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Social and Information Relations in Networks of Small and Medium-Sized Firms

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The current article considers the importance of the links existing between social relations and relations of trust, on the one hand, and economic and business relations on the other, in networks of firms, particularly networks of small firms that have formed involuntarily. Among these links, it is important to discover the way tacit and explicit information flows are established within the network and the conditions for them to occur. We examine these questions in a network of firms from the shoe industry using the methods and concepts of social network analysis. With this in mind, we have analysed the complex network of small firms by breaking it down into subnetworks in order to better understand its general structure. Our findings show that economic relations (cooperation, commercial exchanges) and social relations (trust, friendship, kinship, information interchanges) between the firms in the network are embedded within each other. The firms of the network exchange tacit information only with those firms with which they maintain stronger social and business links. Information and knowledge are treated as a strategic resource that is only shared with those companies that are not direct competitors.

INTRODUCTION

The links between economic activity and the social, historical and cultural context in which it occurs have been considered in thought and in the literature since the beginning. Classical economists such as Smith and Marx considered them explicitly and this tradition has continued to this day in much of the research on business management. However, the introduction of a more analytical and mathematical conception into economics also generated new currents in the field in which business and economic aspects were studied independently of the social context in which they were framed.

The widely accepted position that business phenomena can be studied in isolation does not mean that authors have ignored the important relations between the phenomena and the different social, geographic and historic circumstances in which they are found.

Looking at particular fields of inquiry, such as the analysis of the relations between different organisations, the different approaches also reproduce these distinct frameworks of thought. In recent decades interorganisational relations have been of interest to the most prominent authors on strategy, organisation theory, economics or sociology

(Grandori and Soda, 1995; Oliver and Ebers, 1998; Sobrero and Schraeder, 1998); and among the many and widespread approaches from which they have been studied, the two opposing tendencies are still visible. One considers that business relations can be studied from an analytical conception ignoring social elements. This position is fundamentally represented by transaction cost economics (Williamson, 1985). The other perspective sees economic relations between firms as conditioned by other types of links—of a social or cultural nature—as proposed by neoinstitutionalism (DiMaggio and Powell, 1983). Between these two opposing standpoints, which can be considered the two opposite ends of a continuum, there are many other approaches in between, each closer to one or other of the extremes, each considering interorganisational relations, if at times only laterally and partially. What is most striking perhaps is the absence of theoretical models in the central positions of this continuum—i.e., approaches which consider the important links which exist between business and social relations, but without stressing the predominance of either.

In the particular case of relations between small and medium-sized enterprises (SMEs), the social, historic and geographic context in which these are framed is so essential that it presents clear signs of mutual influence, especially if limited social and business contexts are analysed, whether involving geographic or firm boundaries (Pyke, Becattini and Sengenberger, 1990). The history, society and customs of many cities and regions are at the same time the foundation for, and the consequence of, economic and business relations between small firms. In the same way, an understanding of certain sectors or subsectors of economic activity is tied to the social links between firms, entrepreneurs and institutions. Examples range from the innovation that is fostered in technology parks to the development of the most powerful activities in economies such as those involving the computing and telecommunications sectors, which could not be understood ignoring the business, scientific and social relations that have evolved in the western United States.

A particularly apt approach to interorganisational relations is to consider them within a network. That is, attempting to understand, in all their complexity, the various elements that interrelate among themselves, the specific natures of these relations and their intensities. Inter-firm networks are the object of study in important and recent work (Nohria and Eccles, 1992; Gomes-Casseres, 1994; Gulati, 1998; Dyer and Nobeoka, 2000; Gulati, Nohria and Zaheer, 2000; Kale, Singh and Perlmutter, 2000).

Among networks formed by SMEs it is wise to differentiate between two kinds: on the one hand, those that have formed out of the explicit intentions of the firms concerned—where they voluntarily establish relations of cooperation or alliances; and on the other, those networks that have formed without explicit intention, involuntarily, due to a series of historic, geographic, social and cultural circumstances that have led to a set of preferential relations between competing firms, between suppliers and their customers and between firms and institutions. This specific form of network is the most widespread, and although it is the

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most difficult to identify, its influence on the economy has been considerable in recent decades. These networks continue to be an essential support in the sustainable development of populations, regions and countries (Becattini, 1979; Keeble and Wilkinson, 1999).

In view of this, it is particularly interesting to understand the relations that are found in this type of network of SMEs. Consequently, the objective of the present research is to discover to what extent social and business relations are connected. A particular type of relation—information relations—which allow the transmission of knowledge and know-how between firms and the diffusion of innovations, are particularly interesting in networks of small firms. Their links with stronger or weaker social relations and with the different inter-firm relations that occur between competitors and between suppliers and customers will help us gain a more global perspective of how these relations between smaller firms develop. The objective we have set ourselves permits us to advance in two directions. The first of these is to confirm empirically the existence of overlaps between the social and economic relations in business clusters and other similar networks. The second is the possibility of studying simultaneously the problems regarding the type of information (explicit or tacit) and the information flows that occur within networks of small firms.

This article begins by examining the overlaps that exist between, on the one hand economic and business relations, such as those deriving from commercial interchanges, and on the other social relations, in networks of small firms. Second, we consider whether, in this type of inter-firm network, the information most closely linked to knowledge transmission is more effective between firms with strong links. Third, we propose a new model to describe the operation of networks of small firms, breaking down the structure into its smallest networks, and which will serve to show the influence on the information flows of certain strategic behaviours derived from ecology and resource dependence theory. The hypotheses derived from a review of the literature on these topics are tested on a network of firms from the Spanish shoe industry. The relevant relational data are used, employing the methods of social network analysis. The article closes with the results of the empirical study, the main conclusions drawn from them, and proposals for future lines of research.

SOCIAL RELATIONS IN NETWORKS OF SMALL AND MEDIUM-SIZED FIRMS

Ebers and Jarillo (1998) see an inter-firm network as a group of organisations that have developed a set of recurring ties and that serve a particular market. They point out that such networks identify clusters of organisations that work more intensely together than with other firms from the same sector.

