



Supply Networks: Genesis, Stability and Logistics Implications. A Comparative Analysis of Two Districts

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This study concerns networks whose elements are made up of manufacturing units linked by supply relationships. The authors, comparing the evolution of two industrial districts, analyse the variables that determine or impede the formation of strong linked buyer-suppliers systems, influence the network stability and fashion the logistic pipeline mapping and management. Three central propositions are discussed: (a) the setting up of a supply network process is connected to the presence of operational interdependencies between the units of the supply chain; (b) the stability and effectiveness of a supply network is closely bound to the ability, on the part of the core-firm, to plan the governance structure of the supply relationship; and (c) the product structure and the nature of the process influence the networking process.

Key words—case study, operations management, purchasing, supplier relationship

1. INTRODUCTION

THE TERM system or network of companies generally refers to a vast range of inter-organizational relations. This study focuses on a particular type of network: companies that, by supply relationships, belong to a common production chain. The principle vehicle of interaction/integration is thus the material flow which passes through the units of the chain. The barycenter of the system is, in this case, a 'core-firm' which contracts external units to produce parts of the finished product and manages the outward flow.

Numerous theories deal with inter-organizational relations and the boundary lines between them are not always clearly defined (e.g. the Agency Theory [21], the Resource Dependence Theory [29–31], the Population

Ecology of Organizations [3, 16, 17]). According to the Transaction Cost Theory [39, 41], which is probably the most widespread theoretical approach (and the preferred one also in this study), networks of companies represent an intermediary solution between the integrated manufacturer and the 'market', i.e. the complex of independent manufacturers with whom exclusively short term ('spot') transactions are established.

In the middle range situations, suppliers and buyer agree to co-operate with one another to form a long-term, co-operative relationship guided by expectations of repeated transactions. This type of relationship is characterized by 'neo-classical contracting' [41, 42].

According to a large number of contributions, competitive challenge has brought, especially during the 1980s, success to the systemic

structures, whose dynamic efficiency was shown to be a winning feature during the turbulence and instability that characterized that period.

In fact, the operative independence of the nodes, if properly managed, allows the systemic structure to obtain some of the advantages both of the integrated companies (i.e. product flexibility) and of those completely market oriented for the acquisition of the goods and services which it needs (i.e. volume flexibility, access to new technology or to complementary skills) [26, 32].

The evolution towards systemic structures seems to be, to some extent, industry specific. In some industries, the need for informative and logistic integration between activities at the upper and lower ends of the production chain, mutual involvement in product development, coherence between the respective operation systems, co-operation in the creation of value and the reduction in overall costs of the transaction, promotes the formation of 'strong linked' buyer/supplier systems [22, 27]. In other industries, the process and the product interdependencies and the need for operative and logistic congruency are not such as to justify a strong and exclusive interaction between buyer and supplier [11]. In still other cases, the formation of strong linked systems could be encouraged by competitive dynamics but hindered by the difficulty of developing and managing a manufacturing system segmented into units which, though interacting, still retain their individual competitiveness. Competing at the level of networks is structurally more complex: the units must adapt their behaviour to a joint regime, which requires a transformation of the culture, mode of organisation, work and management of the parts involved.

Though often topics of scientific discussion two aspects, in our opinion, are not sufficiently explained especially at an empirical level:

- (1) the influence of the buyer-supplier operative interdependence on the networking process, or the conditions that favour the formation of strong linked buyer-supplier relationships. Studies on vertical inter-organizational relations in fact have a prevalently economic matrix: the role of such interdependence seems to be often neglected;

- (2) the elements of structural stability in networks.

By means of an empirical investigation carried out in two industrial districts¹ situated in north-east Italy, in which supply networks have been developed, the factors which triggered the networking process and determine its stability are analysed. In addition, the impact of the networking process on the logistic pipeline mapping and management in the two districts is investigated.

The particular interest of the considered districts lies in the fact that the networking process started out under similar conditions and gave rise to network structures that are in some ways significantly different. In particular the nature of the operative interdependencies between the units (in one case they concern mainly the design and production aspects, in the other the logistics aspects²) has affected the configuration of the supply chain and its constituent ties in distinct ways.

A case study research was carried out by means of structured interviews with managers and entrepreneurs of buyer and supplier firms in the two districts. On the bases of the empirical evidence, some central propositions are discussed:

- (a) the setting up process of a supply network appears to be connected to the presence of operational interdependencies between the units of the supply chain. These interdependencies render the supply transaction inoperable under traditional 'market' mechanisms;
- (b) the stability and effectiveness of a supply network is closely bound to the ability of the core-firm to plan the governance structure of the supply relationship. Such structures are in fact intrinsically unstable: the combination

¹By 'district' here we mean an industrial settlement made up of numerous firms linked at a technical-productive level, characterized by a prevalent production typology and between which there are associative and consortial links.

²The word 'logistics', as is well known, has a broader meaning, including "the total flow materials, from the acquisition of the raw materials to delivery of finished products to the ultimate users" [24]. However, here the term 'logistics' mostly refers to the activities concerned with the management of the outward material and information flow from suppliers.

of non-re deployable specific investment and the reduction in the supplier base (typical of a network connection) delineate the conditions under which opportunistic tension would be felt by the parties involved. The effective governing of the network by the buyer is therefore closely linked to the use of suitable safeguards which affect the relative switching cost of the players, thereby creating unilateral dependence and mitigating opportunistic behaviour;

(c) the product structure and the nature of the process are variables which influence the networking process since:

- asset specificity (and thus specific investments) of different kinds are associated with them;
- supply becomes critical on the part of the product and the service;
- pipeline mapping and management (and in general the architecture of the network) are influenced.

After a brief description of the methodology used and the characteristics and evolution of the districts analysed, each of the three assumptions is discussed.

