
Outsourcing and Information Management. A Comparative Analysis of France, Italy and Japan in both Small and Large firms

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Abstract

This paper compares outsourcing processes in France, Italy and Japan in two types of firms, large firms and also small firms. It is shown that outsourcing has increased over the last two decades in both small and large firms in all three countries and that mainly in the last decade the tendency has been to increasingly involve some of the suppliers in product development. We interpret this evidence by means of a cognitive framework related to the activity of information management. Specifically, we show that the more the relationships among suppliers and users are characterised by two-way communication, decentralised information processing, and accordingly balanced contractual power, the more the incentives to create knowledge and to innovate autonomously are guaranteed.

JEL Classification: D23, L11, L22

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1. Introduction

Subcontracting and, more generally, productive outsourcing have diffused in all industrialised countries in the last thirty years. Attention to this phenomenon arose in the field of organised vertical markets in which vertical co-ordination by large firms has been progressively substituted by decentralised network of suppliers, governed by principles of lean production and just-in-time. Outsourcing has also been the more significant source of downsizing in local systems of small firms, implying that small firms remain small.¹ The result has been the growth in the informative and strategic interdependency among firms with numerous implications, ranging from the fragmentation of labour markets to the intensified use of information technology.

Industrial economics has proposed various explanations for the diffusion of outsourcing. The bureaucratic costs of the large, integrated company have been outlined (Chandler 1962), as well as the incentive and the information processing costs (especially Aoki 1988). When products become increasingly differentiated and renewed, the best strategy appears to focus on core competencies and let other firms deal with the production of other parts, maintenance of machines or distribution (Clark and Fujimoto 1991, Cusumano and Takeishi 1991). Thus, disintegrated firms have been shown to be more efficient in terms of lower costs or higher productivity by Aoki (1988) and Asanuma (1989) for the Japanese case, Coriat (1995), de Banville and Chanaron (1999) for the French case, Arrighetti (1999) and Conti and Menghinello (1998) for the Italian case. However, outsourcing yields other advantages, in particular in terms of product

¹ See Acs and Audretsch (1990), (1993), Baldwin (1998) Carree and Thurik (1998), Doi and Cowling (1998), Henley (1994), Loweman and Sengenberger (1991), Traù (1997).

and process innovation. For instance, Clark and Fujimoto (1991) or Michie and Sheehan (1999) show that R&D and product innovation are higher in disintegrated firms.²

Concerning the organisation of production and market structure, such changes mean that the relevant unit of analysis becomes the relationships among firms rather than the single firm. In this paper we focus on the processes of outsourcing among firms that usually assume the form of subcontracting relationships. Specifically, outsourcing involves turning over the functions that fall outside firm's core competencies to another firm whose core competencies are the functions being outsourced. In this way a specific governance form is created, which typically includes the exchange of proprietary information between the user and the supplier.

This paper derives theoretical insights on such information exchanges by comparing some country cases. The aim is to show that the more a supplier is given autonomy of decision and, for this purpose, access to proprietary information, the higher the performance of the network (constituted by the user and the supplier(s)) in terms of innovation. The literature has amply shown the static efficiency advantages of outsourcing; in this paper, our aim therefore is to outline dynamic efficiency, more precisely learning leading to innovation.

We focus on Japan, France and Italy. Japan has been chosen because it is a paradigm of an industrial system based on vertical networks, Italy for the historical predominance of small firms' localised systems, and France for being the European country that experiences the largest decrease in vertical integration in the 1990s.³ We review some empirical evidence related to two different types of supplier networks, namely networks characterised by the presence of large firms and more or less dependent suppliers (Section 2) and localised networks of small firms (Section 3). Sections 4 and 5 provide a theoretical framework for interpreting the empirical evidence. In particular, we outline the dynamic efficiency advantages (innovation) of supply relationships where the supplier is involved in decision-making and product development. Section 4 outlines some definitions, while section 5 examines the activity of information management involved in the production process in order to show these dynamic efficiency advantages. Specifically, the more the relationships among suppliers and users are characterised by two way communication, decentralised information processing, and accordingly balanced contractual power, the more the incentives to innovate autonomously and to improve firms' efficiency are guaranteed. Finally, Section 6 sets out some concluding remarks.

2. Outsourcing processes of large firms

Following the diffusion of the flexible production system, which combines economies of scale and scope by pushing product differentiation to the last stages of the

² Heshmati (2003) offers an updated survey of the literature on the relation between productivity growth and outsourcing.

³ According to Arrighetti (1999), who considers the UK, Germany, France and Italy, the largest decrease in vertical integration has occurred in France (-6,2%), more than the Italian case (-5,6%). Generally the degree of disintegration in France ends up quite similar to the Italian one, but very different from the other two countries. The rate of growth of outsourcing in France is also similar to the Italian rate and different from the English and German rates.

production process, unlike the Fordist system which exploited economies of scale only,⁴ large firms have progressively disintegrated vertically and established particular relationships with suppliers. Such relationships vary across countries and industries, but some regularity can be identified, into different models of subcontracting by large firms.

