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Supply Chain Management in Industrial Production. A Retrospective View

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1. Introduction

In the manufacturing industry the problem of setting up and managing supply chain relationships has recently become of an unprecedented complexity and importance. Today even the most common products are obtained through processes that are highly complex as regards the production technology, the required knowledge and the number of stages involved. The processes in the value chain are spread upon several different technological areas and they require the application of specialized and advanced knowledge in all phases. Consequently firms involved in the development of a new product must coordinate with the other actors in the chain from the earliest stages of design and engineering.

In this chapter we present a retrospective analysis of the evolution of managerial perspectives on supply-chain management (SCM) in industrial production. In our view the philosophy underlying the management of Purchasing and Supply (PS) in industrial firms has reflected, over time, the managerial paradigm at the basis of the strategic choice of the firm. Thus, as well as for all main firm's processes PS has evolved in order to provide an adequate response to changes in the competitive environment. From an early stage, mainly characterized by a major attention to costs and contract terms, supply policies have developed to become part of articulate relational strategies based on variables such as:

- the positioning of the firm along the production chain, hence the identification of core activities opposed to those that can be conveniently outsourced,
- the strategic assessment of the role and the relevance of the various suppliers,
- the suppliers' potential for technological and innovation development,
- the actual reversibility of investments on a specific relationship and/or on a specific technological trajectory,
- the risk associated with dependency on suppliers and the opportunities of multiple and/or parallel relationships, and so on.

Generally speaking, SCM activities are focused on creating value, either through innovation in processes and through the improvement of products and services to the end customer.

Our aim is to summarize the reasons that led to the transition from the traditional procurement policies to the SCM approach and the main variables involved in the process of defining SCM relations.

The birth of the concept of SCM lies in the growing importance assigned to procurement and logistics, such that they become strategic elements of operational management (Oliver & Webber, 1982; Kraljic, 1983). However, the logistical and operational aspects and the strategic ones have evolved and have been dealt with separately until the '90s (Tan, 2001). The concept of SCM has several definitions; Mentzer et al. (2001) identifies three main categories of SCM definitions in literature: a) a management philosophy, b) the implementation of a management philosophy and c) a set of management process. Cooper, Lambert and Pagh (1997) argue that the concept of SCM is, to an extreme, used as a synonym for logistics and, at the other end, as all-encompassing business integration. In fact some authors (e.g. Ellram & Cooper, 1993; Lummus & Vokurka, 1999; Lambert & Cooper, 2000) somehow equate SCM with the management of anything that stands between the raw materials and the product delivered to the final customers, including after sales service. In brief, since academic literature has probably identified for the SCM all the possible definitional combinations that are between the mere logistics and business operations as a whole, to list all the past and present definitions of the concept would not be too meaningful. Other contributors (e.g. Harland, 1996; Croom et al., 2000; Svensson, 2002; Chen & Paulray, 2004) has provided wide reviews of the literature in this field. Such a variety in the conception of SCM is aided by the fact that SCM involves many fields of analysis and by the fact that it can be approached from different perspectives. Moreover, in the everyday experience firms are far from having a unique and/or a uniform approach towards this matter (Frohlich & Westbrook, 2001), but often SCM activities are focused on a limited set of supply & production stages (Fawcett & Magnan, 2002).

In this chapter the conventional procurement is labeled as "traditional" or "Purchase & Supply" (PS) approach, while we call SCM an advanced managerial approach to the management of supply chain relationships which aims to make

supply activities coherent with the firm's strategic objective. Basically, we agree with Svensson (2002) who argues that SCM can be seen as a management philosophy; according to this author, the SCM approach is rooted in the functional dependency that ties firms as a result of their specialization and complementarities in production networks. Of course, SCM philosophy implies an effort that is justified, for instance, in the relationship between an assembler and its first-tier suppliers, or anyway in relationships that are more relevant than a mere purchase.

According to the various interpretations, SCM is of an intermediate complexity between PS and the organization of any activity connecting the raw materials and the product delivery, then it reasonably remains a process which requires a considerable degree of effort and involvement. Therefore, it is not convenient to adopt an advanced / complex SCM approach in all relationships with third parties (Tan, 2002). Better try to differentiate the approaches according to the characteristics of each relation, specifically according to their impact on competitiveness. Williamson (1981) suggests the choice between make or buy (in fact, the elementary level of choice as far as the PS policies are concerned) to be taken by evaluating the supply specificity and the frequency of transactions. Kraljic (1983) identifies different policies according to the strategic importance of supply and the complexity of supply market. Krapfel et al (1991) classify supply relationships on the basis of the commonality of interests and of the power position; then describe six different policies, from the simple bargaining to strategic agreement, to be implemented according to each specific type of relationship. Olsen and Ellram (1997), propose to manage the supply portfolio taking into account four main sets of factors: factors influencing the strategic importance of supply, factors describing the difficulties in managing the purchase relationship, factors influencing the relative supplier attractiveness and factors describing the strength of the relationship. Kaufman et al. (2000) underline the differences in possible collaboration policies arising from the technological linkages between supplier and customer.

