Strategic Management Journal
Strat. Mgmt. J., **20**: 317–338 (1999)

THE LEVERAGING OF INTERFIRM RELATIONSHIPS AS A DISTINCTIVE ORGANIZATIONAL CAPABILITY: A LONGITUDINAL STUDY

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In this paper we present a study of the structure of three lead firm-network relationships at two points in time. Using data on companies in the packaging machine industry, we study the process of vertical disintegration and focus on the ability to coordinate competencies and combine knowledge across corporate boundaries. We argue that the capability to interact with other companies—which we call relational capability—accelerates the lead firm's knowledge access and transfer with relevant effects on company growth and innovativeness. This study provides evidence that interfirm networks can be shaped and deliberately designed: over time managers develop a specialized supplier network and build a narrower and more competitive set of core competencies. The ability to integrate knowledge residing both inside and outside the firm's boundaries emerges as a distinctive organizational capability. Our main goal is to contribute to the current discussion of cooperative ties and dynamic aspects of interfirm networks, adding new dimensions to resource-based and knowledge-based interpretations of company performance. Copyright © 1999 John Wiley & Sons, Ltd.

INTRODUCTION

Reliance on strategic alliances and interfirm relationships has grown considerably in recent years, while partnerships with external actors have become a central strategy for many organizations in a wide range of industrial contexts (Mowery, 1988; Badaracco, 1991; Nohria and Eccles, 1992; Gulati, 1995; Beamish and Killing, 1997). Partnerships are motivated, among other things, by the need to achieve production efficiency, share R&D risks, gain access to new markets and skills, and achieve time compression in the development of new products and the search for new technological opportunities (Kogut, 1988; Hagedoorn, 1993; Eisenhardt and Schoonhoven, 1996).

The option to share strategies and pool resources is seen as a variant of the make-or-buy decision, based largely on transaction cost economics (Williamson, 1991; Hennart, 1991). The transaction cost approach emphasizes the logic of single-party cost optimization but does not fully encompass other types of costs, e.g., learning costs (Ring, 1996a), and coordination costs (Gulati and Singh, 1998). Furthermore, the static nature of transaction cost economics, focusing as it does on a single transaction, is not appropriate for understanding learning and innovative processes when knowledge is broadly distributed and the locus of innovation is found in a network of interorganizational relationships (Zajac and Olsen, 1993; Powell, Koput, and Smith-Doerr, 1996).

One of the main tenets of organizational research states that organizations react to uncertainties and dependencies in their environment by

Key words: organizational competencies; interfirm relationships; relational capabilities
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CCC 0143–2095/99/040317–22 $17.50

Received 26 June 1996
Final revision received 28 July 1998

removing transactions from the market and placing them in more hierarchical contexts (Williamson, 1975; Ouchi, 1980), and this has been regarded as one of the fundamental principles of organizational design (Pfeffer and Salancik, 1978). However, more recent research is beginning to question the generality of this principle by showing that—when market uncertainty increases—individual companies tend to interact more, rather than less, with other organizations, thereby increasing the overall volume of their market transactions (Podolny, 1994). As a consequence, the main effect of market uncertainty is not the absorption of the source of uncertainty within corporate boundaries, but increased reliance on external partners who are known and trusted as reliable (Baker, 1992).

The resource-based view (hereafter RBV) examines strategic capabilities as a pool of internal resources which are strategically important for the creation of competitive advantage (Penrose, 1959; Rumelt, 1984; Wernerfelt, 1984; Barney, 1991; Amit and Schoemaker, 1993). The RBV also suggests that the combination of a unique collection of resources within a single firm will create synergies leading to sources of sustained competitive advantage (Barney, 1991).

A growing body of literature, focusing on different industrial sectors and large and small firms, sees collaborative practices as a viable method of knowledge creation and transfer (Hamel, 1991; Nonaka, 1994; Powell *et al.*, 1996), even though the risk of knowledge erosion is emphasized in some quarters (Teece, 1987). Strategic alliances may also create competitive advantage through idiosyncratic complementary resource combinations between partnering firms (Kogut, 1991), while the idiosyncratic nature and embeddedness of the central firm's relational assets make imitability difficult (Hansen *et al.*, 1997).

The dynamic capabilities perspective (Teece and Pisano, 1994; Lado and Wilson, 1994; Teece, Pisano, and Shuen, 1997) emphasizes that the distinctive competencies of external actors, such as buyers and suppliers, are among the driving factors in vertical integration or deintegration decisions. Along this vein, the knowledge-based view of the firm (Grant and Baden-Fuller, 1995; Conner and Prahalad, 1996) considers the ability to integrate the efforts of different actors as important as the capacity to innovate (Grant, 1996a).

The above perspectives informed and guided our research on the evolution of interfirm networks and on firms' capabilities to interact with other firms. By seeing the firm as transactionally intensive in nature (Hansen *et al.*, 1997), and based on an architecture of capabilities (Grant, 1996b), these approaches supply considerable theoretical support for the assertion that a firms' performance is directly linked to its efforts in competence building and renewal. Despite the different perspectives, all the approaches share the assumption that interfirm relationships are of the utmost importance for knowledge access and transfer. The creation and development of tightly integrated production networks similar to those described in the study emerge as a source of competitive advantage over competitors who forego intense relational activity.

Our study is aimed at filling some gaps in the above literature. The growing body of anecdotal and empirical literature on interfirm relationships has highlighted the importance of a firm's relational capability, but the attempt to link this capability to the achievement of a sustainable competitive position has often led to results of limited value for researchers and practitioners.

With few exceptions (Madhavan, Koka, and Prescott, 1998), theoretical development on strategic alliances and networks are mainly concerned with cross-sectional analysis. Despite the interest in the strategic implication of networks, there is still a strong need for better theories on network evolution and change (Nohria and Eccles, 1992; Lipparini and Sobrero, 1997). Past work has tended to consider networks as given contexts, rather than a structure that can be deliberately designed.

To fill this gap, we approached longitudinally three interfirm networks taken from a successful business environment, namely the producers of automatic packaging machines. The analysis, based on the study of the structure of lead firm-network relationships at two points in time, takes into account the evolution of the network structures as well as the evolution of those capabilities required to manage a progressive intensification of interfirm ties.

Another gap in the literature is that it is mainly concerned with the study of diadyc ties (Gulati, 1998). We move beyond the impact of single alliances by considering the entire set of relationships that should be activated for the realization

of a specific product. We highlight how investments for the creation of an integrated network of suppliers are a common strategy for firms structurally geared to multiple and frequent interactions. In this sense, we aim at providing a fertile ground for theory building on the issue of interfirm relationships and lead-firm networks. In particular, interfirm networks can be shaped and deliberately designed; over time, managers tend to create a tightly related supplier network and build a narrower and more competitive set of core competencies.

The paper is organized as follows. The first section sets out the theoretical background which informed our research. The second section presents the study, highlighting the industrial setting and the relational context in which the three manufacturers operate. The third section focuses on the structuring of functional activities inside and outside the firm, and on the longitudinal study of the production network. The final sections contain discussion and conclusion, together with implications for further research.