2. METHODOLOGY

A case-study research was carried out in the districts considered. The investigation involved both buying and supplying firms. The sample surveyed included 4 buyer, two per district, and 10 supplier firms comprising 4 from the glasses and 6 from the textile-clothing districts (see below). The survey was carried out by means of semi-structured interviews with the production and purchasing managers of the buying firms. These interviews allowed us to outline (a) the main structural characteristics of the firm and in particular those of its production system, (b) draw up a profile of the supply relationships, in particular those areas where the interaction with the suppliers is greatest (product development, production planning, quality, logistics), and (c) to analyse the supply policies and the reasons which determined the evolution. Together with the purchasing managers of the buying firms, we have selected 10 supplier firms. The firms chosen were ones with which the

client had established a medium to long term relationship. The interviews with the entrepreneurs or production managers of these supply firms enabled us to compare the information gathered on the contractors side and analyse, from the supplier's point of view, the evolution of the supply relationship with the buyer.

3. DESCRIPTION OF THE DISTRICTS

3.1. *The glasses district*

Figure 1(a) summarizes the pathway leading to the manufacture of a pair of glasses. Sides-pieces, lenses, nose-bridge, circles and fittings (case, chain, etc.) are generally produced by firms specialized in the production of each component and located in the district. Italy as well as France, Germany, Japan (and in more recent times Korea, Hong Kong and Taiwan) is one of the main manufacturers of glasses in the world. The national production of glasses-frames (for defective vision glasses, sunglasses, sport and protection goggles) has exceeded 46 million pieces. About 85% of this manufacturing activity is in the district analysed. Nowadays 413 production units operate there [1, 20]. They are mostly small in size and generally originated through a process of filiation from one of the mother firms. Table 1 shows the structure of the district articulated according to size.

As one can deduce from Table 1, the district mainly consists of a myriad of small productive units specialized in the manufacture of single components, plus a few medium to large sized assemblers/distributors. The latter externalize a great part of the production for two reasons: (a) some of the production stages are highly specialized and require economies of scale; and (b) smaller firms are cost-advantaged and permit the buyer to have a greater mix and volume flexibility. Furthermore, a decentralized production structure allows the buyer to channel more resources and energies towards other activities, such as research and development, engineering, final assembly, distribution.

In the past, between buyers and subcontractors there were prevalently market-based transactions, frequently repeated, but substantially governed by price mechanisms. In later times the competitive dynamics of the glasses sector became modified. The competitive role played by quality, product (above all on the material

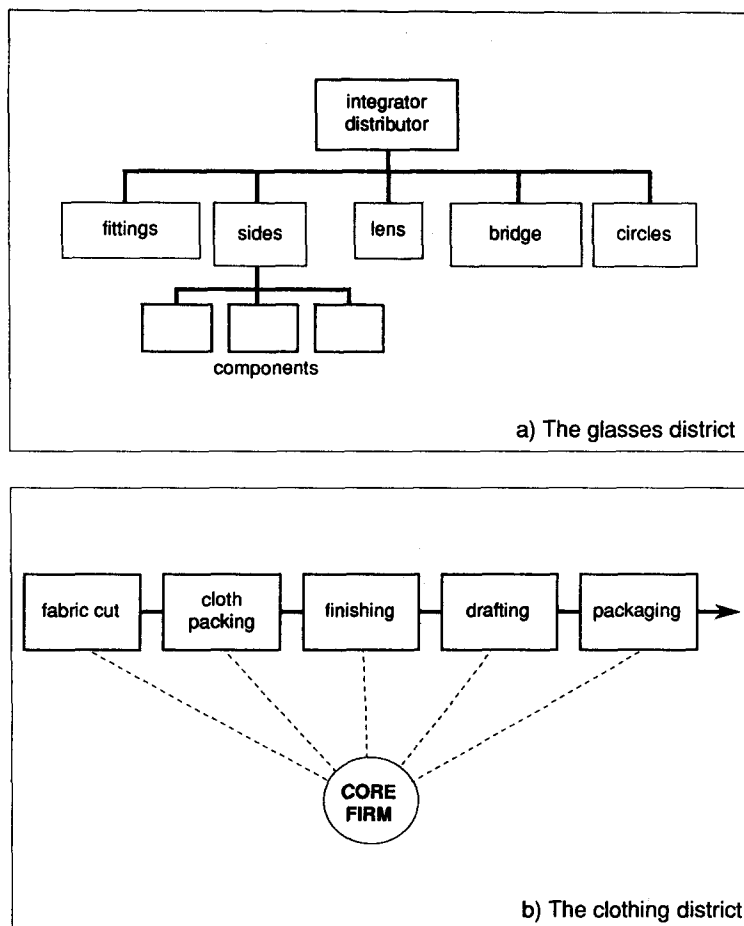


Fig. 1. The districts.

side) and process innovation (to reduce costs) forced the assemblers into a more extended interaction with the suppliers. Today suppliers are frequently part of the design team of the final assembler and have interacting CAD-CAM tools compatible with those of the buyer. To promote greater overlapping of activities as well as speed and efficacy in product development, the assembler tries to encourage horizontal interaction between the supplying units. In addition JIT-TQM methodologies are being established in the productive sphere: an increasingly important element in the selection of

suppliers is the ability to implement management procedures congruent with those of the buyer (i.e. SPC methodologies). Thus the suppliers that are able to co-operate and interact extensively with the buyers in design and production are preferred. The number of supply units in the district, initially in the hundreds, is at present decreasing. At the same time some assembler leaders are becoming more clearly delineated.