Firms could probably obtain more advantages from an approach to supply relationships that distinguishes different policies for each relation rather than adopting a generic method. Therefore, some key points should be highlighted in order to better understand to what extent the SCM approach is actually coherent with, and/or necessary for, the fulfillment of the firm's strategic objective:

- SCM emerges as the systemic response of the firm to the increasing complexity and uncertainty of the environment; such complexity pushes towards the adoption of a holistic perspective about process management (Davis, 1993; Svensson, 2002).
- SCM is embodied in the integration of the supply process within the strategic analysis process. It involves/affects strategic decisions and it has (or can have) a specific relevance for the competitiveness of the firm (Waller, 1999).
- SCM is a process far more extensive and pervasive than the traditional purchase & logistics function. It assumes the possible role of third parties in supporting the competitiveness of the firm and implies cross-boundaries coordination processes, therefore it underlies concepts of network management (Chandrashekar and Scary, 1999; Tan, 2002).
- SCM tries to overcome the traditional duality between hierarchy and market. The first typically has a connotation of flexibility and reversibility, while the latter is generally put in relation with benefits of control and of stability (Thorelli, 1986).
- SCM approach, when actually applied, requires a strong commitment and a relevant effort by the firms involved, since once the SCM relationship is implemented the switching cost is relevant both for supplier and customer, while an eventual poor performance of one of the contractors will affect its partners (Tan et al., 2002).

2. From purchase & logistics to supply chain management

In the second half of the 20th century the evolution of the industrial competitive environment has deeply modified the reference framework of supply-chain relationships.

Until the early seventies the issue of supply relationships has received a limited attention. The dominant paradigm was focused on mass production and little room was left for strategic cooperation. The emphasis was rather on the advantages of vertical integration on the one hand and in the bargaining power on the other.

During the oil shock of the '70s the incidence of logistics and raw materials on costs breakdown increased dramatically, bringing attention to criticality in purchase & logistic activities and towards the development of tools aiming to improve the efficiency of operation management, like the earlier Material Requirement Planning systems (MRP).

Efficiency remained the buzzword until the early eighties, when it was sided by concepts oriented to innovation and to customer satisfaction: time-based competition, product life-cycle, value for customer, and so on. Effectiveness and quality (variously defined) started to pose the issue of an evaluation of supply relationships which goes beyond the mere costs analysis. Specifically, the evolution of production systems that started around the eighties, with the shift from the mass production paradigm to the "flexible" one, has increased dramatically the intricacy of product and process architecture. Throughout the nineties the spread of the lean philosophy, together with the globalization of markets, contribute to drive both theory and practice to a constant improvements and broadening of the SCM concept (Cooper 1993). In the common orientation towards the application of the lean philosophy within and between firms, SCM comes to fore as a natural evolution of processes towards a general integration. At the same time, the

opportunities brought by the technological hybridization of products (that is opportunities deriving from incorporating complementary technologies within products in order to enhance its features and performance) gained a critical role as a competitive advantage. In those industry whose products are complex and require the confluence of technological expertise and advanced knowledge in several technical and scientific areas, the policies of SCM are significant and pervasive enough to require a managerial coordination involving not only procurement and operations, but also functions such as marketing, R&D, and the financial area.

In a market avid of innovation, whose demand is highly fragmented and volatile, firms continuously have to update their knowledge on technologies and on the competitive environment. Decision-making processes involve a large number of variables and this increasing complexity is managed through a tendency towards specialization. In fact, faced with the difficulty of effectively supervising all the necessary expertise, the firm might benefit from partners who can contribute with their knowledge to its production processes (Handfield et al, 1999; Wagner & Hoegl, 2006). The technological complexity of processes and products makes it convenient to outsource to specialized providers the production of components and parts that need continuous innovation. Strategic suppliers are then invited to contribute with their own knowledge to the competitiveness of the final product and therefore they participate, more or less directly, to the formulation of operational and strategic plans of development of customer firm. The assessment of suppliers' capability to improve the competitive advantage of the network becomes a major parameter for the selection of providers.

Consequently, regarding the innovation processes the attention moves from the presidium of peculiar patents & technologies towards the capability of founding value network and of applying combinatorial knowledge.

