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Analysis of Factors Affecting E-supply Chain Performances

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ABSTRACT

The relevance of supply chain (SC) behaviour is continuously increasing, especially with respect to companies adopting e-commerce strategies. Although the huge number of works on this topic, an integrated approach to design and implement effective electronic supply chain (e-SC) – that is supply chain (SC) in which business actors are connected via Internet technologies - is still not available. In order to contribute towards the definition of an integrated and comprehensive framework for e-SC analysis and design, in this paper factors affecting e-SC performances are investigated, including organization, management and control.

INTRODUCTION

In the actual economic scenario, supply chain performances are assuming increasing relevance due to several elements. Firstly, market globalization induces companies to expand their presence at worldwide level. Therefore, activities related to inward and outward logistic become a critical source of competitive advantage. This often induces companies to completely redefine the SC in which they are embedded. Secondly, environmental turbulence and ipercompetition (D'Aveni, 1994) are inducing companies to focus their efforts on business activities in which they own distinctive competencies and resources (Teece *et al*, 1990; Grant, 1991a; 1991b; Amit & Shoemaker, 1993). As a result, logistics is often outsourced to specialized companies. However, such a strategic choice may compromise the level of service furnished to customers. At the same time, the number – and the quality – of relationships with external business actors dramatically increases. Therefore, the externalization decision must be carefully evaluated and frequently verified.

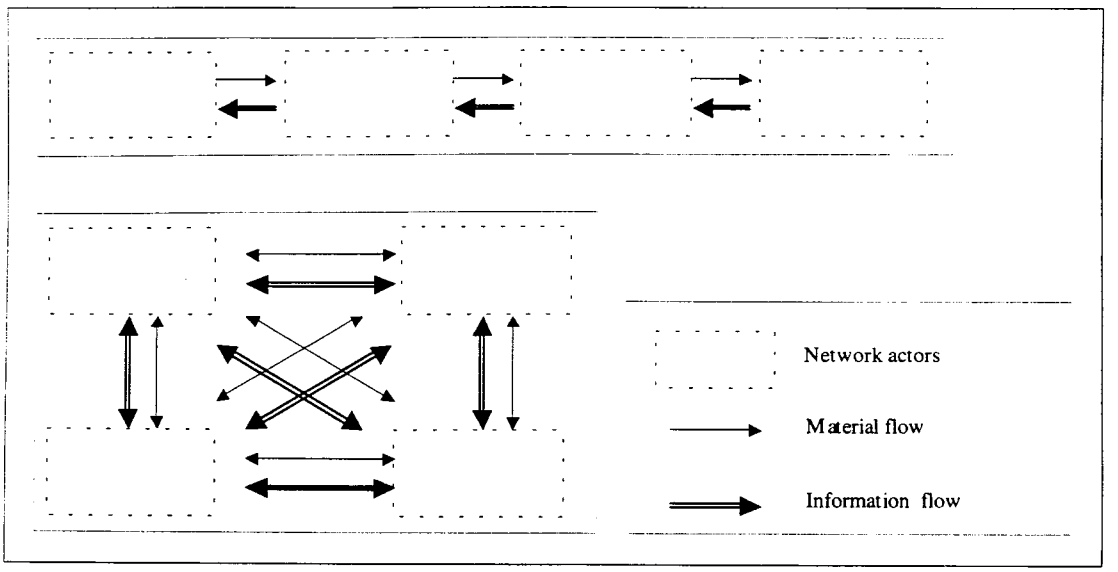
The relevance of SCM is more and more critical with respect to companies adopting e-commerce strategies. This is true especially for small and medium enterprises (SMEs), which – on the base of a me too imitative approach - implement Internet strategies assuming it is the thing to do. With this respect, Cox *et al.* (2001) put in evidence that SMEs often implement e-business strategies without considering their impacts on firm's organizational structure and competitive

positioning. At the same time, Giustiniano (2001) affirms e-commerce an easy-to-implement strategy for SMEs internationalization.

It is quite diffused the idea that Internet technologies permit to reduce uncertainty, increase sales effectiveness and increase service level. However, their implementation obliges companies to completely re-define the SC in which the company is embedded. With this respect, the traditional conceptualization of SC as a sequence of differentiated steps managed by specialized actors is heavily criticized by several authors (Houlihan, 1985; Jones & Riley, 1985; Stevens, 1989; Lee & Billington, 1992; Lambert et al., 1996).