3.2. The clothing district

The steps followed during the manufacture of a generic article of clothing are summarized in Fig. 1(b). The textile-clothing industry is one of the most important sectors of the Italian economy. In 1993 the turn-over in this sector (among firms with at least 20 employees) reached 19,815 billion lire, employing about 130,000 persons [5, 8]. Examining the geographical location of the textile industry in Italy

Table 1. The structure of the district articulated according to size [1, 20]

	Sizes (No. of employees)				TOT
	< 10	10-49	50-99	> 100	
No. of firms	283	111	11	8	413
% of firms	68.5%	26.9%	2.7%	1.9%	100%
% of total employees	13.3%	30.3%	9.3%	47.1%	100%

it is possible to identify certain areas of high concentration, with widespread technological skills, co-operative assistance and training centres, in which the production units present complementary qualifications. In other words, it is possible to identify certain areas which show the typical characteristics of the industrial districts.

The area surveyed is made up of hundreds of firms, mostly small in size and specialized in carrying out a single manufacturing step (the level of technical decomposability of the productive cycle is high). They supply a small number of large contractors, which have their own distribution network and thus act as an interface with the end market. It is difficult to quantify the number of these firms as it is impossible to precisely define the borders of the district. The evolutionary process of the area analysed is ambiguous and the directions of the developmental process are multiple. However, it is possible to state that a network-process has gradually established itself in the area: some leading companies have developed and interconnected a network of subcontractors with different specializations. The former act as coordinators, while at the same time maintaining their core of strategic skills [13].

The core-firms concentrate on preproduction (research and development) and postproduction (marketing, distribution and sales) activities and make use of the external units specialized in each step and strongly connected to its planning system. The majority of production takes place in the supply companies linked to the core firm by relationships strengthened over time. Although particular technological contents are not associated with each production step and the phases are easily internalizable by the buyer, the creation of an interconnected and autonomous productive structure permits the coordinating company to interface with the market with superior quality, quicker response and higher mix/volume flexibility, factors which are critical in a market subject to fluctuations in fashion. So the core-firm has selected and stabilised relations with the suppliers in order to obtain a first-rate service content from them. Thus, if in the past the relationship of supply was solely based on cost efficiency, nowadays the core firm gives greater importance to long term relationships with the suppliers as a guarantee of quality and flexibility.

In the cases analysed, the production activities of the suppliers are governed from the centre by a specific information system (for transmitting production and delivery plans, tracking the progress of orders and the materials movements, co-ordinating transportation activities).

Such a system has meant, for the core-firm and suppliers, a sizeable investment: it requires the diffusion and learning of methodologies, procedures and common languages, in addition to specific hardware. Similarly the supplier-buyer distributive system needs the implementation of specific hardware. Similarly the supplier-buyer distributive system needs the implementation of specific procedures for packaging and some modifications in the inbound and outbound logistic assets at the sources.

Although the core firms analysed have at their disposal a sophisticated EDI network directed towards their distribution channels (downstream), the use of the EDI network upstream (directed towards their suppliers) is still being studied. Its extension towards the suppliers is difficult as these units, generally small in size, do not have an adequate technical culture to be able to implement the new technology and carry out the organizational modifications necessary for the use of telematics. It can be presumed that the use of EDI will be gradually extended upstream, generating a more exclusive supply relationship.

Under the management of the core-firm, the typically linear production flow has assumed a dyadic configuration: the exit flow from each unit returns to the centre and is then sent to the unit involved in the successive step (Fig. 4—this aspect will be dealt with below). In this way the core-firm directly oversees each step and is able to plan the production of each single activity.

4. THE EVOLUTION OF THE DISTRICTS TOWARDS THE NETWORK STRUCTURE

The factors which determined the networking process in each district are discussed assuming the Transaction Cost Theory perspective. According to Williamson [41], each firm organizes its productive activity by choosing those solutions (within or outside its organizational boundaries) able to minimize the sum of production and transaction costs. In particular the

market solution is preferred when the costs of internal production exceed those of external sourcing.

In neither of the districts investigated has the hierarchy solution been considered practical or economically advantageous: so the buyer has resorted to external supplies.

Table 2 shows the principal cost differentials associated with each of the three options: hierarchy (internal production), market and systemic structures. The hierarchy solution was not put into practice in either district mainly because it worked out to be more expensive than the market solution. In fact it involves cost differentials (due, for example, to the absence of economies of scale and experience curve benefits) which made recourse to the market preferable, at least in the initial phase. This is particularly evident in the clothing district, where the process technology involved in the productive phases is easily accessible, but the core-firm prefers to externalise the greater part of production since the small and middle size firms bring cost advantages.

Also the market solution was found to be disadvantageous for the buyer. In fact, market-based mechanisms face difficulties in the efficient organisation of transactions when:

- the transactions are frequent and characterized by a greater amount of behavioural uncertainty. The uncertainty raises the costs associated with the *ex-ante* definition of the transaction (e.g. the definition of the purchasing clauses) and those associated with its *ex-post* control (e.g. enforcement costs). Starting from the hypothesis of bounded rationality and the opportunism of the participants it is impossible to stipulate under these conditions a complete contractual agreement that can solve *ex-ante* all possible contingencies [36].
- In the eye-glasses district, it has become necessary for the buyer and the supplier to co-operate in the design and production phase: quality and innovation have made the supply component critical. From product design through process design, initial production and full production, the concern for quality and effective product development requires the buyer to

work closely with the supplier. Thus the supplier does not exchange only a component with the buyer but also specific skills in the design and productive phases which make his contribution more difficult to define *ex-ante*.

- Similarly, in the clothing industry, the relationship of supply can no longer be entirely governed and controlled by the price mechanism: the supplier offers the buyer a level of quality and service which has gradually matured over time thanks to a continuous relationship. It is in fact the efficient buyer-supplier co-operation which enables the buyer to offer a product of greater quality and to reduce the time to market while maintaining the advantages of mix and volume flexibility associated with the non-integrated solution. In this case too the buyer-supplier exchange does not only involve manufacturing but also other specific capacities. In both districts the supplier transaction has become more complex (because it involves design/productive or logistic interactions), more difficult to pre-define in a contract and more binding for both parties.