THEORETICAL BACKGROUND

Our research questions originated from some weakness of different theoretical perspectives, and was guided by some of their theoretical assumptions. One weakness of transaction–costs economics (TCE) is its static comparative analysis and the normative assumptions underlying the generalized boundary conditions that exist between firm and market (Zajac and Olsen, 1993). These factors contrast with dynamic rent-seeking behavior centered on the leveraging of distinctive capabilities. Furthermore, TCE research primarily has been concerned with transactions involving tangible assets, whereas many researchers relate organizational rents to the possession of intangible assets such as learning, and reputation (Barney and Hansen, 1994).

While TCE focuses on how to integrate various activities in order to lower transaction costs, the RBV emphasizes the untradability and immobility of idiosyncratic resources as the basis of competitive advantage (Dierickx and Cool, 1989; Peteraf, 1993). The RBV sees the firm's enduring competitive advantage as related to the possession of unique, inimitable resources and capabilities, and to processes of resource accumulation and deployment (Wernerfelt, 1984; Barney, 1986). Amit and Schoemaker (1993) refer to capabilities as tangible or intangible assets which are firm-specific, created over time through complex interactions among the firm's resources, and based on developing, carrying, and exchanging information through the firm's human capital.

In search of theoretical support for the relational capability of a firm, we depart from the assumption of asset immobility which currently dominates the RBV (Barney, 1991) and which has prompted critiques based on its being a potential source of rigidities and inertia (Hannan and Freeman, 1989). In particular, Peteraf (1993) argues that there are different kinds of imperfect mobility that do not deprive or hurt the company looking outside for sources of competitive advantage. Hansen *et al*. (1997) claim that some of the unique resources of a firm are selectively tradable through a network of firms. The investigation of capabilities implies a dynamic and processual approach. One common weakness of TCE and RBV perspectives is their focus on a single firm and on single transactions, providing less insight into the processes by which multiple firms, working collaboratively, develop individual and common capabilities.

The capabilities arising from resource-based interaction among autonomous but interdependent firms have only recently begun to receive some attention. Interorganizational relationships are a viable option for the creation of a sustained cooperative advantage (Ring, 1996b) through idiosyncratic, yet complementary, resource combinations (Kogut, 1991; Kogut and Zander, 1992). A resource-based view of strategic alliances has been advanced by Eisenhardt and Schoonhoven (1996). Their basic assumption is that alliances are formed when firms are in a vulnerable strategic position for which they need additional resources, or when firms are in strong social positions giving them the resources critical to know, attract, and engage partners.

Along this vein, the dynamic capability approach and the knowledge-based view of the firm have been useful in informing and guiding our study. The dynamic capability paradigm (Lado and Wilson, 1994; Teece *et al.*, 1997) is an integrative approach to the RBV offering a closer understanding of sources of competitive advantage. The emphasis on process becomes explicit when the authors affirm that it is

extremely important to investigate the mechanism by which firms accumulate and disseminate new skills and capabilities to reply promptly to changes in the competitive environment despite conditions of path dependencies and core rigidities in technological and organizational processes. The possession of dynamic competencies leads to several fundamental features of strategic maneuvering: high response capability, reduced time-to-market, innovative capability.

The recent conceptualization of a knowledge-based theory (KBT) also represents considerable support for our assertion that one of the strategic capabilities of the firm is its ability to integrate knowledge (Grant, 1996a) and to transform dispersed, tacit, and explicit competencies into a wide body of organizational knowledge (Nonaka, 1994). Interfirm networks may provide an effective way to organize knowledge transfer or access in dynamically competitive domains, and in contexts where complex knowledge is scattered or specialized, as well as to use and build on knowledge. Organizational learning capability is especially critical since idiosyncratic advantages naturally erode over time, and an intensive exchange of knowledge, deliberately delivered, may help reinforce strategic positioning. Grant (1991, 1996b) embraces the idea of a firm's competencies being the ability to deploy resources, usually in combination, using organizational processes to achieve a desired end. In this sense, suppliers are regarded as resources enabling firms to consolidate in-house competencies.

An increasing number of studies supplies valuable support to the theoretical perspective presented above. In modern economies, firms engage in a narrow set of activities which are embedded in a complex chain of interfirm relationships (Dyer, 1996). Consequently, the investigation of the division of innovative and manufacturing activities between a lead manufacturer and its suppliers might be useful in highlighting what competencies a firm should develop to integrate and synchronize such a wide number of actors.

Organizations are more and more involved in multiple repeated alliances. Research on the automotive industry (Womack, Jones, and Ross, 1990; Clark and Fujimoto, 1991; Nishiguchi, 1994) highlights the superior performance achieved by firms which rely on tiers of external suppliers, and mobilize them in order to reduce development risks, time-to-market, quality defect rates, and stocks, while at the same time enhancing their capacity for innovation and flexibility (Helper, 1991). Despite the intensification of the relational activity of the firms, a narrow body of research has focused attention on the evolutionary process of interfirm ties formation (Doz, 1996).

A useful area stemming from current research is the analysis and measurement of a firm's capability to develop, integrate, and transfer knowledge across different actors in a network. Even if empirical investigations on the relational capability of the firm are not yet diffused, several conceptualizations of competence reveal their usefulness for a fine-tuning of this concept. In order to manage efficiently the complex relational sets in which they are embedded, organizations must develop: the ability to absorb competencies from others (Cohen and Levinthal, 1990); the ability to combine and coordinate the technical dimensions of a large number of firms (Kogut and Zander, 1992); the ability—described as 'architectural'—to combine existing competencies or generate new knowledge, if required (Henderson and Cockburn, 1994).[1]

In summary, we advanced an argument that the ability to interact and share knowledge with other companies is a distinctive organizational competence for firms transactionally intensive in nature.

THE LONGITUDINAL STUDY

Research design and method

Most definitions and theories in the field of strategic management are longitudinal (Mintzberg and Waters, 1985; Porter, 1991), and strategic moves or organizational structures can be better understood if they are tracked over time (Miller and Friesen, 1982; Schendel, 1996). In order to examine whether or not there are differences between firms from the same industry, as well as between old and new boundaries at the firm's level, we have explored the relational sets of

[1] In addition, others also enrich the concept of relational capability when talking of 'integrative capabilities' (Lawrence and Lorsch, 1967), 'architectural knowledge' (Henderson and Clark, 1990), 'collective knowledge' (Spender, 1994), 'organizational architecture' (Nelson, 1991), and 'architecture of capabilities' (Grant, 1996b).

three Italian firms recognized as major international players in the packaging machinery industry (SIC 3565). This industry was deemed as an appropriate research setting mainly for two reasons. First, firms in the packaging machinery industry are competing on the technological forefront at the international level. Second, this is an industry setting in which interfirm relationships are likely to be strategic due to increasing needs to share R&D risks, and achieve time compression in the development of new products.

The collection of data, initiated in 1995, is part of a larger survey of the 'Packaging Valley,' an industrial district located in the northern Italian city of Bologna, which has the highest concentration of firms operating in the design and manufacturing of automatic packaging machines. Of these firms—identified using data bases, personal contacts, and institutional sources of information—three were studied longitudinally (1988–95). Our longitudinal analysis required the use of measures of identical subjects (one specific product).