On the contrary, a networked approach seems to be more useful in order to analyze and redesign relationships among different business partners (figure 1). As a consequence, SC must be analyzed not more as referred to a specific product/process, but as related to an integrated system (such as, the industry). With this respect, Pires & Aravecchia (2001) state e-SC performances must be evaluated at the industry level, and not at the firm's one.

Figure 1. Linear and Networked Supply Chain



Based on such considerations, it is evident the need for managerial criteria and models to manage e-SCs. Although the huge number of research on this topic (i.e. Snow *et al*, 1992; Rayport & Sviokla, 1995; Grandori & Soda, 1995; Campbell & Wilson, 1996; Cravens *et al.*, 1996; Hill, 1999; Fernandes & White, 2000; Lamming *et al*, 2000; Cox *et al.*, 2001; Harland *et al.*, 2001), an integrated approach to design and implement effective e-supply chain is not still available. As a matter of fact, firms often adopt empirical methodologies, which does not allow for performances optimization. In order to contribute to solve such a problem, a comprehensive

model should be developed to analyze and design completely new e-SC or to re-define existing ones. To reach such an objective, in this work variables influencing e-SC performances are investigated and correlated. In so doing, the Bain (1959) paradigm may be adopted as a theoretical framework. More specifically, it is supposed that e-SC effectiveness and efficiency depends on coherence between business environment and relationships among business actors. Such relationships, in turns, may be analyzed according three different levels of analysis:

a) structures adopted to organize relationships among business actors within the e-SC;
b) criteria adopted to manage relationships;
c) activities to be implemented co-ordinate business partners.

Based on a deep literature review, in the study factors mainly affecting e-SC are analyzed and correlated.

This paper represents the first step of a research project aimed to identify an integrated approach for analyzing and design new e-SC, or re-design existing ones.