In turn, Gulati (1998) considers it particularly apt to see groups of firms as networks, insofar as this allows researchers to analyse with equal intensity the organisations involved and their characteristics, such as the rela-

tions that occur between them. The author points out, in addition, that seeing the group as a network facilitates the study of complex business phenomena such as strategic alliances, thereby overcoming the partial view gained from considering only bilateral relations between firms; instead, the interactions of the entire group of firms can be considered.

Grandori and Soda (1995) propose a classification of organisational networks based on two dimensions. The first is the level of formalisation in the agreements and interchanges between the firms making up the network, distinguishing between three types of network: social, bureaucratic and proprietary, in increasing order of formalisation. The second dimension is the degree of centralisation of the network, distinguishing between symmetrical or parity-based networks and asymmetrical or centralised networks. In groupings of SMEs, and in the fragmented industries in which they normally operate, the most common networks are relatively unformalised and with joint competitive behaviours which occur in an emergent way (Dollinger, 1990).

We are particularly interested in this type of network: i.e., networks of small firms that have not explicitly formalised their collective behaviour and that have their origin in the historic, geographic, commercial, social and cultural context. Grandori and Soda (1995) point to industrial districts and local production systems as examples of this type of network.

Industrial districts, which were identified as early as 1927 by Marshall and clearly defined subsequently by Becattini (1979), are clusters of a large number of SMEs, with a territorial base that gives them cohesion, a certain degree of sectorial specialisation, a division of labour between the firms and the presence of a qualified and specialised workforce. There are processes of external economies and a confluence of competitive and cooperative relations (Becattini, 1979; Dei Ottati, 1994).

Research on local production systems and industrial districts has focussed particularly on the links existing between the business relations occurring in these networks and the social relations also present (Pyke, Becattini and Sengenberger, 1990). Marshall himself already noted this characteristic. However, an understanding of these links depends on the perspective from which the relations between the various organisations are considered.

Nohria (1992) takes up the management jungle metaphor (Koontz, 1961) to characterise the study of interorganisational relations, but also warns that every new arrival plants a new tree in the jungle. Indeed, it is noteworthy that there is such a large number of perspectives and approaches, each one founded on different traditions of thought and coming from various disciplines, all focussing on relations between organisations, if at times only partially.

Because of this, in recent years, reviews of the scientific production on the topic have flourished, with a view to systematically detailing the extant knowledge (Oliver, 1990; Ring and Van de Ven, 1992; Grandori and Soda, 1995; Oliver and Ebers, 1998; Sobrero and Schrader, 1998). Grandori and Soda (1995) make an interesting attempt to outline the various perspectives and the problems on which they have focused, as is shown in **Table 1**.

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However, the review that may prove most incisive, insofar as it not only identifies the perspectives but also the relations between them, is provided by the analysis of Oliver and Ebers (1998). These authors examine the different approaches using techniques of network analysis and signal those that occupy the most central positions. But in order to systematise these, it is more interesting to segment the different perspectives into four research "paradigms". The first of these is that of social networks, which focuses above all on the position of the actors in the network and of its global structure. The second refers to power and control, in which the theories of political power, resource dependence and interchange are found, and which focuses on power, control, centrality, etc. The third is represented by institutionalism and focuses on social links, legitimacy, agreements, trust, conflicts, the density of relations, etc. The fourth paradigm is that of institutional economics and strategy, which focuses on relation governance mechanisms, success, the relation between cost and price, opportunism, etc.

However, looking at the distances between these four paradigms, the authors find that they are polarised between two extremes. On the one side is all the analysis of interorganisational relations related with the social network perspective, which is concerned with the structure of the relations and uses the concepts and methodologies of social network analysis. And on the other, that related to the perspective of the governance of these relations, which considers the strategy of the relations (how to coordinate organisations) from two complementary positions. The first corresponds to institutional theory that focuses on the mechanisms related with social institutions, with industry, with the territory, with politics, etc. The second corresponds to transaction cost theory and strategy and is concerned with how relations arise, how they are organised,

Table 1. Perspectives on interorganisational relations*

Approach	Authors	Issues
Industrial Organisation	Teece, Eccles, Becattini, Brusco	Integration of firm, economies of scale/scope/specialisation, industrial districts…
Organisational perspective	Grandori, Van de Ven	Degree of structure and formalisation of networks, complexity of interdependent activities, hierarchised structures, number of units to coordinate…
Negotiation and game theory	Jarillo, Axelrod	Interchange of resources, way of regulating interchanges, distributive processes…
Laws and politics	Jorde, Teece	Control of negative externalities, control of free competition…
Population Ecology	Barley, Hannan, Freeman	Social context of some forms of interorganisational relations, survival of firms in networks, legitimisation…
Strategy and business management	Porter, Contractor, Hakansson, Johanisson	Obtaining and maintaining competitive advantage, strategic alliances, Swedish school of industrial marketing…
Social psychology	Burt, Lomi	Structure of relations between firms, centrality, position of actors in network …
Resource Dependence Theory	Pfeffer, Salancik, Aldrich	Interdependence, asymmetry in control of resources, strategic control of relations and resources…
Transaction Cost Economics	Williamson	Ways to control between market and structure, costs deriving from relations, transaction as unit of analysis…
Social neoinstitutionalism and sociology	DiMaggio, Powell, Granovetter	Embeddedness of social and economic relations, legitimisation, organisational isomorphism…

*: Based on Grandori and Soda (1995).

and how each actor can obtain control and benefits from them (Oliver and Ebers, 1998). The authors themselves stress the advantages of an integrative vision of these positions located on the extremes, which takes the main contributions of the two largely complementary approaches.

Among the intermediate positions that attempt to embody the basic teaching of the main perspectives (including those located at the extreme positions), the most interesting are the proposals of Granovetter (1985), and his development of the concept of embeddedness.