The analysis was conducted at product level. Initially, we gathered information on each company's history, products, and markets from open-ended interviews. The next step, undertaken jointly with the top management, was the identification, for each of the three firms, of a product in existence since 1988 and representative of the company's portfolio and technological position. We then mapped the internal and external contributions and competencies required for its design and manufacturing, as well as the determinants of the actual configuration of activities. To do this, we asked the CEOs to identify more specifically the persons in their respective organizations who could comment most knowledgeably on 'who' does 'what,' at the product level, and 'why' the firm opted for the 'in-house' or the external configuration for a specific production activity.

Another step was the identification of structural changes in lead firm-networks over time—changes which have led to the current distribution of product and component knowledge across boundaries. To capture these aspects, we decided to undertake a longitudinal study of the entire process of manufacturing of a packaging machine, at two points in time (1988 and 1995), analyzing: (a) how firms distributed across their boundaries the various activities and competencies, (b) why network evolution occurred, and (c) what happened in between and how leveraging was occurring.

Individual interviews with the CEOs, top managers, and technicians were conducted within each company. Efforts were made to interview the individuals directly involved in new product development and actively managing external relationships. Follow-up questions were asked during additional interviews. The interviews ended in late 1996. In total, nearly 40 hours of interviews were conducted with 19 individual respondents.

The sample

The sample consists of three Italian manufacturers of automatic packaging machinery. These medium-sized firms are part of a larger industrial context comprising companies specializing in the production of special-purpose machines designed for specific packaging tasks (i.e. blistering, wrapping, or filling machines), which have contributed to Italy's position of technological leadership in this industry at the international level. Competitive positioning also arises from locational advantages due to proximity with specialized sources of knowledge, such as suppliers, technical colleges, and even competitors, thereby allowing both small and large manufacturers to draw on different competencies.

The distinctive competencies of these firms which contribute to their positioning at the international level are to be found in an ability to create value for customers with totally new brands or simple improvements on past machines; to enter new markets faster than their competitors; to rely on external specialized sources of knowledge; to act as 'system integrators,' able to offer a wide range of packaging machines and complete lines thanks to acquisitions and collaborative agreements. These firms originated in the same incubator (ACMA Spa), which led directly or indirectly to the creation of 'Packaging Valley' through a spin-off process (Porter, 1990). As a consequence of their distinctive competencies, there is broad recognition in the organizational community of their status and leading role in the relationship sets in which they are embedded.

Ima Spa, founded in 1960, is the world leader in teabag packaging machines (global market share of 75%), and a major competitor in the

pharmaceutical industry machinery market. In 1995 it exported about 90 percent of its products. It employs 1000 personnel and its net sales totalled $290 million in 1995. Corazza Spa is the world leader in packaging machines for bouillon cubes and cheese (global market share of 80%). Established in 1956, it has a workforce of 254 employees and in 1995 its net sales totaled $46 million. In 1996 the firm became part of a Chinese group. Wrapmatic Spa is the world leader in the packaging of tissue and paper for office use and exports 90 percent of its output. Recently, it moved into the pharmaceutical industry with the development of a blistering machine. Established in 1960, it now employees 200 personnel and its net sales in 1995 totaled approximately $42 million. In 1991 Wrapmatic was sold to a German group.

The products: mobilizing and integrating internal and external competencies

Our analysis focused on three successful packaging machines for the pharmaceutical, food, and paper industries. These machines are systems of interactive parts and groups, all highly interdependent, emerging from a manufacturing process involving sophisticated equipment and a large number of operations. Each one of the major groups of packing machine is itself a system, comprising a set of interacting and interlocking parts. Since each component is part of a larger system, mutual adjustment and interfirm coordination are required. In recent years, customers (i.e., large multinational pharmaceutical or food-processing companies) have changed their procurement strategies. Instead of buying the constituent parts of a packaging line from different suppliers, they prefer to deal with a single source. This has forced small and medium-sized packaging manufacturers to engage in collaborative practices in order to gain access to external specialized knowledge, and thus supply a complete line. The leveraging of interfirm ties and the use of external specialized knowledge is therefore fundamental to supplying a multinational with, for instance, a filling line comprising an automatic depacker, rotary filling and closing machines, a labeling machine, a cartoning machine, wrapping/binding machines, a vertical case packer, and a palletizer.

The first product we report on is the Ima C90, a blistering machine for the pharmaceutical industry whose main features are low operating cost, reliability, and extreme flexibility. It consists of different units operating as a whole. The first version, introduced in 1988, was modified in 1993 in order to enter the Japanese and Far East markets. We began our analysis by asking technicians to split the machine into functional groups, and to specify, for each of them, whether the product design and product manufacturing were performed in-house, externally, or both, thus assigning specific internal competencies in design or manufacturing where the firm relies on internal forms of organization. We then asked managers to be explicit as to the form of organization they adopted for the design or manufacturing of that type of contribution. Among the options, our respondents indicated that design activity was carried out by an internal R&D department, at a supplier site, or jointly via co-design practices entailing—usually at the supplier site—the simultaneous presence of technicians from the lead firm and the supplier. Similarly, we found that manufacturing activity was either performed by the firm's assembly department, by the supplier in its factory, or via co-makership practices, usually performed at the supplier site.

Table 1 sets out the organization of Ima C90 design and manufacturing, as well as an appraisal of the significant determinants which guided the firm in its choice of what was considered the most appropriate form of organization for the fabrication of a specific group. These findings were obtained from interviews with technicians, functional managers, and CEOs.

The firm relies largely on internal competencies for its product design. Access to external capabilities—via co-design practices—is limited to the shearing group and the numbering–sectioning unit. Other parts or groups such as the printer, protection devices, and TV camera for quality control are wholly designed and manufactured outside, since they are standard products available by catalogue or with minor adaptations on the basis of the individual packaging firm's requirements. Even though suppliers are taking on more and more design work, this activity is still a prerogative of Ima. The situation is different when it comes to the organization of manufacturing activity. With the exception of the component group known as the 'sealing roller,' all the other groups are purchased from outside suppliers

Table 1. Organization of Ima ‘C90’ design and manufacturing

Main groups and parts	Product design			Product fabrication			Make-or-buy Significant determinants
	In-house	Out-sourced	Form of organization	In-house	Out-sourced	Form of organization	
Shearing group	•	•	Co-design		•	Supplier	Distinctive firm capabilities
Dropping group	•		R&D dept		•	Supplier	Distinctive firm capabilities
Electrical box	•		R&D dept		•	Supplier	Distinctive capabilities and economies of scale
Motorization	•		R&D dept	•	•	Co-makership	Complementary capabilities
Cooling group	•		R&D dept	•	•	Co-makership	Complementary capabilities
Numbering–sectioning unit	•	•	Co-design		•	Supplier	Distinctive firm capabilities
Sealing roller	•		R&D dept	•		Assembly dept	In-house distinctive capabilities and uncertainty
Feeding group	•		R&D dept		•	Supplier	Management costs/distinctive firm capabilities
Microprocessor unit	•		R&D dept		•	Supplier	Distinctive capabilities and economies of scale
Folding group for summaries		•	Supplier		•	Supplier	Low asset specificity/distinctive firm capability
Printing group		•	Supplier		•	Supplier	Low asset specificity/distinctive firm capability
Industrial accident protections		•	Supplier		•	Supplier	Low asset specificity/distinctive firm capability
Quality control TV camera		•	Supplier		•	Supplier	Low asset specificity/distinctive firm capability

Source: Ima Spa. Use of data authorized by the firm.

or co-manufactured, as is the case, for example, with the motors and the cooling component groups. This extensive mobilization of external manufacturing capabilities is a common practice in this industry, thanks to the suppliers' specialized knowledge of mechanics and electronics.