More recently, the major attention paid by markets and stakeholder to the sustainability of products and processes has pushed leading firms to introduce further and even more selective criteria in the choice of suppliers' park. Nowadays leading companies are asking their suppliers to develop programs to reduce emissions and, in general, to certify their commitment to corporate social responsibility and environment (Sristava, 2007; Carter & Rogers, 2008; Sukla et al., 2010).

The list of tasks assigned to SCM includes all the traditional purchasing & logistics, plus:

- the definition of criteria for supplier selection and for the evaluation of their performance;
- the definition of different policy supply for different types of supply;
- negotiation and trading;
- the coordination of complex and diverse activities carried out by third parties, such as the co-design and co-engineering of specific components to be manufactured by the supplier;
- the convergence of supplier and customer on targets which might be partially or totally in contrast, such as the decision about the innovation trajectories to be implemented;
- the joint development & innovation of new products, processes and forms of distribution;
- the management of cross-boundaries investment,
- the development of programs and joint projects to improve the service to the end customer
- the strategic analysis of market and technological trajectories.

The traditional approach to purchase management is not abandoned; rather it is combined with a perspective of value creation. This perspective goes beyond the traditional PS criteria since it introduces: i) principles for the assessment of the strategic capability of the suppliers to create value for customer, rather than just being able to fulfill the assigned task; ii) a tendency towards a unified analysis and coordination of processes occurring outside the firm; iii) the spread of customer's satisfaction principles to all ring of the chain. The traditional supply approach, mainly cost-oriented, remains in use for simple, standardized, and low-value goods.

The peculiarities of both PS and SCM are the elements driving the most opportune policy to be adopted, depending on the type of procurement. At the same time, such peculiarities describe and explain the transition from one perspective to the other as a consequence of the increasing complexity presented over time by the competitive environment.

The two ideal-typical approaches to supply relationships here described certainly have common roots but in fact present significant differences (see table 1) as a result of the different set of problems and the different degree of complexity they have to solve.

Table 1: main differences between PS and SCM approaches

	Traditional PS approach	SCM approach
<i>Key-drivers of vertical integration policies</i>	Technological skills, relative efficiency of the involved processes	Technical skills, Know-how, coordination and relational capabilities (network management)
<i>Variables discriminating make-or-buy decisions</i>	Production costs compared to purchase & transaction costs	Present and future competitive capability

<i>Main make-or-buy decision criterion</i>	Breakeven analysis	Breakeven analysis, strategic constraints and opportunities
<i>Key-drivers in supply policies</i>	Cost of supply	Cost of supply, firm's strategic objective, long term competitiveness
<i>Supply policy approach</i>	Bargaining power, protection of firm's interests	Bargaining power, protection of firm's interests, product and process prerequisite, reciprocal benefits.
<i>Main objectives of the negotiation</i>	To maximize firm's share of value added (zero-sum game)	To maximize value for customer and for the supply chain (positive-sum game)
<i>Relationship regulation and coordination</i>	Contractual formalization of performance to fulfill	Contractual formalization and definition of common interests / objective
<i>Criteria for supplier selection</i>	Quality/cost ratio, negotiation power	Quality/cost ratio, negotiation power, innovation capabilities, technological and organizational knowledge

3. The supply relationship according to the traditional approach

Four key-aspects characterize the ideal-type of the PS perspective.

A. *Skills and efficiency are the main determinants of make-or-buy strategies.* Key-decision about the extension of vertical integration and about the positioning along the production chain are taken primarily according to technical knowledge and to the expected relative efficiency, the latter measured by the comparison between the sum of market costs and the costs of internal production. According to this criterion vertical integration is a feasible and effective solution if the firm has the technical capability to implement the upstream production stages with at least the same efficiency of the firms that already operate in those stages. On the contrary, if the company can find components, parts and pre-products on the market at a price that is lower than the cost of internal production, then the firm adopts a policy of outsourcing and focuses only on higher value-added stages of production. Once assured the availability of resources and know-how, the key information for this make-or-buy decision, comes from an analysis of breakeven. No evaluation about strategic opportunities or threats is taken into consideration in such perspective.

B. *Short term, cost-based perspective.* Decisions on the supply policies are taken mainly by evaluating the economic efficiency of each transaction. Each company formalizes its objectives, then directs the negotiation with the third parties assuming such objectives as a reference point, given the constraints imposed by the autonomous decisions of the counterparts. In other words, in this view each contractor evaluates its best strategy in advance, and then negotiates with its suppliers and customers by putting its own constraints and challenging the counterpart on the basis of negotiating power, each one of the parties aiming at bringing the agreement towards its own optimal situation. Other possible elements are relatively less important: the potential impact of the contract on future costs or on competitiveness, the idiosyncrasy of the relationship, the reversibility of the investments.