- the investments in transaction specific assets cannot be entirely recovered in the case of switching. If the parties are opportunistic, they aim to snatch all possible advantages from the specific investments.

- In the glasses district the suppliers have invested in specific design and production assets (i.e. CAD-CAM compatible equipments) so as to be able to interact adequately with the buyer. In this area the suppliers have developed specific skills that do not only concern the plant, but also intangible expertise (e.g. the ability to plan a component or a productive process that answers a specific qualitative or technological requirement, the ability to carry out value analyses and value engineering together with the buyer).
- In the clothing district, the core-firm and its suppliers have made specific

Table 2. Hierarchy-systemic structures-market: examples of cost differentials (adapted from [10])

HIERARCHY		SYSTEMIC STRUCTURES		MARKET
PROCUREMENT ACTIVITIES	<ul style="list-style-type: none"> Dis-economies of scale in the manufacturing of components and in purchasing of parts/raw materials Δ costs due to the absence of experience curve benefits Δ invested capital and fixed costs, thereby enhancement of risk of capacity under - utilisation (especially in cases of uncertain and irregular demand) Δ competitive costs connected to the absence of concentration on core competences 	<ul style="list-style-type: none"> Δ costs of more advanced vendor rating/ranking procedures Δ costs connected with a more intensive buyer-supplier information exchange Δ costs of organizational restructuring (set up of organizational roles and procedures to support the buyer-supplier interaction), reconfiguration of the purchasing function Costs connected with the diffusion of compatible languages and procedures Setting up and management costs of inter-organizational codesign groups 	<ul style="list-style-type: none"> Δ transaction costs of information gathering and analysis, negotiation, contracting and monitoring, enforcement Δ Administrative cost of purchasing (higher order processing costs [i.e.: scheduling]) 	
DESIGN			<ul style="list-style-type: none"> Δ costs arising from the supplier's misinterpretation of the design because of insufficient specifications Δ costs connected with the need to communicate design changes and delays Δ costs of non-reliable prototyping Δ costs due to minor experimentation on prototypes 	
PRODUCTION		<ul style="list-style-type: none"> Δ Co-ordination costs connected with the interaction between buyer's and supplier's technicians and process engineers Δ costs of suppliers training and technical assistance aimed at the adoption of advanced production and management methodologies (SPC, JIT, TQM) along the supply chain 	<ul style="list-style-type: none"> Δ costs of quality control and tracking along the production line Higher inventory levels and turnover connected with the reduction in the supplier's quality and delivery reliability, higher vendor's supply lead time, greater size of shipments, Δ costs of inventories obsolescence Higher demand for storage place - higher storage and holding costs Δ costs linked to a greater planning time horizon Δ costs of lower quality materials (scrap, reworks, ...) 	
LOGISTICS		<ul style="list-style-type: none"> Set up and maintenance cost of the EDI network used to tracking and control of the material flow progress Set up cost for compatible packaging procedures and assets and for customised containers Δ costs of transport and inbound logistics due to increased delivery frequency 	<ul style="list-style-type: none"> Δ costs due to increased receiving inspections and controls along the supply chain Δ costs arising from any possible duplications in controls along the supply chain Δ costs of loading/unloading, storage and in-bound transport connected with unconformity in packaging and shipment size Δ costs of delays in material delivery 	

investments (i.e. in specific packaging and inbound/outbound logistic assets) to make the logistic activities more effective. Furthermore, if the implementation of EDI is carried out, it will involve further specific investments. In relation to the Dyer and Ouchi [12] classification, the suppliers and the buyers have carried out customized investments in both districts: physical (design, manufacturing and logistics equipment) and human (development of partner-specific knowledge). Such a choice was encouraged by the long term relationship perspective offered by the buyer: ongoing relationships create incentives for specific investments and co-operative behaviour since they lessen the danger of opportunistic actions (which increases together with the specific skills of the players).

In the districts investigated even the 'market' solution has proved to be impracticable since competition (and the choice of partners) has made the supply transaction progressively more uncertain and in addition specific investments on both parts are required.³

So there has been no noticeable return to hierarchy but a strengthening of intermediate 'systemic' relationships where the buyer-supplier link is sustained by the prospect of frequent, repeated and more exclusive transactions. The network solution has in fact been shown to be:

- more effective.
- In the glasses district the collaboration between buyer and supplier enables the know-how of both parties to be sinergically exploited, that is the system-integration capability of the buyer and the specialized competence of the supplier can be integrated. As a result: the time to develop a new product is reduced and more ways to innovate

products and processes are identified.

- In the clothing district the network of tightly linked external manufacturing units, directly managed by the central production planning system, allows the core-firm to reduce the time to market, but at the same time retain the advantages of mix and volume flexibility associated with the non-integrated solution. In both districts, the core-firm can concentrate resources on the development of core competencies, while benefiting from the external supplier's innovation and specialised professional capabilities and spreading the company's risk for component and technology development among a number of suppliers.

- more efficient. The overall costs associated with this solution appear to be lower than those of the other two.

Table 2 shows some cost differentials associated with the systemic solution and referring to design-production (glasses district) and logistic (clothing district) phase.

- In the glasses district such a solution means significant higher costs for the co-ordination and management of the suppliers (i.e. the cost of creating and managing the inter-organizational codesign groups), but the costs associated with non-quality, poor delivery reliability, etc., are reduced.
- In the clothing district the costs of the systemic solution are mainly due to the set up and maintenance of a customized logistic and information network, though the advantages in terms of time to market and mix and volume flexibility make it preferable to the recourse of spot suppliers.