The Japanese model of subcontracting has traditionally been seen as based on an asymmetry of bargaining power between a large downstream firm and small upstream firms.⁵ The aims of subcontracting for large firms were primarily to reduce investment in fixed capital by shifting it to subcontractors, to exploit differences in wages between large and small firms (higher in the large firms), to reduce procurement costs, and often to try and shift the effects of temporary recessions to suppliers. Such imbalance of power was interpreted as a competitive pressure on suppliers: they have to reduce cost and provide the required quality otherwise they lose customers. Hence the incentive for performance was much higher than in the case where the supplier was part of a vertically integrated firm, whatever the degree of centralisation of the firm and the autonomy of the division producing the parts.

Such relationships between large firms and their suppliers have progressively become more complex and involve more than pressure for performance. Aoki (1988) and Asanuma (1989) were the first to support this argument. In particular, Asanuma claimed that the Japanese subcontracting relationships have four main characteristics. First, relationships are long-term and duration is determined by the product life cycles. Each time a new product is launched, the large firm makes a sort of call for the best offer from suppliers. At that stage, suppliers compete. Firms however tend to keep the same suppliers; product change is therefore an occasion to renegotiate the contract. Second, the Japanese subcontracting relationship is institutionalised and hierarchically organised. Subcontractors are differentiated according to the type of product bought by the large firm. The first type consists in traded products, which are bought on the market without any intervention in design by the large firm. In this case, the subcontractors are chosen on the basis of quality, and constitute the most autonomous subcontractors. They are “general suppliers” and “ordinary subcontractors” according to Asanuma’s definition. The second type is made of ordered products, which can be designed either by the supplier or the large firm itself (or jointly). In the latter case, the supplier only executes orders from the large firms according to its indications, and is very dependent on the large firm. Suppliers designing or co-designing the product enjoy more bargaining power. Both cases however constitute the first layer of the hierarchy of subcontractors: first-tier suppliers and associated companies. Third, the Japanese subcontracting relationship is contractual and characterised by specific procedures. According to Asanuma, such procedures unfold as follows. After a supplier is chosen, when the new product is still in the development phase, a basic contract is made, with broad specification (no specification of quantities to be delivered, neither of prices, etc.). The contract is made more precise as decisions on the manufacturing process are made, using complementary contracts.⁶ Last, suppliers are contractually encouraged to innovate since they can enjoy the payoffs of their innovation for a certain time period (e.g. one year at Toyota).

⁴ See Labory (1997), for a discussion of the flexible production system and associated strategies on product markets.

⁵ See Miwa (1995), (1996), for an account of this view.

⁶ Quantities and prices start to be fixed in a very precise way especially in case of just-in-time production (see Coriat 1991).

Therefore, in Japan, the relationship between the large firm and its suppliers is characterised by the coexistence of co-operation and competition. Competition prevails in the suppliers' selection phase, but also after the contract has been signed. The performance of suppliers in terms of quality and costs are indeed constantly assessed and compared with other suppliers. If the supplier does not perform well, orders are reduced and, in the last resort, the supplier is changed. However, the large firm has also interest in co-operating with the supplier to avoid switching and associated costs (time to learn the specification of the product, the technology of production, time required to set up trust, etc.). Consequently, the large firm also seeks stable relationships with its suppliers, helping to resolve problems and continuously exchanging information in order to improve the system. The know-how generated by such a relationship is twofold. On the one hand, it is technical, regarding the product and production system. On the other hand, it is "relational", due to the incentives and knowledge creation generated by the coexistence of co-operation and competition.

Aoki (1995) gives other insights into this issue by conceptualising the notion of relational rents. According to Aoki, "group-specific returns" are created by the co-operative relationships between the user and the supplier. Such benefits constitute a relational rent in the sense that they are generated by the high informational efficiency of the contractual relationship developed within the network. Such efficiency allows enjoying the benefits of vertical integration in terms of co-ordination while also enjoying the advantages of markets, in that incentives to innovate are provided.

Hence information flows in the Japanese supply network are intense and complex. Technological and market information are shared so that the co-ordination of the production process and a common language are established. However, the supplier specialises in an autonomous way and therefore has scope to develop ideas and innovate. One could characterise the advantage of such network as the result of specialisation (dealing with a particular subset of the overall information set related to the development of the product) and sharing of generic knowledge (exchange of information and collective creation of knowledge) that imply both co-ordination and innovation. A source of recent evidence on this point is given by the Reports of the Japanese SMEA (Small and Medium Enterprises Agency). According to them, in the 90s the structure of subcontracting has definitively changed in the direction of greater partnership between the various participants. Thus, Japanese subcontractors have raised their profiles by enhancing product quality and by diversifying away from one main contractor. This evolution is clearly linked to a technological up scaling of smaller firms. The criteria for the selection of subcontractors by large firms have accordingly changed. The demand for "thorough cost reduction", "greater quality and precision", or "quality assurance" double their importance when compared with the early 1980s and now rank first. Conversely, the more traditional demands for "stable quantities of products", "fixing delivery time" drop sharply in significance. This changing nature of outsourcing has led to a more horizontal network of inter-firm relationships that goes beyond the vertical *keiretsu* structure.