C. *Win-lose oriented relationship.* The negotiations are based on bargaining power and oriented towards the appropriation of the value added. The prevailing attitude in the negotiation is inspired by the rules of a zero-sum game in which the increase in the share of value added of one contractor is at the expense of the others. In such view neither strategic advantages nor synergies take place in supplier-customer relationships. The managerial perspective that is framed in this model tends to interpret the system as the mere sum of its parts. The coordination of the supply chain is the sum of bilateral decisions and negotiations among the only firms that are in direct contact with each other. The chain's activities are coordinated sequentially, usually through adaptive response to the requests of the final rings. There is no cross borders management activities and the main coordination levers are: i) vertical integration, ii) the production of supplies on the customer's specifications or, conversely, the make-to-stock production, iii) the application of bargaining power.

D. *Contract-oriented commitment.* Contracts, and consequent firms' behaviors, tend to pay more attention to the compliance with contract terms than to the improvement of performances. The supplier-customer relationship is almost entirely framed within contractual rules that are strongly committed on mutual protection from possible contingencies and opportunist behavior. The majority of clauses are focused on transaction conditions and on the solution of possible exceptions or unexpected events. Aiming at preventing the emergence of situations that could radically change the conditions of the exchange, contracts seek to formalize *ex ante* all possible contingencies relating to the specific relationship. This does not mean, however, that the relationship must necessarily be rigid, or prevaricating. The agreement can be declined in many ways, can be written in very simple forms up to an extremely complex structure, and may provide numerous exceptions aiming at renegotiating the terms of the deal to face situations of potential uncertainties. Contracts can also be determined according to a logic of collaborative and mutual concessions, as in the case of a partnership. Nevertheless, formalization and predictability are the central reference point for the terms of agreement, and uncertainty is managed through an attempt of predicting rather than leaving room for flexibility and re-negotiation.

The approach to supply relationships which emerges in this traditional view might be weak or effective depending on the specific context. In theory, if properly applied this approach allows the company to evaluate the different possible relationships of supply from a very self-centered perspective. It reduces the risks related to uncertainty and opportunism by establishing contractual links and activating instead adjustment mechanisms for those factors on which uncertainty weighs more.

It is an effective approach in a broad range of situations, since in many cases firms can not interact with the rest of the chain or have no interest to do otherwise, such as in cases of sporadic and minor purchases. For instance, non-specialized companies, small businesses, firms suffering from preponderant bargaining power, often work in contexts where the economic efficiency of the classical PS approach (with all its many improvements that have led to define a large number of type of arrangements, of brokerage, of facilitators, etc.), works very well since it keeps their supply chain relationships efficient and effective.

On the other hand, the ideal-typical PS approach shows limited or otherwise unsatisfactory effectiveness in those situations where more intense and pervasive relationships are requested to gain a competitive advantage, due to the dynamism and complexity of the market. Of course, in management we often hear “the increasing complexity of environment” or the “increasing competition” to be the mother of all changes and of any new trend. However, we think that the crucial role in settling the conditions for the shift towards SCM has been played by relatively few phenomena.

4. A different order of complexity

In a context of rapid and radical changes such as those that have invested the majority of the industries, the strategic intelligence is required to extend its range of analysis to the implications of different choices of supply-chain positioning. In our view the evolution of the philosophy underlying the SCM reflects, over time, the managerial paradigm at the basis of the strategic choice of the firm and some specific structural conditions of the market. Specifically, the main drivers of changes that led to the transition from the traditional PS towards the SCM approach can be traced in the increased uncertainty and criticality of the supply activities in general, even in cases that should instead be considered routine activities.

Due to the growing dynamism of markets and technology, and the consequent systemic instability of the competitive environment, three critical sources of complexity can be identified:

- The interdependence between various stages of the production chain increases as a result of firms' focus on core competencies and of the diffusion of the lean production principles.
- The coordination of upstream and downstream phases requires technical and organizational efforts that have the connotation of long-term investment rather than that of a purchase / sell contract.
- The control upon all stages of product development assumes a strategic importance but vertical integration strategies face new barriers; firms are therefore forced to look for different ways of quasi-integration.