5. FACTORS AFFECTING THE NETWORK'S STABILITY

The network solution developed in the districts investigated contains some potential elements of instability. Competition at a system level is, in fact, more complex: the need for co-operation is confronted by the individual competitiveness of each unit in the network.

³A third element, besides transaction uncertainty and specific investments, makes hierarchical management more advisable, i.e. the recurrence of the transaction. This aspect was not taken into account in the analysis: before carrying out the empirical survey those relationships that are so unlikely to be recurrent as to force the buyer to make the market choice were discarded.

Indeed, as Richardson [35] says, when the relationship with suppliers is long-term, close and above all exclusive, the efficiency of the system becomes a puzzle: the economist and manager theorist would predict, under such conditions, a worsening of the services on the part of the supplier and consequently of the system. In particular, the combination of specific investment and the reduction of the supplier base delineate the conditions within which, in theory, opportunistic tension should be felt by the parties involved and thus the stability of the network endangered.

In accordance with the transaction cost theory, the starting point for analysing such a structural instability is, in our opinion, the presence of transaction specific investments, to which correspond transaction specific skills and a condition of inter-firm dependence [6, 7]. By definition they are investments dedicated to a particular relationship and are not entirely recoverable in the event of termination of the relationship. The transaction specific investments are analogous to the set up cost of the network: the link with the network requires both sides to acquire assets that are compatible with those of the network, the development of a common language and new operational and decisional routine [14].

Figure 2 illustrates two situations:

- **unilateral dependence.** This occurs when the transaction specific investments are borne to a greater extent by one of the two players. It can be hypothesized that the dominant party bears in any case a certain level of specific investments: these determine exit costs which, as shown by Sriram and Mummalanemi [38], create the conditions for a systemic link between buyer and supplier, in other words a link not governed by simple market logic;
- **bilateral dependence,** when the transaction specific investments (and in a rough estimate even the exit costs) are comparable for both organizations.

According to the empirical evidence, the stability of a network depends on the presence of a dominant, barycentric player capable of developing and properly managing the complex of supply relationships of the system. This leadership role is played in the analysed districts by the core-firm, as usually happens in industrial districts. Situations of unilateral dependence does appear to be potentially more stable: transaction specific investments equally distributed

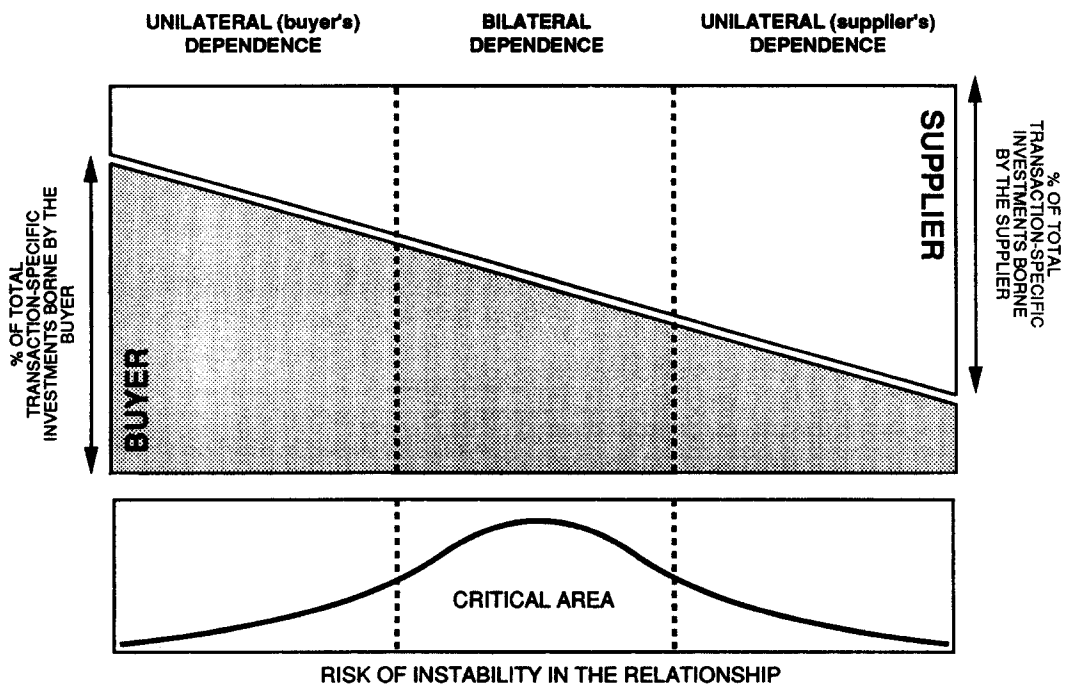


Fig. 2. Transaction-specific investments and risk of instability in the Supply relationship.

between both parties delineate a condition of bilateral monopolium which is evidently unstable. As shown in Fig. 2 the instability curve has a maximum corresponding to transaction specific investments shared equally between buyer and supplier. In addition the curve is symmetrical: in theory, the leadership role could be taken also by the suppliers.

In the districts analysed, the most recurring situation is that of unilateral (supplier's) dependence: the supply transaction demands greater specific investments from the supplier. Furthermore, the number of buyers is limited and it is difficult for the supplier to turn to markets outside his own districts where different associative and consortial links rule. Especially in the case of the clothing district, it is important to note that a buyer tends to privilege an exclusive relationship with a small number of subcontractors.