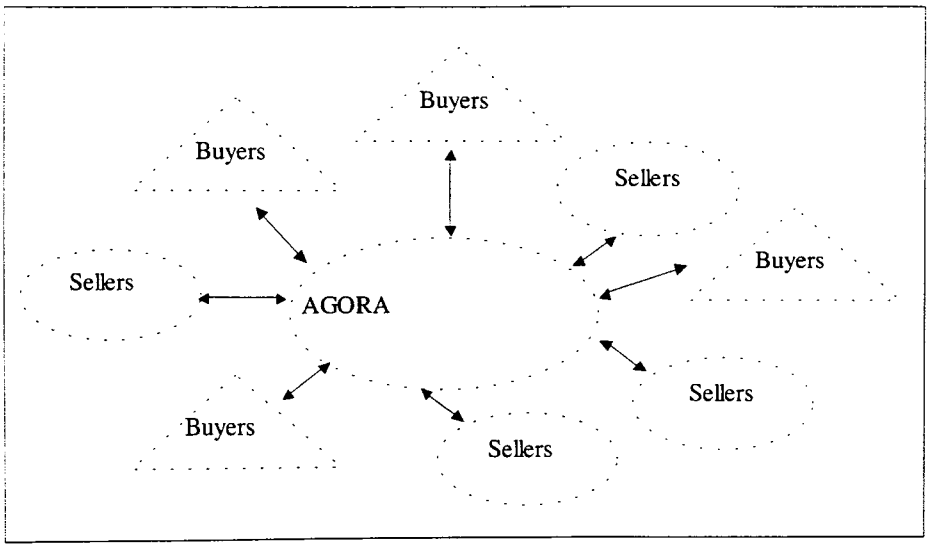
ORGANIZATIONAL STRUCTURES

Several authors proposed organizational structures to create value within a supply chain, traditional or electronic ones (Houlihan, 1985; Jones & Riley, 1985; Stevens, 1989; Ellram & Cooper, 1990; Lee & Billington, 1992; Cooper & Ellram, 1993; Cooper & Garden, 1993; Hewitt, 1994; Hinterhuber & Levin, 1994; Grandori & Soda, 1995; Cravens *et al.*, 1996; Lambert, 1996; Rosenfeld, 1996; Ernst & Kamrad, 2000). Among them, Tapscott *et al.* (2000) suggest a quite useful approach for interpretation of e-SC organizational structures. They propose the concept of b-web, that is "a distinct system of suppliers, distributors, commerce services provider, infrastructure providers, and customers that use the Internet for the primary business communications and transactions" (2000, 17). To describe and classify such a type of e-supply chain, they consider two variables: the level of product-service value integration and the type of control (hierarchical *vs* self-organizing) used for managing the relationships among business actors. More specifically, the level of value integration is defined as the extension of benefits offered to the final consumer. As a consequence, the biggest the number of business actors contributing to the value creation (i.e., suppliers, manufacturers, distributors), the biggest the value integration. With respect to the degree of control, it is named as hierarchical when a leading company defines, manages and control activities of different actors within the b-web. On the contrary, it will be classified as self-organizing, when all actors act independently and the good final value is defined by interactions among them.

Combination of the two dimensions provides five types of b-webs. The first one, called Agora, represents a virtual plaza in which consumers and suppliers interact in order to define equilibrium price, such as in the neoclassical perfect competition market (figure 2). As a consequence, transaction costs (Williamson 1975) reduction is the main objective of such an organizational structure. Within an Agora there is not a leading company which assumes the hierarchical

control on the e-SC. At the same time, the level of value integration is very poor, being offered products generally highly standardized.

Figure 2. Agora



In the Aggregation model, instead, a leading company, after identified customers needs, selects products and services and defines prices (figure 3).

Figure 3. Aggregation

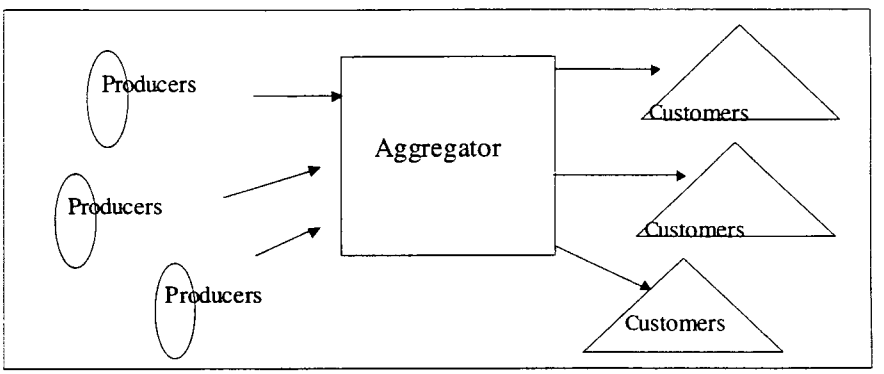
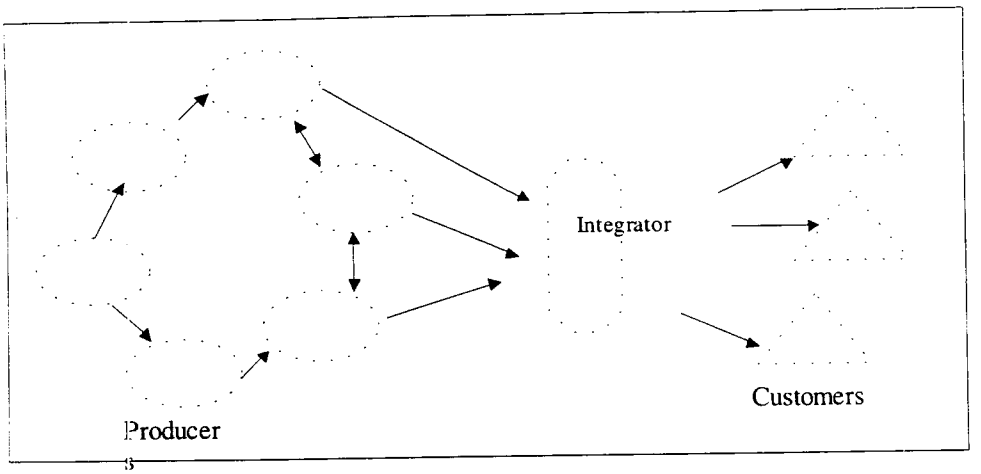


Figure 3. Aggregation

Likewise Agora, value integration is quite modest; therefore this e-SC seems useful for investing so called virtual malls. The unique benefit for e-customers is the possibility to access to a wide range of standardized goods in an unique virtual market. At the same time, however, the degree of control within the e-SC dramatically increases, due to the presence of the aggregator.