The interdependence of the suppliers' and customers' production processes has increased significantly together with the diffusion of lean concepts in production. The interdependence increases the need for coordination and for a comprehensive view of the strategic consequences of supply decisions. Generally speaking, the application of lean principle requires, among other things, an intense coordination and the sharing of operational information between supplier and customer, mainly with the goal of: i) reducing time-to-market, ii) reaching a higher rate of innovation iii) reducing the life cycle, iv) shifting from a make-to-stock logic to a build-to-order one, v) increasing customization. In this evolution the crucial factor is that consumers are more and more demanding as regards timing, innovation, quality, variety and customization. Pressed by the demand, firms are forced to shorten the product life cycle, to increase the rate of innovation and to boost differentiation of products and services. At the same time the fierce competition doesn't leave significant leeway for price policies. In addition, as a result of frequent technological innovation, products and services have assumed a very high level of complexity, so that even commonly used products are obtained through a process of design and development which involve different firms highly specialized in their phases. Consequently, a higher reliance on suppliers is required, since they acquire a to support non-core requirements, particularly in design and engineering support (Prahalad & Hamel, 1990). In order to exploit supplier's know-how and innovation abilities, the firm involves the supplier in the decision-making processes related to new products development (Wagner & Hoegl, 2006; Roy et al., 2004). Information about plans and production processes are shared by both parts and the contractors activate specific units to assure the coordination and the exchange of information, giving birth to a “strategic integration” process (Volpato & Stocchetti, 2002), that is an integration of the strategies of separate firms through the definition of common goals about product development, customer's satisfaction performances, etc. The strategic integration is effective in reducing the time-to-market, through the elimination of idle times during the R&D and engineering process, as well as in reducing failures and second thoughts during product's development (Flint, 2004). Of course such a pervasive relationship arises a number of issues including, to name the most delicate: i) the issue of transparency, about the mutual possibility to track time, phases and cost of partner's production process, ii) the problem of defining the control and supervision responsibilities with

regard to the stages involving the shared resources, iii) the sharing of responsibilities, costs and benefits arising from the development of joint projects.

In conclusion, a strategic integration relationship has the typical features of long-term investments; it requires an analogue process of evaluation, negotiation and goal setting.

Another crucial developing factor is the increasing strategic relevance of supply policies and of make-or-buy decision itself. Supply chain relationships, in fact, gained a strategic importance among firms' processes since they ultimately determine the firm's ability to create value for itself and for the whole chain. Consequently, the control over performance variables (like quality, time to market, innovation, etc.) becomes critical. In the traditional view the full control over critical resources is obtained through vertical integration, but when the competitive environment becomes unstable, particularly when the rate of innovation in processes and products is particularly high, the quantification of costs and benefits of vertical integration is subject to great uncertainty. Even the most structured and comprehensive evaluation of cost-effectiveness, in fact, cannot give answers on the side of the strategic implications and about the possible reversibility of the conventional make-or-buy decision. Thus, intermediate forms of coordination between market and hierarchy are taken into consideration, with the aim to face uncertainty with flexibility.

In such context several elements of uncertainty arise, specifically:

- uncertainty regarding the development of costs of resources, that has a significant impact on the efficiency of processes and influences not only the choices with respect to production technology, but also the vertical integration decisions;

- uncertainty about the evolution of technology embodied in the components. When components technology requires highly specialized processes and / or peculiar know-how, supply decisions almost always involve the choice of a technological trajectory, with a series of long-term implications on the market positioning of the product and its market competitiveness.

To better understand this aspect one can consider the supply chain as a system that replicates, on a wider dimension, the internal value chain of the enterprise. Both the company and the supply chain can be seen as a sort of complex mechanism in which a series of coordinated activities are carried out in order to generate added value and margins, in a word to create "value". Each link in the chain has its *raison d'être* in the fact of being part of a wider process aiming at a definite final result. Indeed, the value of the output of a supply chain depends on the ability of each firm to coordinate its activities with all the others involved in the same chain.

For instance, despite the technological excellence of its products, a car producer who wants to develop an electric vehicle would hardly be able to create durable value (both for customers and the company) in absence of a developed supply chain of companies in the battery & electronic industry. The actual competitiveness of both the carmaker and the supplier depends on the reciprocal coordination / process & products integration and on the capability to fulfill final customers' requests. On the other hand, once a whole set of product is based on the proprietary technology of one specific supplier the relationship with this supplier becomes highly idiosyncratic in both directions. This is the case, for instance, of the Renault/Nissan group, who has developed models of electric cars which can substitute the entire set of batteries thanks to a specific technology designed & developed by a third company named "Betterplace". On one side this new technology has an advantage in that overcomes a typical weakness of electric cars (the long time required for full recharge). On the other side, to introduce and develop such a radical change in the industry, highly idiosyncratic investments are required (development of the platform and its widespread diffusion), generating sunk costs that could not be easily recovered in case one or both companies decide to withdraw. In this case the choice of the supplier comes with the choice of a specific technological trajectory and vice versa. Assessing costs and technical quality of the available alternatives is just part of the problem, since it is also necessary to evaluate elements that require a scenario analysis, like for instance: competitors' reaction (what if no other carmaker adopt the same platform?), degree of improvement of traditional technology (what if the time for a full recharge at the plug decreases radically? What if new batteries are developed?), chances for competing innovation (what if a new kind of hybrid car is developed?), and so on.