Granovetter (1985) attempts to find a middle way in the study of economic phenomena between the view of neoclassical economists, who neglect the context in which these occur, and that of the sociologists who have studied such phenomena, who believe that economic phenomena are determined by the social logic in which they occur (a determinism that is either professional, or of production methods, historic, family-related or political). The author attempts to find a way of working with economic phenomena taking into account a social perspective, but neither from an under- nor an over-socialised approach (Granovetter, 1985). Granovetter criticises, on the one hand, most sociologists, anthropologists, political scientists and historians because, finding their inspiration in pre-market societies, they believe that economic behaviour is determined by social structures. This view leaves little margin even for the rationality of individuals or firms, since once their social, business, professional, historic and cultural characteristics are known, we can discover their behaviour, as it will be determined automatically and mechanically by them. On the other hand, even the most revisionists among the new economic thinkers who refer most explicitly to the social context in which economic transactions take place—such as is the case of the new institutional economy (Williamson, 1985)—fail to articulate in their explanatory models of individual and firm behaviour the influence of the constant social relations between firms or individuals. According to Granovetter, both positions make the same mistake: they have an atomised view of the social and economic actors, such that they do not take their relations into account.

What Granovetter (1985) is attempting to make clear are the consequences of a continuing relation between the actors (individuals, firms or institutions) on their behaviour. These permanent relations have important consequences for economic behaviour that have not been foreseen either by the over-socialised view or by the traditional view of economists: for example the generation of trust and control of disloyal behaviours. Firms prefer to do business with units that have a reputation for the unit of reference. These references mean that many information-related problems in economic phenomena can be resolved. First, because the information is cheaper to obtain; second because in relations of trust the information is richer, more detailed and safer; third, because the parties establishing a continuing economic relation are motivated to create a climate of trust, of morality and of mutual respect, in order not to endanger future transactions; and fourth, because starting from purely economic motives, the continuing eco-

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nomic transactions generate social relations between the parties that improve trust and eradicate disloyal behaviours and opportunism (Granovetter, 1985). In any case, the knowledge about the other party that is obtained from one's own experience (trust) is preferable to the knowledge that can be obtained from their reputation (indirect knowledge).

But for Granovetter, what maintains order in continuing economic relations between firms is not morality or the existence of institutional agreements (a view linked with the neoinstitutional approach), but rather the network of relations—the way in which the links between individuals, firms and institutions are structured. The structure of these relations means that within the rational behaviour of the parties, not only economic ends are considered (which is what classical economics would have us believe), but also questions such as sociability, approval, status and power.

Granovetter (1985) does not, however, develop the concept of embeddedness and its implications in detail; he merely stresses that the continuing relations between the actors and the social structure of these relations have important consequences for their social and economic behaviour, and that this should be an object of study if we are to better understand these phenomena in all their complexity.

A subsequent development of the concept by Granovetter (1992) himself, first taken up and then in turn developed by Gulati (1995; 1998), which amplifies the concept towards the area of interorganisational relations, leads to a distinction between two types of embeddedness in inter-firm relations: structural embeddedness itself and relational embeddedness. The latter refers to the characteristics of the relations between firms; it is an approach concerned with the cohesion of the network, insofar as it refers to the strength of the direct links and the mechanisms through which firms obtain specific and valuable information. The fact that firms share more direct connections implies that they possess more information in common and more knowledge about the other parties. Structural embeddedness refers to the characteristics of the structure of the links, it is a positional approach in that it stresses the information advantages that particular positions within the network structure imply (Gulati, 1998).

Uzzi (1997) carries out an interesting study of textile firms in New York, in which the concept of relation embeddedness is developed in practice. Structural embeddedness has been taken up by Burt (1992) in the concept of social capital, and has been object of a more detailed analysis that has linked it to the strategic resource-based approaches (Rowley, Behrens and Krackhardt, 2000). These two ways of understanding the phenomenon both point to the existence of strong links between distinct types of social and business relations.

Thus, we can expect that the inter-firm relations in the groupings of SMEs under study will be associated with social relations, and we hence formulate our first research hypothesis as follows:

Hypothesis 1: There is an association between inter-firm relations, in particular commercial and cooperative relations, and social relations of, for example, friendship, trust, family ties or information.

TRANSMISSION OF INFORMATION AND KNOWLEDGE

One of the most notable relations among firms concerns the transmission of information and knowledge between them. Without distinguishing the two conceptually, information and knowledge are two vitally important resources for the competitiveness of individual firms as well as of groups of firms (Tallman, Jenkins, Henry and Pinch, 2004). Thus, much of the resource-based view concerns information, knowledge management and organisational learning. The transmission and diffusion of knowledge both within and between organisations have been identified as sources of sustainable competitive advantages (Kogut and Zander, 1993; Nonaka, 1994; Grant and Baden-Fuller, 1995; Grant, 1996).

Within networks of SMEs, the flows of information and knowledge between organisations is strongly embedded in the set of business and social relations that occur between the firms. It is therefore interesting to find out the nature of these information flows, as well as their direction, to provide a new indicator of the way in which social and business relations are interconnected.

With regards the nature of these flows or interchanges of information and knowledge, it is wise to make a distinction between tacit and explicit information and knowledge. The differentiation of these concepts goes back as far as Polanyi (1967). Nonaka (1991) takes up this distinction again when looking at organisations that create knowledge. Nonaka's analysis was a new way of explaining the success of Japanese firms against US ones, very common at that time, but based on firms' knowledge management. Knowledge creation is explained as a spiral, and the analysis is founded on the distinction between tacit and explicit knowledge. The author distinguishes between four patterns of interaction that imply a continuous dialogue between tacit and explicit knowledge (Takeuchi and Nonaka, 1986; Nonaka, 1991; 1994).

However, a fundamental distinction that revolves around this separation between the tacit and explicit and that brings a new conceptualisation of them is due to Kogut and Zander, who distinguish between explicit knowledge, which they call information, and tacit knowledge, which they term know-how (Kogut and Zander, 1992; 1993). Information is easily codifiable knowledge that can be transmitted without loss of integrity; it includes acts, axiomatic propositions and symbols (Kogut and Zander, 1992). Know-how refers to tacit knowledge, which is complex and difficult to codify; it refers to how activities are carried out in firms and it can sometimes be set down explicitly in procedure manuals (Kogut and Zander, 1993).

With the distinction made between the nature of knowledge and information, some authors have stressed the role of tacit information and knowledge and their interchanges and transmission in inter-firm networks. The importance of tacit knowledge within the organisation had been pointed out already (Grant and Baden-Fuller, 1995).

