results seem to suggest that research should consider not only the differences between particular industries, but also the differences between industry life cycle stages. This opens a new opportunity for generalizing results. In order to control for industry effects, most studies focus on a few industries, limiting the generality of their results. Our results show that differences between industries can also be observed at the life cycle stage, providing a higher degree of generalization because samples can be constituted by individuals from several industries. This approach also facilitates sampling. While it might be difficult to obtain large enough samples from only one industry it seems easier to obtain answers from more respondents based on a life cycle.

These conclusions should be considered in the light of some limitations related to the method followed in our research. The sample for testing the hypotheses proceeded from a sample of Spanish companies thus, cultural and environmental factors affecting the activities inside the networks cannot be ruled out. Furthermore, although we received 400

responses to our questionnaire, the response rate was only 4.2%, and therefore insufficient to generalize the results to the population. Consequently, additional research in other countries and with representative samples would be helpful in order to generalize the results.

We adopted a global perspective of looking at the network asking interviewees to refer their answers to the main network to which they belonged. Consulting only one member from a network for information on its activities could bias the data because they came from only one perspective of the situation. Nevertheless, as management activities are a shared behavior for all members of the network, major differences in answers from respondents in the same network are not expected. A way of improving the collection of data from a network would be to identify all its members and interview all the agents involved in the relationships.

Although structural equation models allow testing of direct causal relations in a non-experimental situation, there is still the problem of when an activity is implemented and when it is measured. Further research using longitudinal data is needed in order to test if the relationships established in this study have been affected by the cross-sectional design.

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Table 1. Characteristics of the sample

Economic sector	Age	Employees
Agriculture, forestry and fishing= 8.5 % Manufacturing = 45.5 % Wholesale and retailing = 35.8 % Other = 9.8 %	Up to 3 years = 23.8 % 4 - 15 years = 60.2 % 16 - 40 years = 10 % More than 40 years = 6 %	Up to 10 = 35.3 % 10 – 49 = 38.7 % 50 – 249 = 21 % More than 250 = 5 %

Table 2. Constructs, measurement items and reliability and validity tests.

Item description	Loadings t-value
Inter-firm knowledge sharing (Helfert et al., 2002): α= .86; CR= .83; AVE= .62	
• The members of my main network develop conjoint information sharing routines on customer specific needs (INMAIks1) • The members of my main network exchange information for reacting immediately if customers have any problems with our offerings (INMAIks2) • The members of my main network exchange information for improving our offerings to customers (INMAIks3) • The members of my main network jointly develop solutions for customers (INMAIks4)	.80 (fixed) .80 (18.41) Eliminated .77 (17.47)
Coordination (Helfert et al., 2002): α= .90; CR= .91; AVE= .78	
• The members of my main network discuss in collaboration with customers who is doing what (INMACoo1) • The members of my main network ensure that promises from all parties are fulfilled (INMACoo2) • The members of my main network discuss the steps for fulfilling the aims of the relationships (INMACoo3)	.84 (fixed) .90 (22.90) .88 (23.37)
Conflict (Helfert et al., 2002): α= .82; CR= .87; AVE= .77	
• The members of my main network try hard to realize our firm's interest in the event of conflict (INMACon1) [Reverse scored] • The members of my main network wait a considerable time in the event of conflict in order to calm down the situation (INMACon2) [Reverse scored] • The members of my main network try to establish a compromise which is acceptable for all sides when a conflict arises. (NMACon3)	.97 (fixed) .77 (17.43) Eliminated
Adaptation (Helfert et al., 2002): α= .86; CR= .88; AVE= .79	
• The members of my main network adapt offerings to market needs (INMAAda1) • The members of my main network adapt delivering and usage of offerings to market demand (INMAAda2)	.89 (fixed) .88 (21.14)
Resource sharing (Helfert et al., 2002): α= .90; CR= .93; AVE= .78	
• The members of the main network facilitate the technical systems and equipment from other members (INMARes1). • The members of the main network facilitate access to information about customers from other members (INMARes2). • The members of the main network facilitate access to market information from other members (INMARes3). • The members of the main network facilitate access to information about other members' strategic aims (INMARes4).	.87 (fixed) .95 (22.47) .90 (20.70) .76 (14.85)
Performance (Kohli and Jaworski, 1990; Narver and Slater, 1990): α= .91; CR= .93; AVE= .66	
• Sales volume (SALEVOLU) • Market share (MARKSHAR) • Profitability (PROFITAB) • Access to market (MARKACCE) • Image development (IMAGDEVE) • Know-how development (KNOWHOWD)	.65 (fixed) .78 (18.17) .79 (18.01) .82 (20.16) .83 (19.53) .86 (20.72)

• Global satisfaction (GLOBSATI)	.92 (23.53)
Measurements of quality of fit $\chi 2$/ df = 1.82, RMSR = .038, GFI = .95d, NFI = .98, CFI = .99, IFI = .99	