In 1995, the sealing roller was the only component group designed and manufactured by relying exclusively on Ima's distinctive internal competencies. This item—strategic for the quality and integrity of the pill within the blister—would still be manufactured by Ima even if suppliers could produce it more efficiently. The high environmental uncertainty surrounding this component group, deriving from the fact that potential suppliers cannot guarantee a stable long-term relationship as far as product quality is concerned, combined with the possession of unique internal competencies developed over time, makes internal production of the sealing roller the only viable option currently available to Ima. Nevertheless, the firm has started to cultivate a potential supplier for future joint design practices.

The choice between internal resources and competencies and the reliance on a supplier network are motivated by different reasons. The need to keep up with technological advancements suggests reliance on external contributions when a specific supplier is recognized as having a distinctive capability. This is the case with the 'sharing' and 'dropping' groups, the 'numbering' and 'sectioning' machines, and the electrical box. Suppliers' possession of unique capabilities brings advantages when producing a large number of component groups for different customers. The practice of co-makership is a viable option for the lead firm when suppliers possess complementary capabilities, allowing them to form part of a team for the manufacturing of a specific product. Low asset specificity and the possession of specialized competencies in governing specific technologies at the supplier level are the basic determinants influencing the purchase of entire groups or components from catalogues.

The Corazza FD12-AD12/N is a packing and packaging line for bouillon cubes. Its main production features are high speed and versatility. Using the same interpretative logic adopted for Ima, we find that extensive use is made of internal competencies in design activity. Table 2 shows how all the main subassemblies and parts are designed in-house, except for the 'weight control' group and, less importantly, the 'printer' and 'machine protection' groups which are readily available on the market. Corazza employs a team of designers and engineers working on the entire set of functions a machine should perform. This does not involve co-design activity, but there is large-scale recourse to collaborative practices in manufacturing. With the exception of component groups available on the market, only the 'forming boxes' and the 'dosing' groups are fabricated without the direct participation of Corazza technicians. The 'buy' option arises when complementary capabilities are needed and/or the sharing of resources with suppliers leads to greater efficiency. When external firms possess distinctive capabilities, volume advantages, or operate in situations characterized by low asset specificity, the practice of co-makership tends to be replaced by direct procurement from the supply market. The strategic 'weight control' operating unit is highly sophisticated and wholly developed by a partner in whom the firm invested heavily at the beginning of the relationship. In contrast with Ima's strategy for its 'sealing roller,' and even though the 'weight control' component is critical to the machine's success, the firm has not invested to develop the internal competencies required to lower the risk of opportunistic behavior or constraints in the procurement of such a component. The external supplier is recognized as trustworthy, and as having distinctive capabilities in producing and supplying high-quality products to many major customers internationally.

The Wrapmatic PW33 is a wrapping machine for tissue products. Since its introduction in 1987, it has been upgraded to include the latest technologies for the transportation and control of the product. This machine, 95 percent of whose parts are made by outside suppliers, can operate either independently or within a line comprised of different units, all supplied by satellite firms. Like the other firms, Wrapmatic has invested heavily to develop internally the set of competencies required to design the different groups comprising a packaging line. Co-design activities are performed for the 'electrical box' and the 'microprocessor unit' (Table 3). Similarities with Corazza's network organization are to be found in manufacturing. Here, with few exceptions, joint activity with external suppliers is the rule. Given the critical importance of computerized control

Table 2. Organization of Corazza 'FD12+AD12/N' design and manufacturing

Main groups and parts	Product design			Product fabrication			Make-or-buy Significant determinants
	In-house	Out-sourced	Form of organization	In-house	Out-sourced	Form of organization	
Paper feeding group	•		R&D Dept	•	•	Co-makership	Complementary capability
Forming boxes group	•		R&D Dept		•	Supplier	Distinctive firm capabilities
Dosing group	•		R&D Dept		•	Supplier	Distinctive firm capabilities
Folding group	•		R&D Dept	•	•	Co-makership	Complementary capabilities
Turning group for bouillon	•		R&D Dept	•	•	Co-makership	Complementary capabilities
Exit group	•		R&D Dept	•	•	Co-makership	Complementary capabilities
Weight control			Supplier		•	Supplier	Distinctive firm capabilities
Feeding group	•	•	R&D Dept	•	•	Co-makership	Complementary capabilities
Feeding group II	•		R&D Dept	•	•	Co-makership	Complementary capabilities
Glue dispenser	•		R&D Dept	•	•	Co-makership	Complementary capabilities/asset specificity
Ink-jet printer		•	Supplier		•	Supplier	Distinctive capabilities/economies of scale
Closing boxes equipment	•		R&D Dept	•	•	Co-makership	Complementary capabilities
Electrical box	•		R&D Dept		•	Supplier	Distinctive capabilities/economies of scale
Industrial accident protections		•	Supplier		•	Supplier	Low asset specificity/distinctive firm capabilities/economies of scale

Source: Corazza Spa. Use of data authorized by the firm.

Table 3. Organization of Wrapmatic 'PW33' design and manufacturing

Main groups and parts	Product design			Product fabrication			Make-or-buy significant determinants
	In-house	Out-sourced	Form of organization	In-house	Out-sourced	Form of organization	
Product throwers	•		R&D dept	•	•	Co-makership	Complementary capabilities
Feeding draft	•		R&D dept	•	•	Co-makership	Complementary capabilities
Motorization	•		R&D dept	•	•	Co-makership	Complementary capabilities/low asset specificity
Unwrapping and cutting group	•		R&D dept	•	•	Co-makership	Complementary capabilities
Folders motorization group	•		R&D dept	•	•	Co-makership	Complementary capabilities
Wrapping and lateral folding	•		R&D dept	•	•	Co-makership	Complementary capabilities
Exit draft	•		R&D dept	•	•	Co-makership	Complementary capabilities
Electrical box	•	•	Co-design		•	Supplier	Distinctive capabilities and economies of scale
Microprocessor unit	•	•	Co-design	•	•	Co-makership	Distinctive capabilities and economies of scale
Industrial accident protections		•	Supplier		•	Supplier	Low asset specificity/distinctive firm capability

Source: Wrapmatic Spa. Use of data authorized by the firm.

Table 4. The structure of interfirm relationships in the sample

Leading firm	Ima			Corazza			Wrapmatic		
Suppliers	*N*	Distance (avg. miles)	Duration (avg. years)	*N*	Distance (avg. miles)	Duration (avg. years)	*N*	Distance (avg. miles)	Duration (avg. years)
1st tier	13	32	17	14	36	15	10	41	14
2nd tier	104	44	9	116	61	6	94	36	9
3rd tier	512	–	–	602	–	–	391	–	–

Source: Archival data. Data refer to those relationships needed for the realization of a specific product.
Values concerning proximity reflect the distance between 1st or 2nd tier suppliers and lead manufacturer's main location.

to machine performance, the microprocessor unit requires both internal and external competencies in design and manufacturing. This reflects the competition that has arisen between product lines with different computerized control systems, which are critical to the functional efficiency and safety of the packaging machine. With respect to significant determinants of the make-or-buy decisions, we note how frequently the technicians and managers justify the use of external actors by the need to access distinctive capabilities.