An interesting point of view is offered by Simonin (1997) in research on the know-how present in the collaboration between firms (collaborative

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know-how) and its repercussions in organisational learning. Simonin builds this construct on the basis of a series of indicators measuring the extent to which a firm has the skills for identifying, negotiating, managing, controlling and terminating their collaborations with others.

Powell, Koput and Smith-Doerr (1996), in analysing the way in which knowledge relating to innovations is generated and transmitted in the biotechnology sector find that learning does not occur in every firm, but rather it belongs to the group of firms that interrelate. They see learning as above all a social process and consider that the creation of knowledge occurs in the context of a community. Their main argument is that if the knowledge is widely distributed and is a source of competitive advantages, the centre of the innovations is found in the network of interorganisational relations, since it provides knowledge and resources to firms at the appropriate time—knowledge and resources that otherwise would not be available.

Kogut (2000) proposes that firms be identified with the network, and explains that this is possible through the development of a set of rules that have a technological, cultural or institutional basis, which creates a series of rules for the division of labour and of coordination between the firms. These rules are at the same time deeply embedded in the social identity of the network members.

For their part, Kale, Singh and Perlmutter (2000) consider how firms can obtain the most knowledge from collaborators while protecting their own knowledge; they find that firms can achieve both ends through the creation of a relational capital based on mutual trust.

On the other hand, theorists of collective learning stress the diffusion of tacit knowledge in innovatory clusters with an important geographical component made up of firms, universities, research centres and public sector bodies, and its role in their development (Keeble and Wilkinson, 1999; Lawson and Lorenz, 1999).

Dyer and Singh (1998) stress that the routines that lead firms to share knowledge are a source of interorganisational competitive advantage. Studying Toyota's network, Dyer and Nobeoka (2000) consider important questions about the transmission of knowledge in networks, and find that explicit knowledge can be more easily codified and transmitted, while tacit knowledge requires an intense interaction between the firms and between individuals.

Some studies suggest that strongly connected networks are good for the diffusion of existing knowledge but not so much for exploring new knowledge, which is fostered instead by broader networks with weaker links (Rowley, Behrens and Krackhardt, 2000). But with regards this, Kogut (2000) considers that rents can be obtained from small networks with very strong links, where coordination between members will be very effective and all members can benefit, as well as for a specific firm in a more extensive network united with weaker links, if this firm occupies the position of broker between two indirectly-connected parts of the network, providing the link between them (i.e., acting as a structural hole), following the ideas of Burt (1992).

In this way we can establish that the traffic of tacit information and know-how will be greater in those networks that are supported by

strong inter-firm relations. According to this, we can derive the following hypothesis:

Hypothesis 2: The interchanges of tacit information between small firms within networks are associated with strong relations between the organisations involved.

A MODEL FOR NETWORKS OF SMALL AND MEDIUM-SIZED FIRMS

The second important element with regards information interchanges that occur in networks of small firms refers to the direction of these flows. The distinction between unidirectional information flows (which move in only one direction between two firms) and mutual or reciprocal flows (which move in both directions between two firms) has been considered in previous research (Mohr, Fisher and Nevin, 1996; Gulati, Norhia and Zaheer, 2000), although without incorporating it into an explanatory model in the context of networks of small firms. For this reason, a prior theoretical treatment is required in order to frame the problem in a suitable explanatory model. This explanatory model should be coherent with the developments that have occurred previously, as well as with possible additional contributions in the future.

Thus, this current research also considered the possibility of elaborating a model that would provide us with a good understanding of the operation of networks of small firms that have strong social and business links. The model should be integrative insofar as it should incorporate contributions from the various perspectives that have considered relations between firms (business clusters, industrial districts, collective learning, resource-based view, social networks, transaction cost theory, collective strategy). In particular, it should focus on the question of the direction of the information and knowledge flows within these networks.

With this aim in mind, we took up, as a starting point, the model proposed by collective strategy to identify the various types of firm collectives (Astley and Fombrun, 1983). The model starts from the concept of collective strategy understood as a form of voluntary behaviour in a group of firms. In networks of small firms this collective strategy often occurs in an emergent form—i.e., without it being deliberately followed by network actors, but instead emanating from their joint behaviours (Dollinger, 1990).

This model has been modified and adapted in order to account for the heterogeneity of small and medium-sized firm networks; i.e. such networks are not homogeneous units of analysis, they are made up by a set of subnetworks, which will determine their structure and each one has its own structure (Lipparini and Boari, 1999).

The proposed model includes the two dimensions put forward by Astley and Fombrun (1983). The first one is the type of relationships occurring among the firms. Within business groupings or networks two types may exist: commensal relationships (when firms demand the same resources from their environment) and symbiotic relationships

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(when firms demand different resources from their environment). This concept feeds from Hawley's human ecology formulations (1950), which to a great extent underpin joint strategy ideas. In business terms, commensal relationships will occur among firms within the same sector and symbiotic ones among firms of different sectors (Dollinger, 1990).

The second dimension refers to the strength of interbusiness relationships. In this dimension there is a substantial change of approach in the model proposed in this research compared to Astley and Fombrun's (1983) original dimension, which was the type of association. The creators of the collective strategy establish the difference between direct and indirect relationships, but the allocation of this dimension is not made in an operative manner, since both authors consider that direct relationships depend upon the network being small and indirect ones upon it being large. But Astley and Fombrun also diverge from Hawley's (1962) ecological model, which distinguished between direct and indirect relationships using a more clearly network-based perspective, inasmuch as direct ones occur among organisations with direct links among them, whereas indirect ones occur among organisations relating to each other through one or more ones that act as intermediaries. Hawley's original formulation was not taken into account by Astley and Fombrun and nor will we consider it in this current research either, since it ignores a significant factor with regards relations: their strength or importance.

In short, the original dimension proposed by Astley and Fombrun (1983) is modified in the integrative model proposed here in order to be able to consider the strength of the links between firms. For this, we take up the concept of embeddedness used earlier. Uzzi (1997), referring to the concept of embeddedness, distinguishes between market relationships (basically commercial), and the more intensive ones that include a social and trust component. Thus, in this research, direct or strong links are those that include a greater number of social and business relationships between firms, whereas indirect or weak links refer to the presence of few relationships or only market ones. In the model proposed in this current work, we consider that there will be a strong and direct relation between firms if there is a significant number of links between them, both economic (commercial relations, relations of cooperation and subcontracting) and social (friendship, kinship, trust, etc.). If there are few links of varying kinds between firms their relations will be considered weak and indirect.