When the competitive and technological environment is characterized by high uncertainty the "make" alternative suffers from the risks related to direct investment in research and development, while the "buy" alternative suffers the risks of technological dependence and the limited differentiability of the product on its key component. In both cases the decision will affect the competitiveness of the product, thus implying the involvement of several other functions in the firm: marketing (for demand forecasting, customer's analysis, product positioning, and so on), R&D (for the analysis of alternative technologies, their possible developments, etc..) and production (product engineering, analysis of the process, estimate of material requirement and costs, etc.). In short, supply policies shouldn't be restricted to the purchasing manager evaluation, but they require the involvement of top management and a strategic overview of the various possible occurrences.

SCM then emerges primarily as a response to those situations involving the development of a pervasive relationship with suppliers, such as for instance: choosing a peculiar type production process in relation to the expected trend of the cost of resources; the choice of a new plant location in relation to the development of regional logistics and

productive infrastructure; the costs of local resources, and so on. In these cases the supply relationship are an issue of great importance since it heavily affects the range of feasible options, the possible future conversion to different technologies, the profitability of new plants or new locations. The complexity of a make-or-buy choice in such a context, in which the survival of earlier decisions or the possibility to correct errors of planning is far from being guaranteed, suggests that the evaluation of alternatives is a matter of strategic analysis even more than a matter of cost.

However, up to the '70s, the growing interdependence of production processes and the increased need for coordination mentioned above would have been solved, in the majority of cases, through a choice of vertical integration. Still now, large companies who have access to wide financial resources and who have an adequate organizational and managerial structure would in fact take the in-sourcing options into consideration. However, over time in many industries the degree of vertical integration of enterprises has decreased dramatically. The increasing complexity of products and their hybrid technology (i.e. the convergence of different technologies such as electronics, chemistry, mechanics, etc..) entails the adoption of increasingly sophisticated production processes. Therefore the adoption of highly specialized skills and knowledge is necessary and/or more cost-effective. Such specialization, in an era of rapid proliferation of technological innovations, discourages the vertical integration: i) the investments required to remain updated in several fields of R&D are not justified in comparison with the possibility to partner with specialized companies; ii) investments are highly idiosyncratic, while partnerships could be changed according to the technological trajectory and standards selected by the market over time; iii) the integration of a specialized ring of the chain increases the overall risk since the higher the number of alternatives the faster their development, the higher the failure rate of new products.

All of these reasons on the one hand pose new problems to vertical integration as regards risk, costs, technical and organizational capabilities, then limiting the number of feasible options. On the other hand they bring the terms of the comparison on new and quite different dimensions, putting in evidence strategic opportunities and threats instead of quantifiable costs. Contrary to the assertions of the traditional approach, which suggest the vertical integration for critical and specialized parts, the firm may find more convenient to outsource also critical and tailored parts, while avoiding a relationship of dependency on the supplier (Ellram 1991).

In essence, in the face of the situations outlined above, the traditional PS approach cannot provide a satisfactory basis for evaluating alternatives in terms of all relevant issues.

The SCM approach is developed to achieve apparently irreconcilable objectives:

- Meet the requirements of flexibility,
- reap the benefits of decentralization,
- coping with the demands of innovation,
- all this without giving up the prerogatives of control.

Through the SCM approach the firm extends its management activities beyond its own boundaries and adjusts its supply relationships on a broader basis than that contractually defined, even beyond the supplier-customer relationship where both are directly involved and interacting with subjects which are not in reciprocal contact within the chain.

5. The supply relationship according to the SCM approach

The situations outlined in the previous paragraph, which led to the current configuration of supply chain relationships, became more common and widespread at the beginning of the nineties. Since then, of course, both theory and practice have witnessed a rapid evolution of knowledge to support policies of SCM. However, some of the pivotal principles in the strategic management of supply chain relationships have been developed as early as the eighties, and among the first contributions there are important points of reference. In those years, the transition from a period of relative market stability to an environment characterized by rapid changes has increased the criticality of monitoring all areas of the business and invested the activities related to the supply, prompting firms to identify the main variables capable of distinguishing the situations which would require an advanced approach to supply relationships.