In Italy, most large firms have outsourced by adjusting to subcontractors' characteristics and radically changing their internal organization. For instance, Camuffo and Volpato (2001) describe the case of the car industry, while Crestanello (1999) discusses the textile and clothing industry case. First-tier subcontractors have tended to become less numerous and to take responsibility not only for the production of specific parts but for technological innovation and components design as well. In addition,

outsourcing increasingly concerns production services, be they low added value and more labour-intensive services (security, cleaning and catering) or more complex services such as logistics, computer maintenance, or transportation.

In the case of the textile industry, Crestanello (1999) distinguishes two main types of suppliers according to their degree of autonomy. The first type is the dependent supplier, which just executes orders from the client firm. This kind of relationship is hierarchical, and information flows are typically one-way, from the user to the supplier. The second type is more autonomous and is involved in co-design of products. The subcontractor in this case faces more competitive pressure, from other potential suppliers, but has more bargaining power on the price of the product.

Insights into the characteristics of these relationships in the car industry are given by the example of the carmaker Fiat. Recent works (Volpato and Stocchetti 2000, Bianchi, Enrietti and Lanzetta 2001, Camuffo and Volpato 2001) show that outsourcing is relatively common at Fiat, in both production and services. While in the 1970s and 1980s, outsourcing concerned mainly low value added production phases, since the late 1980s it involved important production phases such as the assembly of suspension units and crucial services like plant maintenance and logistics. The most evident measure of the extent of this process is given by the reduction in employment level by 38 per cent from 133,431 units in 1990 to 82,450 units in 1999 despite the maintenance of the same production level.

The downsizing of Fiat has been accompanied by the restructuring of the suppliers' relationships. Subcontractors are divided into three groups. The first-level subcontractors are those producing more complex components that are designed in close collaboration with Fiat and that are usually modules to be assembled internally by Fiat. The other two groups produce more standardised components and their activity is relatively more independent from Fiat.

The rationale for outsourcing appears to be the increase in the specialisation of activities. Subcontractors are chosen on the basis of their specific technical knowledge and not of lower labour costs.⁷ First-tier suppliers carry out specific tasks that correspond to a module. In order to make the different parts complementary, Fiat has organised the production of cars by arranging the different phases in such a way that the information necessary to produce each of them can be processed autonomously. While in the past car components were designed and engineered by the car manufacturer who led the whole project and suppliers simply manufactured them, the supply chain is now decentralised according the pattern described in Volpato and Stocchetti (2000, p. 9): First, the fundamental aspect of coordination based upon *ex ante* planning is that any individual operator does not need information on the whole chain of operations. Any chain operator must know only start and end date for a given activity, and must be concerned about precisely meeting its specific deadline. This implies a hierarchical management of information. But forms of simultaneous coordination on the whole of operations, aimed at compressing chain slacks require on line access to the whole sequence of operations, in order to carry out adaptations any time in which downwards demand triggers a wave of change which involves the whole upward operation chain. In

⁷ This change of perspective has important consequences for collective bargaining. Trade unions are indeed successful in extending their bargaining power to the subcontractors. For example, an agreement signed in 1998, which externalises logistics from Fiat Mirafiori's establishment to a Dutch multinational, keeps all the rights provided by the old agreement (the kind of employment contract, the benefits available in Fiat, the guarantee of job security and insurance for accident) to the new relationship.

other words, this implies forms of network connections among operators. The decision making processes related to product development involve both the car manufacturer and first tier suppliers. According to the continuous improvement both in product and process technology, nowadays the competencies that are necessary in order to manufacture a competitive car encompass a wide range of fields of expertise. As a result, critical decisions might often take place in an inter-firm process and thus an agreement among peers could be required.

The involvement of first-tier suppliers in the product development process implies their access to some strategic information of the large firm. The main consequence is that the supplier gains bargaining power and the relationships between the large firm and the suppliers become contractually more balanced. Given the possibility of opportunism and resulting hold-up problem, duration is substantial, related in practice to the product life cycle. Even in this case, the long duration of relationships allows enjoying some of the benefits of vertical integration, while simultaneously avoiding its drawbacks, such as the lack of incentive for performance for the component maker. It is noteworthy that Fiat incurred the problem of excessive outsourcing: some R&D functions have also been delegated to outside suppliers and it seems that this lead the large firm to lose too much control over the strategic phases of the production process; after the bad performance of the firm, Fiat has tended to re-internalise some of these functions.