However, even in the cases where the size of specific investment (and the exit costs) was comparable for both players, the buyer transformed the bilateral into unilateral dependence, enhancing the stability of the network. According to Klein *et al.* [23] the buyer's actions, defined as 'safeguards' against potential 'hold-ups' due to specific transaction investments are:

- multiple sourcing policies, which allow the core-firm to compare the performances of the sources and have a bidding competition between them;
- keeping part of the product in house, which restores credibility to the possibility of completing backward integration on the part of the buyer. Having the option of in-house production strengthens the buyer's bargaining position.
- This is most evident in the clothing district where the core firms retain more than 20% of their production in-house. There are two main reasons for this choice:

- to facilitate the testing of new processes and materials;
- to have a greater control over the pool of suppliers. In fact, in-house production makes the buyer more aware of the supplier's cost-struc-

ture: incompleteness or informative asymmetries are therefore reduced.

As Williamson [41] says, these actions allow the buyer to mitigate the 'contractual hazard' linked to the specific investment, and extinguish possible opportunistic moves made by the suppliers.

To clarify this aspect, a generic supply relationship within each of the two districts analysed is considered. Let us assume that, before the implementation of the safeguards, the buyer's and the supplier's non-redeployable specific investments are roughly equally shared. The buyer's and the supplier's switching costs (SC) are therefore equal, i.e.

$$SC_{\text{buyer}_A} = SC_{\text{supplier}_A}$$

The resulting situation is shown by the letter 'A' (% of total SC borne by the buyer = % of total SC borne by the supplier = 50%) in Fig. 3 and would be highly unstable (point A' in the instability curve).

Following the implementation of the safeguards, the buyer's switching costs are lowered by a value of ΔSC , proportional to the intensity and effectiveness of the safeguards. A variation in ΔSC , will cause a variation in both the buyer's absolute switching costs and his relative switching costs defined as:

$$\%SC_{\text{buyer}} = \frac{SC_{\text{buyer}}}{SC_{\text{buyer}} + SC_{\text{supplier}}}$$

that is defined as the percentage of total switching costs (= SC buyer + SC supplier) borne by the buyer. The buyer's absolute SC are shown in Fig. 3 as shaded bars along the AH line, while the buyer's relative SC are represented by black rectangular symbols along the AK curve. Obviously the supplier's absolute SC (open bars) do not depend on ΔSC , while the supplier's relative SC (= 100—buyers relative SC) increase while ΔSC raises.

Let us suppose that, because of the safeguards, the buyer's absolute SC decrease by ΔSC_B , thus having the value:

$$SC_{\text{buyer}_A} - \Delta SC_B = QB$$

shown in Fig. 3 with a shaded bar. The relative buyer's SC assumes the value:

$$\frac{SC_{\text{buyer}_A} - \Delta SC_B}{SC_{\text{buyer}_A} - \Delta SC_B + SC_{\text{supplier}_A}} = QC$$

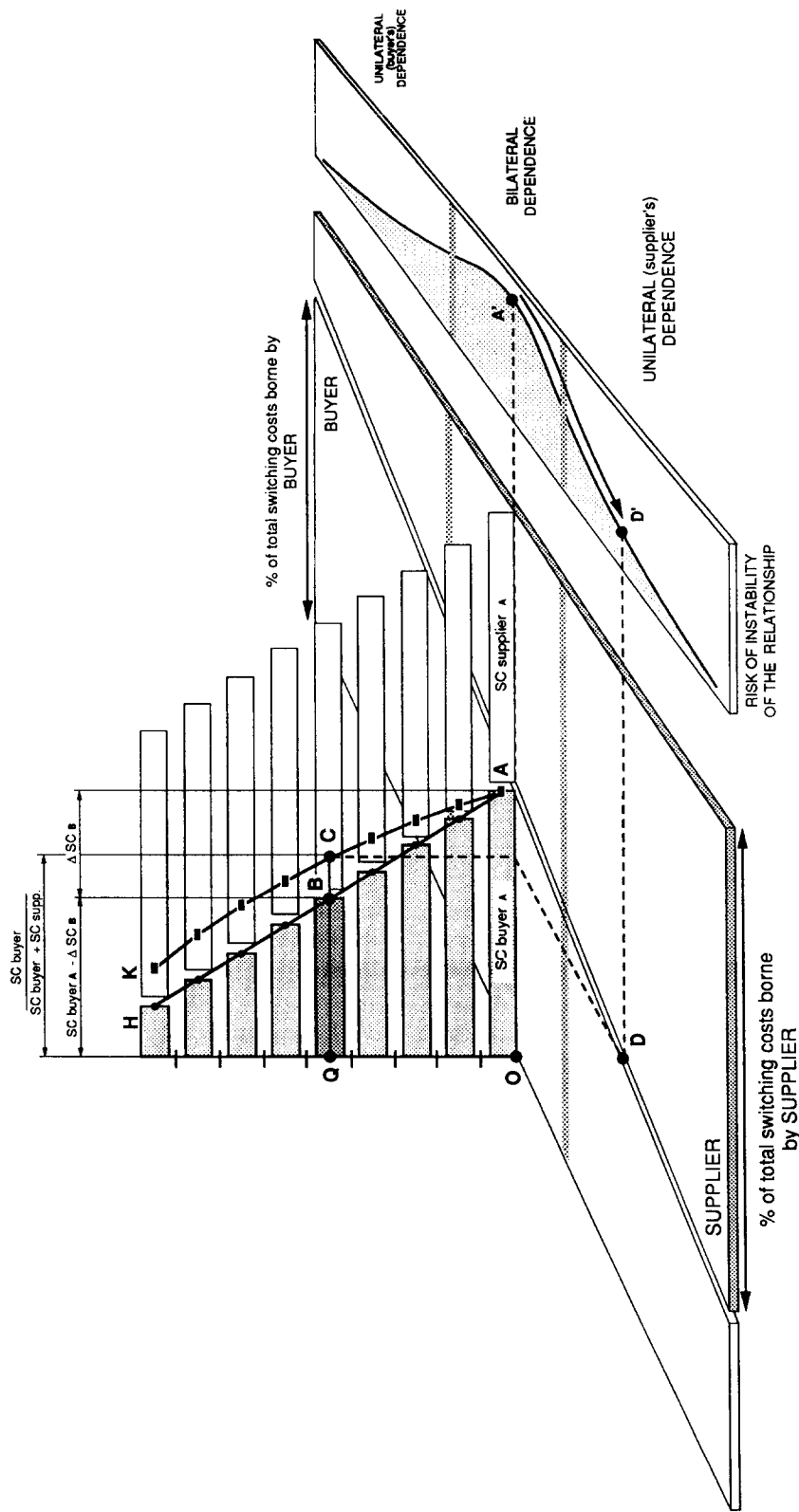


Fig. 3. The effects of buyer's safeguards on the Supplier's dependence.