The process: How lead firm-networks evolve and change over time

To approach the network evolution dynamically, we decided to undertake a longitudinal study of the entire process of fabrication of a packaging machine.

With the aid of technicians and engineers, we identified the following logical flow of activities: (a) manufacturing of electronic, electromechanical and mechanical components, safety devices, and finished groups; (b) subassemblies of major components which will be assembled by lead suppliers, the focal firm, or both; (c) assembly, to integrate the various components of the machine; (d) format adjustment, to meet different customer requirements in terms of package size, speed, and machine operating conditions; (e) testing, to guarantee that the machines meet technical and functional efficiency requirements under specified conditions.

Figures 1–3 show the functional competencies which the three firms have developed in-house and those they currently access on the outside. A first glance reveals common ground in a behavioral path towards progressive deintegration of the manufacturing process. The figures reflect how the firms have expanded their reliance on suppliers and have contracted their own firm boundaries over time. The shaded area indicates those activities and competencies which are currently performed entirely outside the firm's boundaries. Changes in firm boundaries are identified by the dotted line—representing the situation in 1988—drawn within each figure.

The longitudinal analysis reveals how the three lead firms have focused on what they consider to be their strategic competencies—format adjustment, and testing—resorting to interfirm relationships to meet their requirements with regard to electronic and electromechanical devices, external protection devices, and mechanical components. A common behavioral trend in 1988 was to perform internally all the main activities required to construct a machine. In the case of Ima, for example, the groups that were built using specialist external expertise were preassembled (with the exception of the guards) by the company, and then assembled together with other, internally fabricated mechanical components. At that time, competencies extended to the production of finished groups, as well as format adjustment and testing (Figure 1). Seven years later, the firm was focused on a narrow set of functional competencies: the machine customization and final

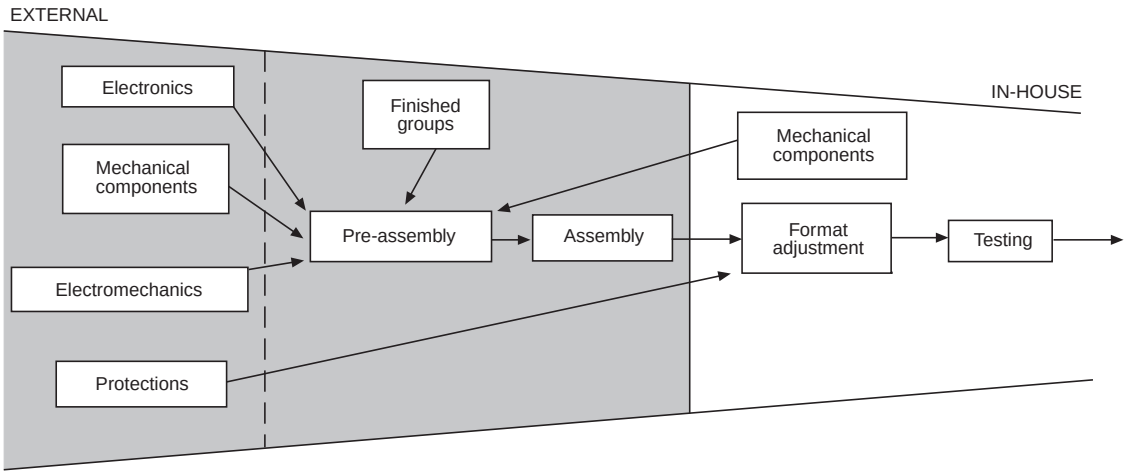
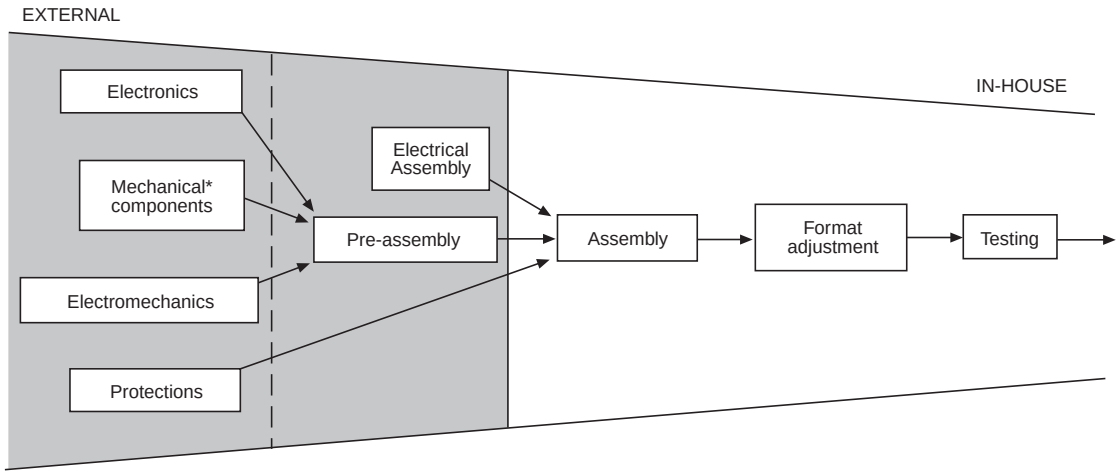
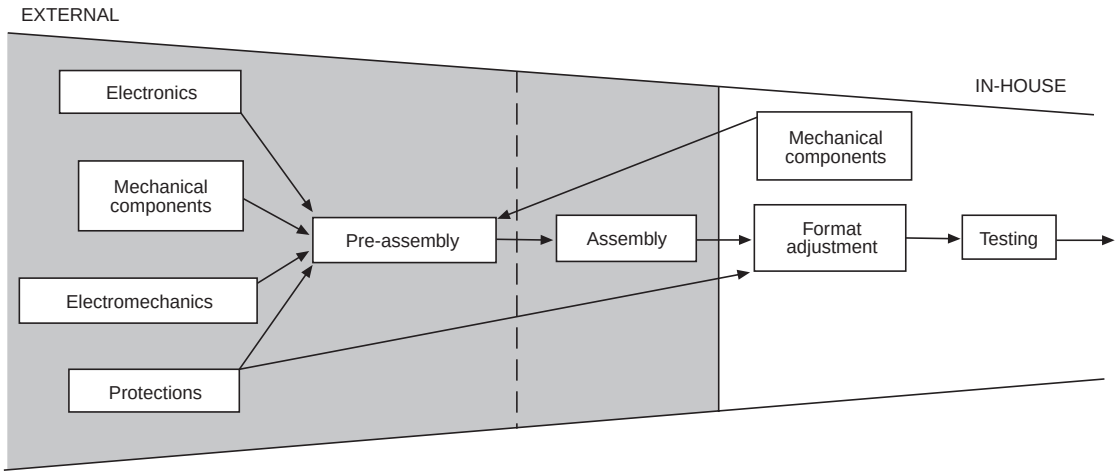


Figure 1. The Ima C90: Changes in functional competencies and firm boundaries (1988–95)



Vertical dotted line shows old boundaries
* Internal production of mechanical components gradually ceased in the period 1988-1993

Figure 2. The Corazza FD12+AD12/N: Changes in functional competencies and firm boundaries (1988–95)



Vertical dotted line shows old boundaries

Figure 3. The Wrapmatic PW33: Changes in functional competencies and firm boundaries (1988–95)

testing, and the production of a small number of mechanical components as a buffer for new, unplanned orders.