In France, the relationships with suppliers have increasingly been defined as “partnership” relationships, characterised by a system of reciprocal commitments, whereby the supplier commits to delivery time, quality and price, while the contractor commits to order time, participation in investment and transfer of techniques and know-how. The transfer of techniques and know-how can take the form of the provision by the large firm of some of its machinery, or the maintenance and switching of tools, and technical co-operation (on manufacturing methods, product specifications and so on).

Until the 1970s, the dominance of the large firm over its suppliers was total: technical, industrial and commercial, and the relationships with suppliers were based on the criterion of minimum price for the specific volume. Delivery time was secondary and solved by stocks. Such Fordist inter-industrial practices (with the division of tasks, specialisation, the separation of conception and manufacturing and one-way – top to bottom – information flows) was characterised by:

- open booking: no contract was signed and the supplier had to face fluctuations in demand with strict price controls;
- high competition: the large firm kept several potential suppliers for each part, so that only the least cost supplier was chosen;
- no autonomy on product development, only execution of orders from the large firm.

Hence the suppliers’ scope and incentives to innovate were limited.

After the 1970s, new relationships have progressively been set up, following both the vertical disintegration of large firms and the imitation of the Japanese model. Besides JIT, French firms imitated some aspects of the particular contractor-supplier relationships, such as the already-mentioned pyramidal structure and both the financial participation in some subcontractors and the establishment of suppliers’ clubs, with the first-tier suppliers only. In Japan, such clubs are *kyoryokukai*. Partnership relationships have several characteristics, close to the Japanese model: trust, based in mutual

commitment; technological expertise of the supplier on its product (not just execution of orders); short delivery times (JIT); and duration: procurement contracts are signed.

In terms of information flows and knowledge exchange, two phases have to be distinguished. In a first phase, broadly in the 1980s, French producers outsource to reduce costs. Hence relationships remain authoritative, the buyer making precise requirements to the supplier and the supplier having mainly execution tasks. More recently, in what can be called a second phase, broadly in the 1990s, co-operative relationships have been developed with *some* suppliers, involving them earlier in the component design process (Dyer 1996, de Banville and Chanaron 1999). Important changes occur: the supplier has progressively been involved in product development and innovation; profit gains and technological and economic information have been shared. Hence information flows in the partnership relationships have become two-way and differentiated, as in the Japanese model (Leclerc, Perrin and Villeval 1999). While generic information is shared and constitutes the common denominator of the network, each actor specialises in a certain part of the overall information set related to the final product. Such features regard the first tier of suppliers because it is the only tier to be involved in co-design. Information advantages are similar to those of the Japanese case.

These three national cases points to a number of hypotheses that can be theoretically checked:

1. Large firms tend to develop horizontal networks with their first tier suppliers who are involved not only in cost reduction and time saving in production but co-design and innovation as well.
2. Moving from lower tiers to the first tier of the supplier network, information flows between the buyer and the suppliers shift from one-way information flows.
3. These processes, which lower firms' average size, seem to improve the suppliers' autonomous capacity of innovation.

The next section examines the case of outsourcing among small firms.

3. Outsourcing processes of small firms

Although large firm disintegration has been a major factor to the growth of the occupational share of small firms, the process of outsourcing among small firms has also been significant in France, Italy and Japan, where vertical disintegration has concerned an increasing number of firms since the 1970s.

Regarding Japan, the "White Paper on Small and Medium Enterprises in Japan" (SMEA 2001) offers interesting evidence. Like in the large firm case, supplier relationships among small firms have also moved from pure cost reduction orientation to more flexible interactions and more product development initiative.

Although there is historical evidence that the probability of working as subcontractor is negatively related to firm size in many Japanese industries in the 1970s and 1980s (Kimura 2002), the data collected for the *Survey of the structure of subcontract work in Japan*, published by SMEA since 1996, shows that in the 1990s a radical restructuring of the subcontracting relationships occurred. The percentage of small firms engaged in exclusive subcontracting contracts halved during the period 1987-1995, while dispersed and semi-dispersed contracts increased by more than twenty per cent (SMEA 2001). Such a partial opening of supply chains and the consequent development of productive

structures with many apexes have lead small firms to higher specialisation. In particular, the requirements of buyers to their suppliers have significantly changed even for lower tiers. The changing nature of subcontracting relationships naturally led to network structures with more intense communication among small firms, flexibly extending beyond *keiretsu* and rearranging more horizontally the whole Japanese supply chain (Lakshmanan and Okumura, 1995).