The complex set of concepts, guidelines and operational tools that goes by the name of supply chain management (SCM) is driven by above mentioned changes. In such a perspective firms operating in the same value-chain coordinate their strategies with the purpose to increase the overall value rather than compete for the allocation of the existing one. Firms' network of suppliers and the relational capabilities assume a critical role in order to coordinate the value creation processes within the chain. For this reason, firms develop new tools for managing and coordinating the interrelationships between the production processes of supply-chain contractors, joining the strategic perspective with the traditional, somehow simplistic, make-or-buy evaluations.

SCM is a complement to (not a substitute for) the traditional approach and is characterized by some ideal-typical key features that both complement and contrast with the four key issues listed in part 3:

A. *Partnership opportunities and competitiveness are the main determinants of make-or-buy strategies.* Vertical integration decisions are taken also according to the relational and coordination capabilities. The decisions about the

degree of vertical integration and about the positioning along the value chain depend not only on technological skills (in broad sense) and efficiency, but also on the relational and coordination capabilities. For instance, successful firms that operate downstream of the value chain in most dynamic sectors can exploit their knowledge of demand and customers' needs to assume a proactive role and to pull the entire chain towards projects of improvement and innovation. These capabilities will then put the firm in a crucial role within the supply network, feeding a situation in which the leading role of the firm allows it to control the critical phases of the value chain without the need for internalization. In contrast, a firm that for various reasons suffers the bargaining power of suppliers for critical components and parts, will be more oriented to choose the path of integration even with a cost disadvantage.

B. *Medium/long term, strategy-based perspective.* Supply decisions involve the assessment of the medium or long-term strategic perspective. Without neglecting the economic assessments, supply policies also take into account opportunities typical of a medium to long term perspective (eg.: innovation, learning economies, flexibility), then adopting choices that may also have sub-optimal effect in the immediate future, but against an upcoming better result or a strategic necessity. The key-principle of assuring the long-term profitability is not neglected. Rather it is declined on several dimensions, including evaluations that are not directly translatable into monetary or financial terms, such as quality, competitiveness, technology leadership, customer satisfaction, and so on.

C. *Win-win oriented relationship.* Supply chain relationships are managed with the perspective of seeking a win-win outcome or according to an overall optimization. Firms aim to increase their share of added value by increasing the value generated by the whole chain rather than through its division. The competition in the research for individual optimum is seen as leading to a systemic sub-optimal outcome. Usually, the coordination promoted by one or a few actors in the chain, typically downstream firms or those with the largest potential market and technology.

D. *Goal oriented commitment.* The regulation of supplier-customer relationships is in part ruled by orientation to common goals rather than by contractual clauses. The adjustment of the supplier-customer relationships, while being formally established by the enforcement of contractual terms, indeed is largely determined by the orientation to common goals, which may be, for instance: the development of a new product, the opening of a plant, the entry into a new market, and so on. This does not imply the loss of constraints: common contractual obligations are added to targets systems that cannot be placed in explicit terms as they go beyond the firms' boundaries.

In conclusion, the SCM approach includes the management of issues related to procurement and placement of products on the market; then goes further, analyzing and regulating relations with other firms in order to build up the convergence of interests among industry players and in order to build common processes aimed at improvement of processes and products. For this reason we can say that the SCM is a process, including assessment of the competitive implications of decisions on supply. Therefore, it must involve the coordinating role of the top executives at least in the design of strategic guidelines.

6. The drivers of the choice between PS and SCM

The identification of variables relevant to the supplier-customer relationships is the first step in the evaluation of different possible strategies of SCM. In theory, there are several variables that can affect SCM strategies and the most appropriate way to handle each specific supply relationships. Some of them are of major importance and are all closely interrelated with each other:

- a) start-up and management costs of supplier relations,
- b) the complexity of the finished product and the degree of technological hybridization,
- c) availability and customization of supply,
- d) convergence or divergence of goals between firm and supplier.

a) Supply policies are influenced by the different incidence of costs arising from the start-up and from management of supply relationships. In brief, costs can be broadly divided into:

- transaction costs (launch of the relationship, coordination and negotiation, opportunism),
- costs of inventory management (purchase of equipment, cost / opportunity arising from capital equipment, maintenance stock, obsolescence and decay, logistic),
- costs related to the quality (in broad sense) of supply (defects, technical and quality level, degree of innovation of the product)
- switching costs / idiosyncrasy of the relationship.

The general principle that suggests choosing the supplier who minimize the sum of those costs, can hardly be followed in practice, since those costs are actually quantifiable only after the supply relationship is activated. The uncertainty in itself is often the first source of disagreement. Traditionally, in order to avoid or reduce the occurrence of disputes, contracts include a number of clauses meant to foresee and solve any situation that may bring the actual scenario to deviate significantly from the one predicted (e.g. changes in supply costs due to external causes, changes in prerequisite due to new laws, the occurrence of problems related to the rate or quality of supplies, and so on).