Table 3. Discriminant validity tests

Confidence interval test		
Scales	**Correlation**	**Confidence interval**
Inter-firm knowledge sharing – Coordination	.76	[.70; .82]
Inter-firm knowledge sharing – Conflict	-.79	[-.85; -.73]
Inter-firm knowledge sharing – Adaptation	.87	[.81; .93]
Inter-firm knowledge sharing – Resource availability	.53	[.45; .61]
Inter-firm knowledge sharing – Performance	.30	[.20; .40]
Coordination – Conflict	-.71	[-.77; -.65]
Coordination – Adaptation	.67	[.61; .73]
Coordination – Resource availability	.51	[.43; .59]
Coordination – Performance	-.28	[-.30; -.20]
Conflict - Adaptation	-.61	[-.69; -.53]
Conflict - Resource availability	-.46	[-.54; -.38]
Conflict - Performance	-.28	[-.38; -.18]
Adaptation – Resource availability	.41	[.33; .49]
Adaptation – Performance	.23	[.13; .33]
Resource availability - Performance	.35	[.25; .45]

Table 4. Descriptive statistics and correlations

Growth stage	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Growth	1														
2. Age	0.05	1													
3. Firm size	0.01	0.22*	1												
4. Inter-firm knowledge sharing	-0.04	-0.20*	-0.32**	1											
5. Coordination	-0.11	-0.20*	-0.16	0.62**	1										
6. Conflict	0.12	0.12	0.12	-0.64**	-0.66**	1									
7. Adaptation	-0.12	-0.22*	-0.28**	0.82**	0.58**	-0.58**	1								
8. Resource	-0.11	-0.20	-0.08	0.47**	0.50**	-0.51**	0.48**	1							
9. Sales volume	-0.01	0.05	0.16	0.14	0.24**	-0.20*	0.17	0.21*	1						
10. Market share	-0.07	0.04	0.14	0.16	0.31**	-0.31**	0.21*	0.22*	0.79**	1					
11. Profitability	0.10	-0.18	0.09	0.17	0.25**	-0.21*	0.28**	0.14	0.60**	0.61**	1				
12. Market access	-0.01	0.01	0.19*	0.04	0.27**	-0.26**	0.07	0.23*	0.59**	0.67**	0.64**	1			
13.Image development	-0.15	-0.03	0.15	0.03	0.24**	-0.17	0.01	0.15	0.54**	0.65	0.50**	0.68**	1		
14.Know-how development	0.07	0.01	0.20*	0.09	0.29**	-0.15	0.15	0.30**	0.59**	0.61**	0.57**	0.68**	0.78**	1	
15.Global satisfaction	0.03	-0.09	0.16	0.13	0.36**	-0.29**	0.18	0.33**	0.70**	0.68**	0.74**	0.75**	0.63**	0.70**	1
Means	3.75	9.08	110.83	4.17	3.57	2.35	4.18	3.25	3.31	3.09	3.28	3.14	3.21	3.34	3.48
S.D.	1.10	11.76	359.87	0.82	0.76	0.84	0.89	0.90	1.01	0.97	1.03	0.99	1.00	0.94	1.00
Maturity stage	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Maturity	1														
2. Age	0.12*	1													
3. Firm size	0.04	0.24**	1												
4. Inter-firm knowledge sharing	0.06	-0.02	0.05	1											
5. Coordination	0.00	0.00	0.09	0.70**	1										
6. Conflict	-0.09	0.04	0.02	-0.67**	-0.63**	1									
7. Adaptation	0.00	0.05	-0.02	0.74**	0.62**	-0.53**	1								
8. Resource	0.07	-0.02	0.05	0.45**	0.47**	-0.42**	0.33**	1							
9. Sales volume	-0.06	-0.04	0.11	0.20**	0.18**	-0.15*	0.18**	0.21**	1						
10. Market share	-0.04	-0.03	0.10	0.31**	0.38**	-0.24**	0.21**	0.33**	0.62**	1					
11. Profitability	-0.05	-0.08	-0.05	0.23**	0.24**	-0.16**	0.14*	0.21**	0.54**	0.56**	1				
12. Market access	-0.06	-0.11	0.09	0.24**	0.28**	-0.20**	0.16**	0.22**	0.49**	0.55**	0.60**	1			
13.Image development	-0.05	-0.19**	0.07	0.25**	0.36**	-0.23**	0.15*	0.31**	0.44**	0.55**	0.53**	0.61**	1		
14.Know-how development	-0.05	-0.14*	0.06	0.20**	0.35**	-0.21**	0.14*	0.19**	0.42**	0.49**	0.51**	0.61**	0.77**	1	
15.Global satisfaction	-0.04	-0.10	0.08	0.33**	0.34**	-0.25**	0.22**	0.29**	0.64**	0.63**	0.65**	0.66**	0.69**	0.71**	1
Means	2.36	10.95	52.77	4.09	3.56	2.44	4.04	3.16	3.35	3.09	3.22	3.17	3.25	3.30	3.44
S.D.	0.95	12.44	173.95	0.78	0.71	0.76	0.88	0.90	0.97	0.96	0.95	0.92	0.94	0.92	0.84

** p < 0,01.

* p < 0,05.