identified in the figure by the segment QC. The latter projected on the plan of the buyer/supplier's relative switching costs (Fig. 3), identifies point D located in the area of unilateral (supplier's) dependence. It can be seen that the safeguard actions allow the buyer to affirm his dominance and to reach a more favourable position in the instability curve (from point A' to point D').

It should be noted that the safeguard actions raise the whole transaction cost borne by the buyer, who accepts a more expensive transaction in order to secure his own dominance. In general, the choice of the buyer, regarding the safeguards to activate, must take into account the consequent cost differentials, which are:

- positive, when they entail the duplication of resources and competence;
- negative, when they allow a saving of costs through a greater control and regulation of the supplier's conduct.

These considerations are of value only when assuming (this is central in the transaction cost theory) that the parties are opportunistically inclined. If this is not the case, then the above mentioned control measures are useless. Moreover, this assumption has been frequently discussed by the critics of the transaction cost theory. In particular the criticisms regard the fact that the buyer-supplier exchange is usually embedded in social structures in which behaviours (such as trust) different from opportunism may prevail [9, 15, 37]. Judging from the districts analysed, the importance of the social aspects for the stability and effectiveness of the supply relationship cannot be excluded. However we think that these aspects enhance the stability of the relationship only after correct means of regulation and control have been established. In other words, the trust and quality of the personal relationship between the organizations influence the stability of the supply relationship, but they do not determine it. Rather they become more effective the more solid and appropriate is the governance/exchange relationship structure. Only in this perspective, we believe, some 'trust building practices' [12] used by the procuring firms in the two districts may be justified, such as grants for assistance and services (technical and financial) to the suppliers. These practices, however, do not only increase the trust of the supplier in the

buyer but are a means by which both can share the relational-quasi rent [4] associated with the greater effectiveness and efficacy of the systemic solution. It is exactly this prospective which, as Heide and John [18, 19] observe, probably best cements the buyer-supplier relationship within the system.

As a final remark to this paragraph it seems opportune to point out a key element in the stability and effectiveness of the supply network: the ability to plan the governance structure of the supply relationship (=the institutional framework in which contracts are initiated, negotiated, monitored, adapted, enforced and terminated [2]) on the part of the core-firm. This ability is manifest:

- in the choice of the type of relation-cooperation with the suppliers. To return to the classic hierarchy-market distinction, the firm that wishes to create a stable supply relationship must define how far the outsourcing arrangements can be from the market. In other words, the firm must be able to specify (in function with the profile of the suppliers and the value of the object of supply) the length of contract, the intensity and nature of the information exchange, the amount of supplier operative involvement, the pricing and the (single-dual-multiple) sourcing policy. As Quinn and Hilmer [34] observe, in deciding on a sourcing strategy for a particular item (or for a particular segment of their business), managers can use a variety of outsourcing options: the degree of sourcing control is decided in function of the characteristics of the supply object (which can require greater or lesser joint involvement and commitment), of the marketplace (and the potential market failures) and the supplier profile;
- in the development and use of adequate procedures for the selection, evaluation and monitoring of the sources. Objective and sharply defined rules for the game make the supply relationship more stable and clear: the relationship is no longer governed (and consequently controlled) by pure market-based mechanisms;

■ in a good system of incentives, risk-sharing practices and rewards for the supplier firms, of tools to control any possible opportunistic tendencies, of means for confrontation and emulation (forced competition) between the suppliers aimed at their continuous improvement [25]. In other words this means setting up a control system to strengthen the intermediate forms already dealt with by Williamson [40].

6. NETWORKING PROCESS: IMPLICATION OF THE PIPELINE CONFIGURATION AND MANAGEMENT

In the districts analysed the origin of the networking process can thus be traced to a motivation held in common: the greater critical-

ness of suppliers, calling for controlled ('systemic') sourcing solutions rather than relying on the market.

Even if the motivation that has led to the networking process is similar, there exists a series of differences between the two districts as can be seen in Fig. 4 that have determined the different development in the aforesaid processes. The main ones are:

■ in the production structure. In the glasses district the end product is the result of the assembly of separately manufactured components (articulated product); in the clothing district the end product is the result of a series of phase transformations. The bill of materials in the former case has developed along two dimensions while in the latter, one;