By crossing both dimensions a model is created that distinguishes four types of possible relationships among firms, which can be identified as subnetwork types that may be found within a complex small and medium-sized enterprise network of the kind we are analysing. These subnetworks are shown in **Figure 1**.

Agglomerate networks and subnetworks are made up by organisations within the same sector and with weak or indirect relationships. They occur for example among the group of final product manufacturers in an industrial district. They undertake joint actions to exchange information and gain a joint market positioning. It is normal to have profes-

sional and business associations in charge of their coordination (Swan and Newell, 1995).

Confederate networks are made up by firms belonging to the same sector with strong or direct relationships. Alliances and other forms of cooperation belong to this group. They have close relationships that combine cooperation and competition and formal and informal agreements to guide their joint actions.

Conjugate networks are made up by firms from different sectors with strong or direct links. One example of them is the network of firms subcontracted by a larger firm. There are usually hierarchical links between them (Lorenzoni and Baden-Fuller, 1995; Lipparini and Boari, 1999).

Organic networks occur among firms from different sectors with indirect relationships. Many subnetworks of this type can be found, but in the case of industrial districts, the district itself is a clear example of this type of network, with an amalgam of main and auxiliary firms (Becattini, 1979). All of them undertake joint actions such as creating a network image or maintaining their members informed. They are supported by external, usually public, organisations.

This model is modified to adapt it and allow for the heterogeneity in networks of SMEs—i.e., these networks are not homogeneous units of analysis, but rather they are composed of a set of subnetworks that make up their structure, each having their own characteristics (Lipparini and Boari, 1999).

Combining the distinction between commensal and symbiotic relations made by the proposed model with the ideas of resource dependence theory (Pfeffer and Salancik, 1978), one can argue that firms will develop liberal and generous behaviours vis-à-vis other firms as long as the latter do not make the same demands as they do on their environment. In this way, firms that are associated via symbiotic relations will tend to be more generous among themselves.

In contrast, if the firms make the same demands on the environment (commensal relationships), we would expect them to compete for

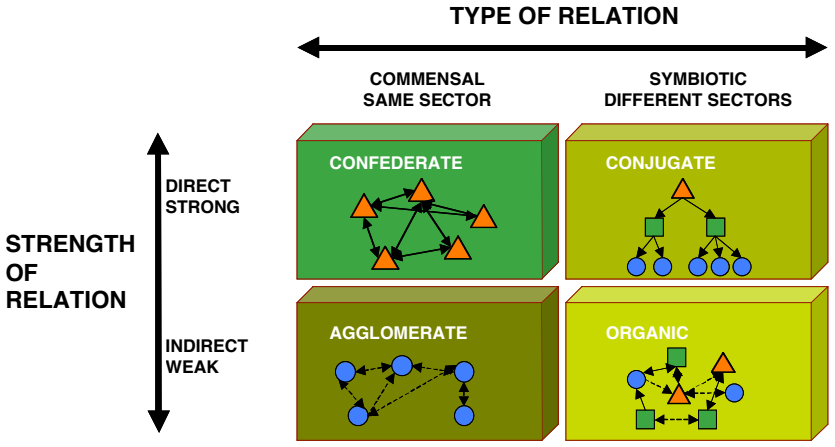

Figure 1. Explanatory Model of Networks of SMEs

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resources, and when one firm gives some resource to another, it will be within a process of interchange, so it will receive some other resource in compensation. This argument has been amply employed in the literature on interorganisational networks analysing the free rider problem (Gulati, Norhia and Zaheer, 2000; Rowley, Behrens and Krackhard, 2000). Translating this argument to the flow of information, we can say that firms that have commensal relations will tend to establish two-way communication flows, such that, in order to avoid the free rider problem, a firm will not give important information to another, if it is not in exchange for some other resource, normally likewise information.

On the other hand, firms that are linked by symbiotic relations will tend to be more generous to each other. Thus, we would expect there to be circulation of information in one direction—unidirectional information—in which one firm transmits this resource without expecting anything in exchange. Echeverri-Carroll, Hunnicutt and Hansen (1998), in their study of asymmetrical networks—in which there are vertical symbiotic relations deriving from processes of flexible specialisation—postulate that the main firms will generate a unidirectional information flow towards the small firms with which they work. They advance two hypotheses on the question: the first is that this transmission of information and knowledge will be carried out in exchange for gaining control over some of the small firms' decisions; the second is that for this transmission of information to occur such control is not necessary. The results support the second hypothesis. In their study, they show that these small firms are also ready to offer their information to the main firms, disregarding their fear of giving information away. Thus, there are information flows between the main firm and the subcontractors, without anyone expecting any compensation and without any hint of opportunistic behaviours. However, Dyer and Nobeoka (2000), in their study of Toyota's conjugate suppliers network, find that there are mechanisms to prevent free rider behaviours, although one such one is for the firms of the network to have free access to Toyota's operational knowledge. Although no network can exist for long periods without some kind of mutual exchange of resources, for informative relations, going by the previous considerations, we can derive a new hypothesis:

Hypothesis 3: Information flows will tend to be unidirectional in networks of firms with symbiotic relations, and bi-directional or reciprocal in networks of firms with commensal relations.

METHODOLOGY AND FIELD WORK

Tichy and Fombrun (1979) and Fombrun (1982) propose social network analysis as the most appropriate methodological strategy to study business networks, since the study subject is inter-firm relationships and social network analysis is the most appropriate method to study relational data. Selected data involve links among elements and not the core attributes of such elements. The focus is not on firm characteristics but rather on the relationships among them.

Social network analysis analyses the elements or nodes within a network and the relationships of different types among them: social, economic, care, movement, transfer, etc.

In order to contrast the above hypotheses, an empirical study has been conducted focusing on a small and medium-sized firms network. The decision was to carry out a case study; i.e. only the network is being analysed. The case study methodology is valid for exploratory research in emerging theoretical concepts with contextual implications, as it is the case in this research study (Yin, 1989; 1993). Furthermore, social network analysis requires a detailed study of the whole network and it is not easily subject to sampling conditions (Scott, 1991; Wasserman and Faust, 1994).