A contract structured to try to solve in advance all possible situations is "closed" because it seeks to regulate in a single definition all the predictable conditions rather than contemplating the possibility to redefine the basic terms of the agreement. However, this option only applies to stable and predictable occurrences. With increasing turbulence it is extremely complicated and risky to address the problem with closed contracts. Rather, contracts rely on "open" agreements that instead include terms of adjustment or the possibility of renegotiating the terms. A predictable scenario will not create specific incentives to a SCM approach, while uncertainty is one of the main drivers that lead firms to include strategic evaluations in the decision related to supply relationships.

b) Products that require specialized parts or materials and know-how involving several advanced technologies (electronics, electrical engineering, chemistry, etc.) need intense inter-firm coordination, due to the complexity of engineering and development and to the difficulty in coordinating multiple firms that have different specializations, procedures and *modus operandi*.

In this situation the role of the supplier is particularly important, since one firm alone may not (and usually doesn't) possess the technological and market knowledge required for the design and development of the final product.

In cases like this the convergence of objectives on the project development of the final product is essential to guarantee an effective coordination. The supplier tailors parts and components on the firm's needs, then involving a specific commitment of resources from both parts, then leading them to provide mutual guarantees to offset the risk related to the low reversibility of dedicated investments.

c) The availability of a resource on the market has relevant strategic implications and it is (or might be) connected with the degree of customization. Besides from having a significant impact on supply costs and supply relationship management, it has a key role in determining the balance of power in the supply chain and the presence of a certain amount of local supplier is one of the main factors taken into account when the location of a new plant is decided. Of course a scarcity of supplier for a specific resource will tip the balance of bargaining power of the supplier. On the other hand the widespread presence of suppliers with high-value know-how, in a relatively circumscribed geographical area is, quite often, a strength point that affects the entire chain. When an area has a high concentration of a particular type of work and expertise rarely found elsewhere, that area (usually defined in terms of cluster or regional cluster) often becomes a place of excellence as regards research and innovation in the field. This triggers a virtuous circle: on the one hand the productive specialization and expertise generates added value and attracts investment. On the other hand these investments support further research & development. This circle will generate innovation and new knowledge more effectively and efficiently than could be done elsewhere, in the absence of that "production culture" consolidated in that specific region.

d) The convergence of the contractors on issues of common interest produces a significant boost towards the cooperation. The requests of the two contractors are not necessarily incompatible. The real issue is that every concession implies an additional commitment for the lender, and potentially lower margins if the increased commitment does not find an adequate payment. But if customers and suppliers believe they can achieve mutual benefit (thus adopting a view of a positive-sum game rather than that of a zero-sum game), then one of the cornerstones of the negotiation consists in mutual requests for guarantees about the opportunity to: i) improve efficiency, ii) strengthen their competitive positions, iii) achieve satisfactory results. The most important among the key-drivers of the negotiation process are the sharing of risks and opportunities, and the reciprocal transparency on strategies and market trend (Swink & Mabert, 2000).

9. Conclusions

The frenetic changes of recent years have led firms to suffer from conflicting pressures. In particular, the tendency towards specialization contrasts with the increased need for coordination; new and higher barriers to vertical integration challenge the need for direct control of the most critical stages of production. Over time both theory and practice have developed tools to enable firms to respond effectively to environmental challenges. Faced with unprecedented complexity, firms have extended the strategic coordination outside their boundaries and across the supply chain, trying to merge the advantages of integration with those of flexibility and specialization. The result is the development of an extremely diversified range of relationships.

In those industries characterized by high technology and high rates of innovation, the relationship between companies and their suppliers are generally much more intense and pervasive than the traditional market agreements. For this reason the SCM perspective tends to give great importance to the sharing of goals rather than to the contract itself, according to a logic that relies on the mutual interest in flexibility. These relationships settle long-term cooperation that, if successful, increases the competitiveness of each contractor. Concretely, the competition between companies is evolving towards a competition between supply chains. However, the SCM approach requires significant efforts and it is not without risk. It is therefore necessary to understand the conditions of effectiveness of this perspective to discern those cases where SCM is appropriate. Indeed, to understand if a particular supply can be critical to the competitiveness and to future strategies it is probably more important than the terms of the contract. The retrospective analysis of the competitive scenario that led to the birth and evolution of this approach is a useful element for

understanding the strengths and the limitations of SCM. Through the review of the main factors in the evolution of supply issues, SCM emerged as an organizational / systemic response to complexity. Its application is appropriate in dynamic and uncertain environments, while in other cases the traditional PS alternative might bring equal or greater benefits.

8. References

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