Similarly, the Corazza manufacturing process (Figure 2) has seen increasing recourse to external competencies in the assembly of electrical devices and the preassembly of groups, while the internal production of mechanical components has gradually been wound down in parallel with the evolution of supplier capabilities. At Wrapmatic, the current focus is on the final stage of the manufacturing process and testing, and the use of suppliers in preassembly—already performed externally—and assembly (Figure 3).

The similar paths towards a network-like organization of manufacturing activities cannot be explained simply by imitative behavior due to spatial proximity. The drivers for change were the need to respond to events at the industry level. The investigation of specific events as occasions for structuring (Barley, 1986) may be helpful for the interpretation of structural modification in the lead firm-networks. As advanced by Madhavan *et al.* (1998), key industry events provide occasions for network restructuring. These could be, for instance, technological advancements, the entry of a prominent competitor, or radical shift in consumer preferences. Such events

could either increase the value of the lead firm's current set of external resources or push the firm to enter into new relationships to access the competencies required.

The first such event in this industry was the huge output expansion in the 1970s and the 1980s as a consequence of the diffusion of packaging for many industrial products. At this initial stage, firms manufactured most of their components internally, and subcontracting was a short-term strategy. The increasing pressure of new technologies and the need to reduce costs forced the firms to improve the flexibility of their structures. The lead firms began to rely increasingly on suppliers for finished product subassembly and assembly operations. Over time, a large number of small and medium-sized firms evolved from suppliers of simple parts built to the firm's specifications into highly specialized manufacturers of components and groups. Moreover, the suppliers improved their capabilities in assembly and sometimes in product design. As a consequence, in the 1990s, lead firms and their suppliers have become closely linked. At this point, the lead firms decided to manufacture only the systems for which they possess special expertise. Most of them were co-developed with experienced suppliers, while relying on others for the procurement of complete high-technology subassemblies.

Another event was the dramatic shift in buyer priorities. The customers for these firms are mainly the large multinationals operating in the pharmaceutical, food, or paper industries. The need to match their high standards, in terms of quality and technology, forces the manufacturers to concentrate on what they can do best. Testing is one of those activities defined as 'strategic' or 'critical' to success in the packaging industry, since the lead firm is responsible for the ultimate reliability of the product. This explains the renewal of in-house competencies in this area. Compared with our other cases, Corazza maintains its assembly capabilities in-house. Since the founder of the company was originally an assembler, the family directed much of its efforts to upgrading the firm's ability in combining components. Accumulated production experience still plays an important part in the interpretation of network structuring. The format adjustment is another task a lead firm could not delegate. A source of competitive advantage in this industry lies in the ability to adapt the machine at the customer's plant, modifying the machine configuration and transferring the basic knowledge to manage the packaging process.

The networks' evolution was vigorously supported. A key role in leveraging external ties is that played by middle managers. Their willingness to interact with suppliers as external sources of knowledge and to access their complementary capabilities emerged as driving forces toward the fine-tuning of the network structure.

Table 4 shows the structure of interfirm relationships in the sample at 1995. The relational structure resulting from farming or contracting out strategies over the 10-year period reveals a multilevel supply chain similar to those observed in Japanese firms and their lean production systems. Two key features of such linkages are proximity, seen as a facilitating coordinative mechanism (Gerlach, 1992; Uzzi, 1996), and duration, a variable related to performance in companies characterized by intensive transactional activities (Larson, 1992; Gulati, 1995). Proximity leads to lower search costs for a member of a networked organization.

The observation of what happened between 1988 and 1995 reveals some trends: (i) the number of first-tier suppliers decreased while the quality and content of the relationships increased; (ii) the first tiers focused their activities too, becoming specialized componentry makers; (iii) first-tier suppliers apparently were able to lower their production costs as a consequence of their customer base increases; (iv) familiarity among parties—the average duration of ongoing relationships with first tier firms is 14 years—has helped to shape relationships based on trust, thereby reducing transaction and coordination costs.

The leveraging of interfirm relationships occurred with *deliberate* initiatives undertaken by the lead firms. Among them, the upgrading of the suppliers' evaluation system was an important move to get access to the competencies that best fit with the internal ones. Again, frequent seminars with key suppliers were organized on critical issues such as: Total Quality Management techniques, stock reduction, strategic cost analysis, and techniques aimed at improving responsiveness. Frequent intercompany meetings, similar to those generated in the Japanese reality (Dore, 1983; Sako, 1991), also created a 'network environment' with the aim of fostering trust and cooperation. Before involving the suppliers in

closer collaborative practices, the lead firms also provided engineering and manufacturing assistance, and management consulting.

In addition to the large number of long-lasting relationships with proximate suppliers, another similarity among the three networks lies in the progressive abandonment of a conventional arm's length mode of transactional governance, and the progressive investment on the relational side of the exchange. Since the beginning of their deliberate process of network redesign, all the lead firms regarded partnering strategies as the best way to access knowledge and to simultaneously pursue product quality and flexibility.

By adhering to a 'learning by cooperating' logic, firms may profit from the early sharing of critical information as well as from a continuous flow of technical and managerial suggestions. In creating the conditions for their boundary shifting strategies, firms are likely to exchange goods and knowledge on a day-to-day basis. This is seen as the best way to develop the suppliers' capabilities while ensuring high adaptability to the environment. These aspects are best expressed in the words of two managers from the engineering departments of Wrapmatic and Corazza respectively:

> . . . we compete in an environment where information has to circulate faster and faster. Suppliers cannot adapt quickly to our changing requirements if they are not kept abreast of new advances . . .
>
> . . . we try to engage in collaborative practices as soon as we can. We are aware of the benefits deriving from partnering and networking activities with external firms . . .

When the 'learning by interacting' mechanisms started to show their usefulness, the lead firms abandoned the 'hierarchy' option of manufacturing, adding the relational dimension to the efficiency-based consideration traditionally driven by make-or-buy alternatives. This is summed up in the words of a purchasing manager from Ima:

> . . . we have long-standing relationships with external suppliers with unique capabilities in the production of strategic groups for our most successful blistering machine. In the last five years, we have focused our efforts on keeping in-house only those activities whose cost would be higher if performed outside, as well as those activities for which we possess unique capabilities. Nevertheless, we must not forget the relational dimension of this process which has required—and still requires—commitment at different levels. Thus, the efficiency criterion comes with extensive partnering strategies and networking. The re-definition of our boundaries requires a preliminary stage during which we get to know our potential partners . . .