The network selected was the shoe and auxiliary industries of the town of Valverde del Camino in Southern Spain. This group of firms can be identified as a network that meets the requirements established in the research study objectives. This network had an advantage; it was especially appropriate for social network analysis due to its heterogeneous character and its medium size.

Two interviews were conducted with individuals that knew the network well in order to verify whether the case under study was appropriate for the analysis to be carried out and the historical, social, cultural and economic context of the shoe firm cluster in Valverde.

The network is made up by 50 firms: 33 of them are shoe manufactures and the other ones belong to auxiliary industries. Altogether, 29 of them make their main product in Valverde (winter boots). Furthermore, we analysed their relationships with two organisations that provide services to these firms and with a firm that acts as a subcontractor for some firms in the network but is located in a nearby town.

Fieldwork was carried out in two phases. It started in mid January 2001 and the first phase lasted until March. It included 45 personal interviews to different managers from as many companies. Most of the interviews were made at the firms' production facilities.

The questionnaire used in the interviews included a total number of 13 questions that required concrete answers for each of the network's firms, and so in a 52 organisations network accounted for more than 650 items. It also included 30 additional items, mainly on firm attributes. For all the above the length of the interviews was highly variable, ranging from 30 minutes to 4 hours. Average duration can be estimated between 45 minutes and an hour and a quarter. A system of lists and files contributed to comprehensiveness in data collection and to systematisation and preciseness in information exchange.

The second phase took place in June 2001, since five firms that where reluctant to meet the interviewer at their facilities or to accept a face-to-face interview, accepted to answer to a reduced questionnaire by phone. In order to programme and structure these interviews it was necessary to process, codify and draw the relational information for each interviewed firm in order to filter questions with redundant information. This was done to prepare customised formats for telephone interviewing.

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Only two firms refused to be interviewed either directly or by telephone. Information on them was obtained thanks to the data collection process of references stemming from other firms, which was verified and completed with the references provided by a qualified informant on the sector and on its firms' operations.

Most of the data collected corresponded to social relationships (kinship, friendship, worker exchange and trust), business relationships (commercial, subcontracting and cooperation) and information relationships (tacit and explicit exchanges): relationships (eventual or sporadic contacts are excluded) were measured in dichotomic scales in order to facilitate data collection and treatment by social network analysis programmes.

A great number of relational data were collected. Each interviewed firm had to consider some 650 information units meaning that altogether 30,000 data units were processed.

The programme chosen for data processing and drawing of outcomes with social network analysis was UCINET V for Windows, due to the wide dissemination and use of its indicators and outputs (Borgatti, Everett and Freeman, 1999).

A methodology belonging to social network analysis was used to contrast hypotheses, since relational data, due to their characteristics prevent the application of usual statistical tests inasmuch as observations are not independent or at least, its independence cannot be assumed (there are other problems such as data standardisation or random character of sample—if we are working with one). Indeed, in a research study Krackhardt (1988) found that the magnitude of error when applying standard methods is quite important. The results in samples from populations in which the null hypothesis was true found that there is a 70% possibility to obtain significant results with classical contrast methods.

More specifically, several contrasts based on the QAP (Quadratic Assignment Procedure), proposed by Krackhardt (1987) were used. This serves to compare a matrix as dependent variable (with data from a relationship) with one or more matrices as independent variables. This technique uses the permutations test proposed by Hubert (Wasserman and Faust, 1994) as an alternative to traditional statistical models for attributive data. It has been used in the field of business management since recent time (Kilduff and Krackhardt, 1994) and also in the study of interorganisational relationships by Gulati and Gargiulo (1999) in their analysis of strategic alliances.

RESULTS

The relational data obtained concerning the existing links between the firms of the network under analysis will be used to test the hypotheses proposed in this work.

The first hypothesis postulates that business relations (specifically commercial and cooperative relations) are associated with social relations. To test this, it is necessary to create an indicator of the degree to which each

firm is tied to the others in a series of intense social relations, which can be compared with an indicator of the business relations directly included in the model. The former indicator should reflect the degree to which a firm establishes social relations with another firm. In this way a new relation should be built, in which the indicator presents a value, even of direction, of the social relations between the firms of the network.

Given the exploratory nature of this work, we opted for a simple and meaningful indicator. Thus, we built the indicator called EMBSOCIAL, which incorporates in a new matrix the relations of trust, friendship, family ties, workforce interchanges, interchanges of tacit information and interchanges of explicit information. The elements of this indicator will take values from 0 to 6.

Taking into account that the basic business relations analysed were commercial relations and cooperative agreements, the hypothesis can be divided into two subhypotheses: the first postulates that commercial relations are associated with social relations; the second, that cooperative relations are associated with social relations.

Applying a multiple regression analysis QAP (MRQAP) to test the hypothesis referring to the embeddedness between social and business relations is very simple. This analysis is incorporated in the Ucinet program and compares two matrices of relations, one as dependent variable and the other as independent variable. The technique attempts to test the null hypothesis that business relations are not associated with social relations (measured by the indicator EMBSOCIAL). The result of this analysis is shown in **Table 2**.

Table 2. Multiple regression for social and business relations

MULTIPLE REGRESSION QAP
Dependent variable: *COMMERCIAL*
Independent variables: *EMBSOCIAL*
MODEL FIT

R-square	Adj R-Sqr	Probability	# of Obs
0.169	0.169	0.000	2652

REGRESSION COEFFICIENTS

Independent	Un-stdized Coefficient	Stdized Coefficient	Significance
Intercept	0.113332	0.000000	-0.311
EMBSOCIAL	0.189482	0.411420	0.000

Dependent variable: *COOPERA*
Independent variables: *EMBSOCIAL*
MODEL FIT

R-square	Adj R-Sqr	Probability	# of Obs
0.163	0.163	0.000	2652

REGRESSION COEFFICIENTS

Independent	Un-stdized Coefficient	Stdized Coefficient	Significance
Intercept	-0.015729	0.000000	0.000
EMBSOCIAL	0.076744	0.404186	0.000

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In **Table 2** we report R^2 for the model and its level adjusted to the number of variables, along with the significance of the model itself. All the parameters have the same interpretations as in typical regression analyses. Thus, R^2 is an indicator of the percentage of the variance of the dependent variable that is explained, which in the majority of network analysis models is low. The significance level of the model proves its goodness of fit and suitability for studying the relation in the two subhypotheses.