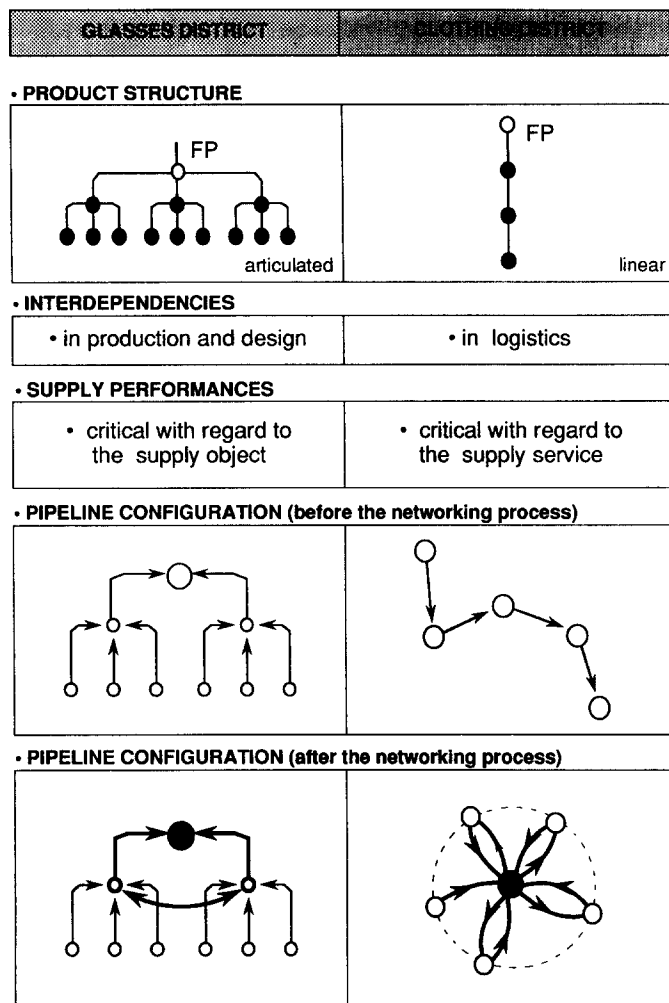


Fig. 4. Main characteristic's of the two districts.

■ in the nature of the operational interdependencies that have arisen between the buyer and supplier in the two networks. In the glasses district interdependence mainly regards the design and production process, in the clothing district the logistic-distribution process. The different nature of the operational interdependence leads to differences in:

- asset specificity;
- criticalness of supply. In the glasses district supply is critical in regard to the supply object (the component supplied determines the quality, cost and innovation incorporated into the end product), in the clothing district supply is critical in regard to the supply service (speed and reliability of delivery).

These differences have repercussions on the pipeline configuration. In particular:

■ in the clothing district the need to control and plan each phase has lead the core-firm to radically change the progress of the supply flow, which now is pushed and managed by the central planning system of the core-firm. As a result:

—there is a drastic reduction in the pipeline time. Before the networking process, the pipeline time (from raw materials to finished product) were decidedly longer: with equal process times there has been a clear reduction in the move and queue times (the times of movement and waiting in stock) in each unit along the manufacturing chain. The suppliers too, in addition to the core-firm, have benefited from this cut in the pipeline time. A more rapid flow means less work in progress along the whole pipeline (= all in all less volume in the channel) and so a reduction or elimination of the intermediate pipeline stocks (points where supplies are accumulated along the pipeline). So they can reduce the slack resources kept as a precaution against disruptions in the supply chain;

—there is centralized management of

forecasts. In the past suppliers produced mostly on forecast, whose errors were particularly high for the suppliers situated at the initial steps in the supply chain. Today the suppliers produce on order from the core-firm who then assumes all the risks connected with forecast. However, since each productive step has moved closer to the demand (thanks to the reduction in pipeline time) there is a reduction in the overall uncertainty associated with the forecast;

■ in the glasses district the supply chain has maintained the tree-net structure that characterised the product, even after the networking process had taken place. However the criticalness of supply has modified the intensity of the buyer-supplier link in the terminal channels as well as the entity and nature of the interaction between the units situated at intermediate levels of the supply chain (i.e. between the producers of components). The need for a solid agreement between buyer and supplier has transformed the final tie of the chain from a simple vehicle of transport of material into a vehicle for the transmission of information of a planning and productive nature. In addition, the procuring firm encourages the horizontal interaction between suppliers of complementary components, according to a systemic logic aimed at improving the quality of the final product and the effectiveness of the design activities. Within the districts analysed the network connection has thus generated new ties (multiplexity).

Finally, the product structure and the nature of the operational interdependence between buyer and supplier influence:

■ the pipeline mapping. In the clothing district the networking process has meant the elimination of some supply channels and has modelled the pipeline according to a dyadic architecture. In the eyeglasses district the networking process has not modified the pipeline mapping, however it has

led to structural changes in its constituent ties. The end tie must, in fact, not simply transport material but rather the interactions/collaborations between buyer and supplier associated with a more complex supply transaction. Horizontal links between the suppliers have also been established;

- pipeline management. In particular in the clothing district there is a centralized management of the logistic pipeline.

7. CONCLUDING REMARKS

The comparative analysis of the two districts lays emphasis on the following points.

- (1) The creation of networks, thus the affirmation of a co-operative approach in the buyer-supplier transaction, has been shown to be the result of the inadequacy of the traditional governance structures. In particular:

- the hierarchy solution was found to be inefficient, intrinsically rigid and inert, unable to respond quickly to the changes in the competitive environment;
- the market-based (arm's length) buyer-supplier relationship failed when confronted by the needs of transaction specific investment and the greater level of uncertainty associated with the content of the transaction.

As other empirical surveys have shown [28, 33], by co-operating and focusing on long range outcomes, both supplier and buyer may well be able to compete more successfully than in a traditional market-based exchange since transaction cost will be low and pressure for short-run results will diminish.

- (2) The hybrid structure developed in the two districts has some elements of potential fragility, due above all to the presence of specific investments in the design/productive and logistics areas. The stability and effectiveness of the networks considered appear to depend on the presence of a dominant barycentric player capable of

developing, controlling and managing (by means of appropriate safeguards and institutional devices) the supply relationships of the system.

- (3) The nature of the operational interdependencies between buyer and supplier influence the pipeline mapping and management. In the clothing district, the networking process has meant the elimination of some supply channels and has modelled the pipeline according to a dyadic architecture, centrally managed by the planning system of the core-firm. In the glasses district, the networking process did not modify the pipeline mapping, however it entailed structural changes in the basic ties.

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