This change of attitude takes us far from the more diffuse patterns of subcontracting relationships of the 1960s and the 1970s, when small firms mainly played the role of suppliers of low cost labour. This population of small firms, mainly composed of capacity subcontractors,⁸ had a comparative advantage for the "dualistic" Japanese manufacturing industry (Koshiro, 1990) where "the abuse by large firms of their subcontractors was one of the most significant political issues" (Friedman, 1988, p. 166). The turning point can be dated from the early 1990s, when the high yen crisis, following the 1985 appreciation of the yen, (Glasmeier and Sugiura, 1991) represented an external shock causing a process of selection above all among the capacity subcontractors whose productive activity was reduced in favour of outward direct investment. At the same time, a gradual increase of specialised subcontracting was necessary to cope with the shift of the Japanese system toward production at a higher technological level. Even if this process had the net effect of reducing the employment of small Japanese firms as a whole, because the shrinking of the large population of capacity subcontractors was only partially compensated by the growth of specialised subcontractors, it contributed to improve domestic efficiency by reflecting the growing importance of technical change in relation to simple cheap-labour advantages of capacity subcontractors (Carnazza et al., 2001). Market characteristics and technological change can explain why outsourcing has become the main pattern of relationships even among small firms: specialisation has allowed them to improve their capacity to process information and build contractually more balanced, specialised and innovative partnerships with other small firms.

Finally, this process has increased the importance of industrial clusters of small firm in the Japanese industrial organisation. According to the 1996 SMEA survey, there are 537 clusters widely dispersed across Japan. Most of them are characterised by the presence of hierarchically structured relationships between manufacturers, first-tier suppliers, and second-tier suppliers. At the same time a detailed analysis by Yamawaki (2002) of a sample of 14 major cases of Japanese manufacturing clusters concludes that: "Among the advantages identified in the paper, that created by the existence of specialised suppliers in a localised industry is considered the most important element in creating agglomeration economies. A supplier's skills and capabilities complement other suppliers' skills and capabilities, which in turn complement manufacturers' skills and capabilities. Through such a network, firms develop the skills specific to a cluster." (Yamawaki 2002, p. 139).

For the Italian case, a recent study promoted by the Bank of Italy (Signorini, 2000) analyzes the processes of outsourcing among small firms in the Italian industrial districts. The main finding – confirmed by Conti and Menghinello, 1998, Corò and

⁸ Carnazza, Innocenti and Vercelli (2001), distinguish between capacity and specialised subcontracting. Specialised subcontracting means a relationship between a contractor and a subcontractor where the former continuously relies on the latter for the supply of an input for which there is no in-house supply. Capacity-based subcontracting indicates a relationship where the contractor hands over supply to the subcontractor only in the case of temporarily high levels of demand (Carnazza et al., 2001).

Grandinetti, 1999, and Innocenti, 2003) – is that the processes of outsourcing characterised by high levels of knowledge specificity and product quality only involve firms belonging to the same local system, among which vertical cooperation is arranged on the basis of long term duration, explicit ex-ante agreements and implicit renewal over time. Production characterised by low knowledge specificity and intensive use of labour is shifted to low labour costs countries. The latter type of subcontracting is however considered valuable only if close co-operation between the contractor and the subcontractor is not crucial.

The difference between these two types of subcontracting can be better pointed out by describing what changes have concerned subcontracting relationships in industrial districts since 1970. These patterns of evolution are very similar to those sketched above for the case of the outsourcing of large vs. small firms. A significant part of these relationships among small firms turned from one-way to two-way information flows. Two major factors explain this change. First, the increased technological level of production induces small firms to increase their specialisation. This implies the creation of more stable agreements, the multiplication of the tiers of subcontractors and more balanced contractual powers between suppliers and buyers. At the same time, capacity-based subcontracting, which was largely used in the past as excess capacity to be exploited during temporary phases of demand expansion, becomes less attractive. Second, the final markets in which Italian industrial districts are specialised have become increasingly fragmented. The production of these local systems is largely concentrated on the high quality segments of three macro-sectors: the so-called "fashion system" (textiles, leather, clothes, shoes, glasses); the goods for the house (wood, furniture, ceramics, accessories); the machinery produced for the previous two macro-sectors. These production systems have acquired the characteristics of niche markets, where customer needs are deeply diversified and the product life cycle has shortened. Rather than price, firms' market strategies are increasingly dependent on design innovation, product differentiation, customisation, after-sales services and brand loyalty. These requirements appear to be only satisfied by intensifying the process of outsourcing and asking suppliers to co-develop products or parts.

Concerning French small firms, a number of empirical studies surveyed in Aniello and Le Galés (2001) interpret the recent restructuring process of French manufacturing as a transformation of the industrial organisation towards clusters similar to the Italian industrial districts. This process is in fact a local rooting of production by the setting up of supplier networks between small firms, whose origin can be traced back to the evolution of the relationships between large and small firms described in the previous section: the shift towards more involvement of suppliers in co-design and productive innovation has been also followed by small firms and their suppliers (Courlet and Pecqueur 1991, Ganne 1992).

A specific case is the region of Mediterranean France, where a virtuous process of development has been triggered by a network of small and medium enterprises, which were historically prevalent in this region (Hansen 1990). The processes of vertical disintegration have caused the emergence of specialised areas where inter small firms' linkages allow to exploit external economies through the expansion of the regional network as a whole.