At a second level appear the coefficients of the model for the independent variables, in this case EMBSOCIAL, and for the constant, along with their standardised values and the significance level. The coefficient is positive; hence there exists a relation between the variables analysed. In this case the significance level of the independent variable allows us to reject the null hypothesis that the commercial relations and the social relations included in the EMBSOCIAL indicator are not related. The same results are obtained for the second subhypothesis: the significance level allows us to reject the null hypothesis and we can say that the cooperative relations are linked to the set of relations composing the indicator of social embeddedness (EMBSOCIAL).

From the analysis we have carried out we can say that the first hypothesis is supported: there is a link between business and social relations. The type of analysis does not allow us to establish causal relations, but in this research the direction of the relation is not as important as confirming its existence.

The second hypothesis concerning information and the strength of the links postulates that the interchanges of tacit information are associated with the strength of the inter-firm links. **Table 3** shows the model obtained via the analysis MRQAP, taking the interchange of tacit information as dependent variable and the indicator EMB as independent variable. This indicator should represent the strength of the links between the firms under study; so, following Uzzi's (1997) proposal, it should measure market relations as well as social relations concerning trust. We built this indicator, called EMB, adding in one relation links

Table 3. Multiple regression for tacit information and strength of ties

MULTIPLE REGRESSION QAP
Dependent variable: *TACIT*
Independent variables: *EMB*

MODEL FIT

R-square	Adj R-Sqr	Probability	# of Obs
0.137	0.137	0.000	2652

REGRESSION COEFFICIENTS

Independent	Un-stdized Coefficient	Stdized Coefficient	Significance
Intercept	-0.008103	0.000000	0.000
EMB	0.092723	0.369705	0.000

relating to the following: commercial interchanges, the network of cooperation, the network of subcontracting, the flows of specialist workers, the links of friendship and trust of others. Again, the elements of the variable vary from 0 to 6, depending on the strength of each of the relations between the firms.

The results show that the model fits the data well and that the null hypothesis is rejected: tacit information flow does not relate in a random manner with the strength of the social and business links between the firms. In this way we can confirm that there is a relation between tacit information and the strength of the inter-firm links.

However, the explanatory model of the relations in networks of SMEs proposes the separation into subnetworks: those in which the links are strong and those in which they are weak. It is therefore interesting to study if this relation is maintained if cut-off points in the strength of the links are established and two new indicators are built, one for the strong relations between elements (EMBSTRONG) and the other for the weak relations (EMBWEAK). An additional problem is to find cut-off points to measure the relations between the variables such that, as well as the global effect, we can distinguish between the behaviour of the dependent variable (referring to information content) if the links in a dyad are strong or weak. We used as cut-off point the intermediate level of the interval considered by the indicator. Thus, from value 3 upwards the relations between a pair of organisations are considered strong, otherwise they are considered weak. Each of the two indicators mentioned takes the form of a binary matrix showing the type of relation that exists between each pair of elements in the network. This was achieved establishing the cut-off point in the interval of the matrix of origin and re-codifying the matrix in order to obtain two different relations. Thus, we test the hypothesis that the interchanges of tacit information are associated with the strong relations and not the weak ones.

In **Table 4** we report the results of the regression model QAP to test the hypothesis that tacit information and strong links are related.

Despite the low level of R^2, the model fits the data, and the particular consideration of the independent variable (EMBSTRONG) allows us to reject the null hypothesis of no relation with the dependent variable. Thus, in view of the results, we can say that there is a relation between the presence of strong links and the interchange of tacit information.

With regards weak links, we can see that the model does not explain the dependent variable at all and is not significant. The results allow us to say that there is no statistically significant relation between the interchange of tacit information and the existence of a weak relation between the firms. To confirm this result, we checked the level of correlation between the variables, which was very low and non-significant. Thus, we can clearly accept the hypothesis derived from the model that there is an association between the interchange of tacit information and the strength of the inter-firm links.

Hypothesis 3 postulates the existence of reciprocal information flows between firms with commensal relations (same sector) and of unidirectional information flows between firms with symbiotic relations (different sectors). To test it, in view of the structure of the data, it is nec-

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essary to build four subhypotheses that will be analysed with statistical methods. This is due, in part because we must differentiate between reciprocal (or mutual) information interchanges and unidirectional ones, and in part because we have studied two different types of information interchange: those relating to tacit information and those relating to explicit information.

For each of the four possibilities, we have to analyse the differences between groups and within groups. We again use social network analysis tests included in the program Ucinet, in particular network autocorrelation with categorical attributes, which also uses for the analysis the permutation test.

In order to test the four subhypotheses, we built four new matrices: one containing the mutual relations in the interchange of explicit information (EXPLMUT); the second the unidirectional relations (EXPLUNI); the third the reciprocal relations for the case of tacit information (MUTACIT); and finally the last subhypothesis contained tacit unidirectional relations (UNITACIT). We used independent questions in order to detect the interchanges of tacit and explicit information, following the criteria of the theoretical distinction mentioned above. Explicit information refers to questions relating to prices, market conditions, innovations in machinery and materials, etc. Tacit information refers to specific aspects of each firm's business, such as their way of doing things, their cost structure, production processes, etc. In order to

Table 4. Multiple regression for tacit information and strong and weak links

MULTIPLE REGRESSION QAP
Dependent variable: *TACIT*
Independent variables: *EMBSTRONG*
MODEL FIT

R-square	Adj R-Sqr	Probability	# of Obs
0.14	0.14	0.000	2652

REGRESSION COEFFICIENTS

Independent	Un-stdized Coefficient	Stdized Coefficient	Significance
Intercept	0.025309	0.000000	-0.311
EMBSTRONG	0.050242	0.118359	0.000

Dependent variable: *TACIT*
Independent variables: *EMBWEAK*
MODEL FIT

R-square	Adj R-Sqr	Probability	# of Obs
0.000	0.000	0.576	2652

REGRESSION COEFFICIENTS

Independent	Un-stdized Coefficient	Stdized Coefficient	Significance
Intercept	0.045086	0.000000	0.295
EMBWEAK	-0.006738	-0.014432	0.295

differentiate between unidirectional and reciprocal relations we asked the respondents for the direction of the relation and we built separate matrices for the two cases[1]. In addition, we took into account whether the firms belonged to the same sector with the vector SECTOR, obtained from the data provided by the interviews.