Leveraging of interfirm ties during the phase of network transition also occurred with the awareness that firms do not need to protect their core activities by means of internalization. Disturbances can be avoided by cooperating extensively with suppliers at an early stage of new product development process. Accumulated knowledge allows them to coordinate and control external sources of knowledge more effectively. Buyer experience lowers the costs of governing market contracting, and leads to the decision to access external knowledge and complementary assets. A fundamental step has been the one of considering suppliers as 'knowledge generators' and as trainers of the lead firm's capabilities. The leveraging occurred when lead firms upgraded the status of key suppliers, involving them in a sort of 'interfirm council'. Here suppliers are asked to play a fundamental role in helping the lead firms to identify methods and opportunities in the application of new technologies, making access to ideas and innovations possible. Company-network embeddedness (Granovetter, 1985), and overall network interdependence (Provan, 1992), create incentives for cooperation and long-term commitment (Uzzi, 1996). The leveraging requires an ability to rely on trust playing a prominent role in the relationships, serving as a substitute for more formalized control systems (Ring, 1996b).

DISCUSSION

The organizations in the study pioneered a collaborative strategy with many selected suppliers to access complementary competencies. On the whole, the findings from this research indicate that lead firms are homogeneous in their efforts to structure the interfirm network of which they are a part. Large-scale reliance on collaborative activity has the potential to reshape the nature of competition, and a firm's network portfolio becomes a key organizational attribute. Our longitudinal analysis demonstrates a co-evolution

between the distinctive competencies of the firms and their relationship sets. Consistent with the theoretical approaches presented early on, organizations have learned how to gain access to, and transfer knowledge across, alliances and locate themselves in network positions which enable them to keep pace with technological developments within the industry.

The findings also suggest that networks can be potentially subject to managerial design (Nohria and Eccles, 1992; Madhavan *et al.*, 1998). The lead firms deliberately act to create an architecture of capabilities, where expertise is located both internally and externally, and partnered organizations are seen as intelligence units. An important issue here is that, within a learning network, the internal knowledge should help the lead firm to appreciate, select, and mobilize external capabilities. Simultaneously, lead firms should develop the ability to interact with others to better manage their internal competencies refinements.

The explanatory power of TCE is of limited value for an interpretation of changes in organizational boundaries and the choice of the most efficient organizational form. The static assumptions of TCE, and research which is based on short-term dyadic linkages, are not appropriate for the study of what transforms a combination of firms into a durable network (Uzzi, 1997), or the large-scale reliance on interfirm collaboration. TCE appears inadequate to describe changes in the structure of lead firm-networks also because the focus on cost overlooks the opportunities that can be deployed through intensive relationships. To provide a broader framework to understand sources of competitive advantage, the TCE perspective should be coupled with the RBV and KBT assumptions that the integration of competencies and combination of knowledge across a firm's boundaries is an important goal of managerial action.

Our empirical investigation suggests that lead firms are making serious efforts to create an interacting platform with selected partners in which knowledge and information are generated and transferred. This may foster the learning process in the network, while making it difficult for unconnected competitors to pursue imitative practices, especially when interfirm relationships become idiosyncratic.

When these conditions arise, the partnered organizations become strategic assets influencing the sustainability of the lead firm's competitive advantage. The quality of the partners and their distinctive competencies provide greater flexibility in the innovative process when compared with vertically integrated firms. In organizations similar to the companies studied, the cost structure changes with the progressive deintegration of the production process and the incremental involvement of external sources of knowledge. The transformation of fixed costs to variables costs as a consequence of large-scale reliance on inter-organizational collaboration is a hidden facet of the debate on transaction cost management, as the focus is shifted from the nature of cost to the magnitude of costs, where direct comparison is less feasible and relevant.

Two propositions can be advanced on the basis of the research results we have presented. The first proposition originates from the observation that the large-scale networks arising from tight, repeated, trust-based relationships among actors are likely to bring sustainable advantages in terms of innovation and cost economics. Network stability and the combination of the social and economic dimensions of the exchange may have a profound effect on innovation and transaction cost reduction.

Interfirm ties are enhanced over time by the creation of a sense of community and trust, daily activity in knowledge access, and co-design practices. Familiarity between organizations through prior alliances convinces firms to progressively use less hierarchical structures in organizing new alliances. This suggests moving beyond the price mechanism as a means of governing interfirm ties, and embracing the idea of an architecture of governance mechanisms (Bradach and Eccles, 1989). The presence of interfirm trust is a strong lubricant for alliances involving interdependence and task coordination between parties (Gulati, 1998). In particular, trust seems to be a basic ingredient even when the risk of knowledge dispersion is scarce, as is the case for many of the components of a packaging machine. External actors are skilled, but their competencies are limited to the parts, and do not extend to the whole.

Over time, repeated transactions potentially lead to lower transaction costs, thus permitting economic actors to gain advantages in subcontracting to suppliers who are developing their own competencies more effectively, thereby lowering the overall production costs of the network.

TCE tends to neglect important processual aspects of networks entailing continuing exchange and fine-tuning. As demonstrated (Gulati and Singh, 1998), appropriation concerns are relevant to firms entering into alliances, but there is another set of concerns resulting from coordination costs. Lead firm-networks are often formed on the basis of consideration associated with managing costs resulting from the anticipated ongoing coordination of tasks across organizational boundaries, and the complexity of coordinating activities to be completed jointly or individually. For these reasons, trust-based relationships are distinctive in addressing both coordination costs and appropriation concerns, as reflected by the nature of contracts between parties. Reliance on trust may eliminate the need for formalized contracts, and serve as a substitute for many of the kinds of endogenous safeguard prescribed by Williamson as a means of reducing opportunistic behavior, thus reducing coordination costs.

On the basis of these assumptions, and the observations derived from our sample, the following proposition is advanced, to be tested by further research:

> *Proposition 1: Lead firms potentially can lower the overall coordination and production costs of a network through multiple, repeated, trust-based relationships with key suppliers.*

Our analysis of lead-firm networks suggests a number of prominent issues which must be fine-tuned in future research. The interactive process among actors creates a greater quantity of planned and spontaneous information, while accelerating the learning process. The failures of the market system and the rigidities of internal control are overcome by interaction among partners, bringing new knowledge either through the crystallized network of firms or the selected contamination of new actors (Imai, 1987).

One key issue in interfirm cooperation is the leakage of knowledge or the loss of idiosyncratic capabilities. This is a critical concern in both the transaction cost and resource-based approaches, while research into strategic alliances highlighted how in vertically disintegrated organizations multiple and dense interfirm linkages offer access to specialized knowledge distributed among many firms, with significant effects on knowledge creation and transfer (Mowery, Oxley, and Silverman, 1996; Grant, 1996b). In large-scale networks like the ones described in the study—i.e., in biotechnology—knowledge resides in smaller organizations, and larger companies can concentrate on a narrow set of resources and core capabilities (Powell *et al.*, 1996). The 'strategic centers,' those firms with relational capabilities in regulating and controlling trade between partnering firms (Lorenzoni and Baden-Fuller, 1995), are focused on core internal idiosyncratic technical and coordinative capabilities, and have access to specialized third-party knowledge.

A dense network of firms with multiple, repeated relationships determines an organizational form in which the intensity of strong ties is coupled to and consistent with weak ties, in order to create variance and to introduce scattered capabilities into the system. At the same time, networks of firms built on intensive relational bases are open to the contamination of new actors, thereby avoiding organizational inertia. Potential information is denser and the burden of entropy and inertia is lower. The extent of the competence and knowledge of external partners creates a redundancy effect of different potential inputs, and this condition generates innovation and change (Nonaka, 1994) without being exposed to the cost of slack (Nohria and Gulati, 1995), since this is absorbed by third parties.