In general there is a growing strand of literature on the French industry in which the development of trust between large and small firms and the creation of partnerships between contractors and subcontractors are assessed as the main factor enhancing

productivity (Linhart 1991, Lorenz 1992, Lorenz 1993, Gorgeu and Mathieu 1993). These contributions support the view that small firms increase generally their autonomous capacity of innovation and consequently of making profits by specializing in narrower production phases and by outsourcing the pruned processes to other small firms. According to these authors this evolution has improved the French industry's international competitiveness.

Overall, this outline of the outsourcing process of small firms supports similar hypotheses to those outlined in the previous section:

1. The advantages of being small mainly result from the opportunity to specialise in narrower phases of the productive chain.
2. In the 1990s, small firms prefer to outsource any activity other than their *core* activity because externalization increases the probability of innovation.
3. Although communication costs may be higher in local systems of small firms than in hierarchically dominated organisations, horizontal competition permits to maintain efficiency. Independent small firms tend to base their competitiveness on the dominance of a niche market, where it is essential to maintain a monopolistic position. Therefore, small firms are particularly keen on keeping their strategic information and not leaking it to potential competitors. They actively cooperate vertically with other small suppliers and users but they also compete horizontally by protecting their own specificity.

Hence during the 1990s the trend in outsourcing has been to increasingly involve suppliers in decision-making, suppliers not being merely executors of orders but having a say in both the production organisation of their product and product development. Such rising involvement only concerns however a limited number of suppliers, those of the first tiers. Hence between the firm and its first tier of supplier a more balanced network is established, in that the relationship is less hierarchical and authoritative. This generates not only static efficiency effects (cost reduction) but also dynamic efficiency effects (innovation) that have not been extensively discussed and demonstrated in both the empirical and theoretical literature. Therefore, we provide in the next sections a theoretical framework for understanding these latter effects.

4. The network as an information conveyer

The first step in defining the theoretical framework is to provide some definitions. In the first place, we assume that knowledge is, to some degree, always tacit, while information is the only part of knowledge that can be transferred. Knowledge can be considered as an infinite set – mainly because it is the outcome of a mental process – that includes information as a closed set (Fransman 1994). While information can be communicated, knowledge cannot ever be communicated perfectly. In other words, information is knowledge made explicit that can be communicated to others. The process of knowledge creation can be described as a sequence where the subject collects information, that is explicit knowledge communicated by others, and combines it with the previously possessed knowledge, which is both explicit and tacit. The outcome is new knowledge that is only partially communicated to others.

We also assume a specific meaning of hierarchy. Hierarchy has been defined as a system where "only a few individuals (or only one individual) can undertake projects,

while others provide support in decision making", as opposed to a polyarchy, i.e. a system in which "there are several decision makers who can undertake projects (or ideas) independently of one another" (Sah and Stiglitz 1986, p. 716). This definition helps to compare the integrated firm, i.e. a self-contained hierarchical system, with the decentralised network, which is a polyarchy where several independent decision makers autonomously undertake productive projects. By the same token, if the integrated firm is the place where all residual rights of control accrue to the owner, then the decentralised network can be seen as a system in which multiple owners possess rights of control on separate competencies.

The choice of an organisational pattern can thus be represented as the selection of a point on the line joining the extreme cases of the fully hierarchical firm, which can be defined as an ideal organization collecting all the productive units under only one hierarchy, and the "monadic" network, which is a network in which each producer is an autonomous decision-maker. Outsourcing, which corresponds to the decentralization of competencies, represents a movement along the direction going from the fully hierarchical firm to the totally decentralised network. In this setting all the intermediate types of organizations have to deal with the same problem that is to co-ordinate in the presence of specialisation. Taking the above definition of information and knowledge, this activity amounts to internally diffuse the information necessary to make complementary the specialist knowledge possessed by the various decision-makers. Co-ordination has to be obtained while minimising knowledge transfers because "Communication, like decision making, is always imperfect. No individual ever fully communicates perfectly what he knows to another" (Sah and Stiglitz 1986, p. 717). In this way the process of information management becomes a key variable to explain performance differentials across different organizational structures.

According to this interpretation, the network would assume the role of information conveyor, which diffuses information among firms possessing separate pieces of knowledge. The choice of the most efficient organisation and the boundary of the firm would depend on the degree of decentralisation that is optimal when it makes each firm able to collect and process all the information pertinent to the specialist knowledge it owns. Specifically, separate firms could efficiently conduct two adjacent production phases if a single firm can process all the information concerning each phase without the knowledge employed in the other production phase. By specialising in the processing of a narrower set of information, each firm can establish a full correspondence between the information it processes and the information that is pertinent to the knowledge they utilise.