The results of the different tests appear in **Table 5**. For reciprocal interchange of explicit information, the test shows that the relation within Group 1, made up of shoe manufacturers, has a significance level less than 0.05, while for the crosses with the other groups the values are not significant. Thus, for the case of the intra-group relations (within the same sector) the null hypothesis is rejected and we can say that mutual explicit relations are more probable here than when the firms belong to different sectors.

A similar analysis applies to the case of the predominance of reciprocal interchanges of tacit information. Again we must test if these interchanges are more frequent in the same sector than between different sectors. The results are similar to those obtained for the case of explicit information interchanges—i.e., they clearly show that the reciprocal information interchanges between same-sector firms show a non-random behaviour, and therefore we can reject the null hypothesis that they follow a random distribution. In the same way, the relations between sectors show the reverse result; hence we cannot in this case reject the null hypothesis.

It seems to be demonstrated with the two above analyses, according to the data obtained in the network under analysis, that information interchanges present reciprocal flows when the firms are from the same sector, but not when the firms are from different sectors.

With regards the unidirectional interchanges of explicit information, we see that the model presents a good fit and that the different relations within and outside the group of manufacturers are significant. Thus, in principle we can say that the interchanges of explicit information occur between firms belonging to different sectors, rejecting the null hypothesis. But in addition there is a significant result for the test on the unidirectional interchange of explicit information within the group of same-sector firms. However, we must look at the sign of this coefficient, such that we can also say that it is less likely that this type of information interchange occurs within firms of the same sector. These results are

1. Following the recommendations of an anonymous reviewer, it is interesting to point out that in the data collection we posed questions about the different relations that we were analysing to each firm about all the rest, so that we obtained redundant information allowing us to check the veracity of the responses. Thus, for a relation of friendship to be considered in the final data, this link had to be confirmed by the two interviewees concerned simultaneously. In the same way, in the case of the relations where the direction of flow is important (such as those of sales, subcontracting or exchange of information or knowledge), we asked each interviewee independently about the two directions—i.e., we posed two questions (for example: do you buy from this firm? And: do you sell to this firm?).

Table 5. Comparison of information interchanges within and between sectors

	Model		Within Sectors		Between Sectors	
	R^2	Significance	Coefficient	Significance	Coefficient	Significance
Mutual Explicit	0.019	0.014	0.113	0.020	0.019	0.019
Mutual Tacit	0.021	0.004	0.122	0.005	0.021	0.021
Unidirectional Explicit	0.211	0.000	-0.241	0.006	0.211	0.211
Unidirectional Tacit	0.001	0.560	—	—	0.001	0.001

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consistent with the proposals of resource dependence theory, insofar as the information is treated as a strategic resource by firms, and it will only be used generously by a firm as long as the other firms with which it relates do not make the same demands on its environment as it does.

In the case of unidirectional interchanges of tacit information, the results of **Table 5** show that the model is not significant. This may be due to the fact that the number of unidirectional relations of tacit information interchange was reduced, since this relation presented a high component of mutuality. Thus, from the data obtained from our study of the network considered, we cannot conclude anything about what occurs with the unidirectional interchanges of tacit information depending on whether the firms are in the same sector or not.

CONCLUSIONS

The data obtained from the empirical study carried out allow us to support the three hypotheses proposed in this research to a large extent. We have confirmed that business relations (particularly commercial and cooperative relations) are embedded in social relations, so that the mutual dependence of the economic and social elements is shown for the networks of SMEs considered.

In these networks, established not by the explicit intention of the participants but rather motivated by the historic, geographic or social context, there are information flows of explicit as well as tacit information. These latter are particularly important because they are the means of transmitting and generalising know-how and tacit knowledge, thereby allowing these networks to obtain and maintain competitive advantages over outside firms. We have shown that interchanges of tacit information occur when there are close and strong links between the firms—links which range from commercial relations to social relations, such as the interchange of workers or friendship between entrepreneurs or executives (Tallman *et al.,* 2004).

Tacit and explicit information have both been identified as scarce resources subject to strategic control in these networks of small firms, since, following the assumptions of resource dependence theory, firms share information with those firms with which they do not compete, and hence with those that do not make the same demands on their environment as they do.

In short, the current research includes some advances with respect to the previous literature, in particular on the overlaps that exist between the economic and social relations and the flows of information and knowledge that occur in the networks of small and medium-sized firms. Thus, with regards the first question, although the connections between the social and economic links is a classic issue in the literature, it has been rarely explored empirically and within the particular context of a network of small firms, such as occurs in business clusters. With regards the information and knowledge that circulates in the business networks, the main contributions consist of the empirical

analysis and the demonstration, on the one hand, of an association between the tacit or explicit nature of the information that is exchanged and the strength of the relation between the firms; and on the other hand, of an association between the way firms are linked together and the direction of the information flows. Finally, these analyses have been carried out using a methodology allowing us to go beyond the study of the dyad—the usual level at which interorganisational relations have been studied in the past—and analyse the whole of the network.

The model proposed by collective strategy (Astley and Fombrun, 1983) can be taken up to explain new research on networks of firms, and in addition it can be complemented with new variables such as is the case here with information flows. In particular, the identification of subnetwork types within the networks of small firms may help to explain the complex phenomena that occur in these groupings. For this, it is necessary to study questions such as the form of control that exists in these subnetworks and its influence on the global network.

In general, applying the methodology and assumptions of social network analysis for the study of interorganisational relations will allow various existing lines of research to advance and will help create new ones. An interesting line of research would be to incorporate the concepts of social capital and relational capital into this model. The use of relational data will allows the construction of powerful indicators that promise to shed light on these concepts that are the object of a fundamentally theoretical treatment at present.

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