Membership in a network also facilitates learning through multiple knowledge flows, and may reduce the cost of the capability-building process. The distinctive governance pattern of interfirm relationships in a large-scale network of firms has particular effects with regard to the nature of knowledge flows between partners. The learning that is generated by recurrent contracting (Ring and Van de Ven, 1992) within networks may be less costly than the learning that would come from a variety of unrelated partners, as observed in the Japanese automotive industry, where suppliers dealing with different manufacturers tend to be more profitable than those dealing with just one.

Research into strategic alliances has sparked a debate regarding the alternative nature of transferred knowledge vs. access knowledge (Mowery *et al.*, 1996; Grant, 1996b). In vertically disintegrated organizations, multiple and repeated interfirm linkages offer access to specialized knowledge distributed among many firms, with significant effects on knowledge creation and

flow. Leveraging provides access to capabilities that the focal firm does not retain.

The networks tend to evolve to respond to some environmental changes, as advanced early on. The changing requirements of multinational companies—among the most important customers for the packaging firms—leads to boundaries redefinition and new divisions of labor. The ability to respond to specific events is a source of competitive advantage engendering new capabilities and increased flexibility. The search for new internally developed capability comes together with managerial actions aimed at helping partnering suppliers to became componentry specialists (Kogut and Bowman, 1995). The deliberate nature of these moves does not rule out mimicry completely, but it certainly gives mimicry a secondary role in shaping organizational structure. These efforts are not restricted to manufacturing, but influence the whole activity, the full learning pace, creating an improved convergence among the partners.

The new propositive role of suppliers, as well as support from the assemblers aimed at giving them new tasks, show a deliberate reorganization of the lead firm boundaries and a refocusing around internal core competencies. The dissemination of knowledge among many actors improves the absorptive capabilities of the whole network as well as mutual adaptation of network participants. Upgrading of capabilities and network flexibility are reached in spite of the relative stability of the relationships.

On the basis of these assumptions, we advance the following proposition:

> *Proposition 2: Multiple, repeated, trust-based relationships with key suppliers favor lead firm's access to complementary capabilities and specialized knowledge with positive effects on the networks as a whole.*

CONCLUSION

The findings of this study generally support the expectations regarding the outcomes of interfirm relationships and the potential of the network form of organization (Ring, 1996b). One of the intended goals of the study is to contribute to the discussion of the dynamic aspects of interfirm networks. Coherently with research that uses the network perspective to investigate strategic processes (Nohria and Eccles, 1992; Shan, Walker, and Kogut, 1994), interfirm relationships play a significant role in the development of new products and in the fine-tuning of competencies of partnered organizations.

This paper highlights an important set of conditions deriving from changes in lead firm-networks. Given the limited understanding of the dynamics of networks, interfirm relationships provide a unique laboratory in which strategy and structure are intertwined and the dynamic evolution of firms' competencies can be examined.

Probably our most interesting result lies in the attempt to understand why and how lead firm-networks evolve over time, certainly a main question in the understanding of how networks can become valuable resources subjected to managerial action and design.

Our investigation of three networks in the packaging industry has suggested that lead firms can achieve remarkable positions using multiple formal and informal ties as a vehicle for organizing knowledge access and transfer. Rather than using external ties as a substitute for capabilities which a firm has not yet developed, firms use collaborations to expand and improve their core competencies. These results could be extended to similar networks of learning which emerge when the sources of knowledge are disparate, as in the biotechnology industry, where organizations simultaneously learn which collaborations to pursue and how to function within a set of multiple cooperative ventures, and where the locus of innovation is found within a network of inter-organizational relationships (Powell *et al.*, 1996).

The field analysis reveals several distinctive behavioral patterns in medium-sized company technology access and transfer which have previously been documented in other industries, thus furnishing further insight into asset mobility and knowledge protection. The cases reported here confirm the deployment and combination of internal and external knowledge, embedded in product components and widely dispersed among a large number of actors who are expected to actively reinforce the network structure. Firms like those presented learn new skills by recombining their capabilities, and growth occurs by building on current social relationships (Kogut and Zander, 1992). The findings add weight to the architectural innovation model (Henderson and Clark,

1990), since they show how value is created by the reconfiguration of competencies belonging to a selected set of partners.

When the 'periphery' of the network contributes as much as the center to the generation of value, and when any single unit acts entrepreneurially and helps to keep the system alert, the potential of the network-like organization increases. The ability to interact with outside firms helps competence renewal and reduces resistance to change. In keeping with other theoretical propositions, firms tend to invest in assets corresponding to a combination of current capabilities and relational expectations as to future opportunities (Kogut and Zander, 1992). We have argued further that the lead firm's relational capability can shape interfirm networks representing a structure-reinforcing competence.

The ability to orchestrate multiple sources of learning is seen here as occurring with 'strategic intent,' and not as a result of relatively unplanned strategies (Burgelman, 1983). Partnering at an early stage, with a vision into the future, appears to be an essential precondition for the rapid development of the relational capability necessary to efficiently steer the process of boundary redefinition. Once a firm begins collaborating, it develops experience at interacting, and this provides fertile ground for further innovative interactions. Over time, the development of relational capability allows managers to lower the cost of exchange, to optimize the choice of governance structures, and to internalize specialized knowledge across the interorganizational network.

Our findings also offer a relational perspective for the study of industrial districts and, more generally, for the analysis of systems of colocated firms, such as industrial and technology parks, research centers, and high-tech 'valleys.' In these cases, the locational effects save time since the partners share updated knowledge and work on signals rather than complex contracts.

Another theoretical implication centers on the design and leveraging of relationship sets where intelligence and knowledge are not the prerogative of a single firm. From this point of view, our findings are of more general interest since they show how lead firms can simultaneously operate on the content side and the implementation side of their relational sets in order to secure significant results. This suggests developing guidelines for the strategic design of networks so as to facilitate their evolution and the achievement of a sustainable advantage.

The limitations of a research study based on a small set of cases are obvious, and attempts to generalize the results to a diverse population are oversimplistic. Nevertheless, the decision to focus on interfirm ties increases the number of firms involved, thus allowing the researchers to generate predictive content even from a limited number of case studies (Eisenhardt, 1989). As we have focused primarily on the initial conditions and final outcomes of the boundary-shifting process, our appreciation of interpersonal interactions, governance mechanisms, and learning processes can be underestimated. Despite these basic limitations, the research study may be useful in generating further theoretical and empirical research into organizational networks and interfirm strategic alliances.

If it is a common purpose of networks to experiment with new ways by which interfirm relationships are structured, then relational capability emerges as a strategic asset both for large and small firms, bringing flexibility in resource combination and coordination.

ACKNOWLEDGEMENTS

We received many helpful comments from Peter Smith Ring, Robert Grant, and Walter Powell. We would also like to thank Ed Zajac and two anonymous reviewers for their insightful comments on earlier drafts of this manuscript. We are very grateful to the engineers and managers whose cooperation made this study possible. We alone are responsible for errors and omissions. The research was generously funded by the CNR (National Research Council).

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