5. A phase model of outsourcing

The empirical literature summarised in sections 2 and 3 shows that small and large firms share similar patterns in the diffusion of the processes of outsourcing in France, Italy and Japan. In both cases outsourcing is associated with the intensification of competition mainly based on non-price factors. Regardless of their size, firms have developed horizontal networks with their main suppliers, first tier suppliers being involved not only in cost reduction and time saving in production but also in information processing and knowledge creation. They have implemented a two-phase outsourcing strategy. First, outsourcing aimed at cost reduction was limited to second

tier suppliers involved in structured tasks such as scheduling and logistics or in activities characterised by low knowledge specificity. Second, first tier suppliers have been involved in product development, and thus have started to create their own strategic knowledge. As a result information flows that were one-way flows, whereby the buyer gives orders to the supplier and the latter executes, have transformed into two-way communication. This has occurred since design and specifically innovation is a complex task, which requires a high level of specialisation (accumulation of specific knowledge) together with intense communication (between modules specialising in specific kinds of knowledge).

This evolution can be interpreted on the basis of the definitions given in Section 4 and hinges on two issues. The first concerns information management, that is, the process through which productive units collect, process and transmit information with the purpose of creating knowledge. The second issue is that of making the different pieces of knowledge created through the managing of information complementary.

The management of information can be viewed as comprising three phases, each defined by problems, decisions to be taken and sources of costs (see table 1).

Table 1 The management of information

Phases	Main problems	Decisions	Costs
1. Collection of information	Inability to absorb information	Choice of senders	Selection costs
	Information overload	Criteria for information collection	Collection costs
2. Processing of information	Partition of decision-making and implementation	Matching decision with implementation	Matching costs
	Delay between decision and implementation	Timing of implementation	Communication costs
3. Transmission of information	Tacit knowledge	Modalities of transmission	Transmission costs
	Information appropriability	Choice of receivers	Appropriability costs

The first phase is information collection. The subject who collects information has to choose the senders from whom he receives information and the criteria for collecting information. Both decisions imply costs – respectively selection and collection costs – that can be lowered by specialisation: a subject specialising in this phase progressively invests to build a receiving channel (Demsetz, 1991) that is used again for new information collection. Narrowing the scope of information collection reduces the cost of information collection but also reduces the variety of information collected. This weakens the absorptive capacity of the firm (Cohen and Levinthal, 1990), resulting in a narrowing of its knowledge base.

The second phase is information processing. The information collected in the first phase is complemented by the knowledge previously possessed by the decision maker. Costs are given by matching the decision with the subjects who implement it (matching costs) and by the time elapsing between the information processing and the implementation of the decision (communication costs). Both costs are influenced by

specialisation. In particular, the efficiency of this phase depends on the net effect of the reduction of matching costs due to the decrease in the number of decisions implemented by the processing subject and of the increase in communication costs necessary for connecting the act of decision-making and of implementation (Bolton and Dewatripont, 1994). De Canio and Watkins (1998) show that an increase in the capabilities of processing allows a flattening of the organisations mainly by decreasing matching costs.

The third phase is information transmission in which modalities of transmission are chosen and receivers are selected. The sources of costs are both transmission costs, which depend on the sender's skill of conveying tacit knowledge through information, and appropriability costs, which are determined by the capacity of the receiver to exploit information to create knowledge.

By applying this classification, we define the decentralisation of information as the increase in the share of information processed by the same subject who collects it. In the firm, the decentralisation of information increases when the task of coping with emergent events of a specified activity is transferred hierarchically downwards (Aoki 1986). This implies that the upper layers don't need to process information related to that specific activity and that all the information collected by the lower layer is processed directly by the collector. Similarly, the decentralisation of information in the network is given by the increase of the share of information processed by the same firm, which collects it. We can define a network as fully hierarchical if it includes a single firm processing all the information, including that collected by the other members of the network. In contrast, the same firm that collects it in a fully decentralised network processes each piece of information. In the intermediate cases, information will be partially transmitted by the collecting firm to another firm for processing it. In as far as independent decision-making is the outcome of decentralised information processing, the difference to be emphasised is not that between the firm and the network but that between a decentralised organisation – that is, a polyarchy where autonomous decision makers undertake projects independently – and a hierarchical organisation, where decisions are taken by the centre “overseeing” the whole production process.

In the case of a network, the effects of the degree of information decentralisation can be examined by means of the classification given in Table 1.

Phase 1 Collection of information.

The receiver chooses the senders and the criteria for collecting information. In the fully hierarchical network, where only one firm processes information, these choices are made by the firms which collect information and not by the firm which processes it. This splitting between collecting and processing causes an increase in costs. The decentralisation of information reduces these costs by increasing the quantity of information processed by the same firm that collects it. The ability of collecting information is consequently improved and the risks of information overload falls. Both selection and collection costs decrease. If the relationship between supplier and user becomes long term the efficiency of this phase is further improved. As senders are the same and the same criteria are used and improved over time, scale economies in the collection of information can be fully exploited.

Phase 2 Processing of information.

The processing of information makes collected information complementary to previously possessed knowledge. In the case of fully hierarchical networks, exclusively the firm which takes decisions processes information. The decision maker must give orders instead of information to the lower layers of the hierarchy because tacit knowledge must be excluded from the content of the orders. Otherwise the decision maker would lose the control of production. This centralised mode of functioning is the source of matching costs, namely to match the orders with the executing firm, and of communication costs, to diffuse orders among the firms of the network. In the decentralised network, reducing the number of firms that execute orders decreases matching and communication costs and increasing those who process the information they collect.

Phase 3. Transmission of information.

In the fully hierarchical network transmission costs increase in relation to the number of layers composing the hierarchy. The difficulties of conveying tacit knowledge by means of information increase with the distance between layers. The other source of cost, information appropriability, depends on the specificity of information. The more generic is the information transmitted by firms, the higher is the risk of being imitated. The decentralisation of information replaces the transmission of orders with the exchange of inputs between supplier and user. Tacit knowledge is incorporated into the inputs. Real communication is limited to the vertical communication between supplier and user. The proximity of their productive phases enhances their ability to communicate and lowers transmission costs. Appropriability costs are also reduced because information becomes more specific. Being production modularised, each module relies on its own exclusive knowledge and this prevents other productive units from appropriating the specific knowledge of the specialised unit.

This representation of information management can also give insights into how decentralised information is made complementary across the network by improving the communication of tacit knowledge. If collaboration is limited to adjacent productive phases linked by long-term relationships and a continuous and frequent exchange of information, not only information but also tacit knowledge is progressively shared, allowing efficient complementarities between the two productive phases. Specifically, we can describe the establishment of relationships between suppliers and users as a sequence of three phases, which differ according to the state of the prominent information:

a) The information is disseminated. The user decides to outsource the production of a new input and addresses a request to a population of potential suppliers. Some suppliers study the feasibility of the product specifying the range of possible investments.

b) The information is shared. The user accepts one (or more) proposal on the basis of the outline of the product characteristics. The user and the supplier co-project the prototype of the input and make the investments.

c) The information is modularised. The supplier produces the input and autonomously decides any change to the process that can derive from local shocks and unforeseen contingencies (errors, imperfections, adaptations to its own productive process). The user inserts the input in its product, autonomously introducing the adaptations that come from unforeseen contingencies relative to its production process.

Signals of problems can be derived from the market are solved in the decentralised mode by means of the information relevant to each specific module.

This sequence creates and makes common to the user and the supplier a shared body of knowledge in the information sharing phase, in which the problem of complementarities between the adjacent stages are solved. After that, the process of information modularisation allows the firms' contractual power to be balanced since it prevents weakening the incentives for introducing innovations. If the firm collects, processes and transmits information and is also the residual claimant to the rents from innovation because it is protected from being expropriated of its specific knowledge, it will have strong incentives for improving its performance by creating new knowledge and consequently by innovating. It is specifically the increase in the amount of information processed by the collecting firm – that we have defined as the decentralisation of information – which creates better incentives for knowledge creation.

6. Concluding remarks

The decentralisation of information, by delegating the processing of information to autonomous suppliers rather than keeping propriety or maintaining control over the whole productive chain of the network, make the production process complementary not through hierarchical arrangements but through a shared body of knowledge created in the phase of information sharing. Information decentralisation provides the suppliers with higher incentives to develop specialised knowledge related to the particular stage of the production process they are dealing with because their contractual power is protected and enhanced by the modularisation of information.

Our phase model emphasises how the governance form of the production network is a key variable to create efficient suppliers' networks. In particular, the balanced distribution of contractual power along the productive chain is a signal of the high degree of information decentralisation.

This theoretical interpretation can also explain why large and small firms share similar patterns of relationships in the processes of outsourcing. For both types of firms information decentralisation leads to an increase in knowledge creation by the subcontractors. Information decentralisation also implies that incentives are enforced because users cannot easily replace suppliers and the contractual power is more equally distributed. In this way the pattern of governance traditionally characterizing relationships in local systems of small firms, especially in most Italian industrial districts, has been progressively extended to networks previously led by a large firm. This convergence has a number of implications for industrial policies. In particular, the financial support to the creation of medium and large firms in local systems of small firms, or the establishment of large plants in industrially underdeveloped regions may not be that advantageous in as far as they establish or maintain control over the present or the future network and take measures to monitor and to direct the activities of the suppliers, thereby reducing their innovative potential. Likewise the provision of business services or public support to consortiums and associations of firms are bound to fail if they are harmful to the contractual equilibrium. Policies aimed at establishing new local systems of production should take this point into consideration. For example, financial support to a large firm to enter into clusters of small firms is often seen positively

because small firms gain access to wider markets and to financial resources. Our analysis points to the risk that the difference in bargaining powers of the different actors may result in a distortion in information management, and a loss of capacity to create knowledge. The capacity of the whole network to create knowledge and develop innovation may therefore be weakened.

In addition, the issue of what happens to the second and lower tier suppliers should also be addressed. We have shown that first tier suppliers can be involved in knowledge creation with the user and this increases the innovation performance of the network. However, we have not discussed what happens to lower tier suppliers: being excluded from this knowledge creation process, are they worse off? Are there possibilities of moving to first tiers lowered? Such questions are left for future research.

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