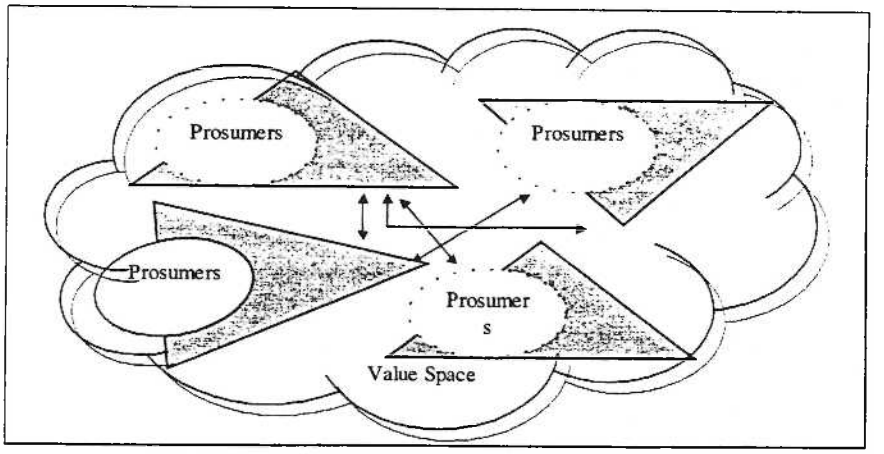
Slightly different is the case of the Value Chain model, where a primary firm develops and sells goods, externalizing production and assembling phases to other business actors (figure 4). This model is not completely new, being already diffused in the so called old economy, as in the case of industrial districts. Completely new, on the contrary, is the possibility to make more effective and efficient interactions among different partners, due to Internet technologies adoption. These technologies reduce transaction costs (efficiency) and delivery times (effectiveness); besides, adopting such e-SC each business actors focus its attention on activities in which is more competent. To sum up, Value chain model is characterized by both, a high level of value integration and the presence of a leading firm.

Figure 4. Value Chain



The fourth model is named Alliance and is based on mutual cooperation among independent actors (figure 5). More specifically, there is not a principal firm which hierarchically controls the rest of the b-web. On the contrary, the leader only defines a general framework, based on which each partner acts independently to reach widely accepted objectives.

Figure 5. Alliance



Finally, the Distributive network model is focused on actors offering infrastructural services (i.e., banks, logistics, etc.) that allow other actors to create value (figure 6).

Figure 6. Distributive Network

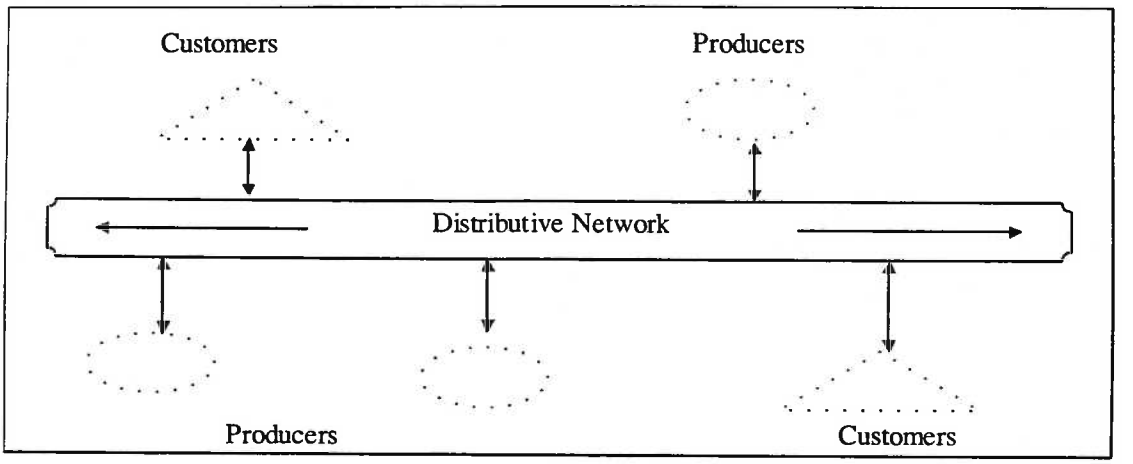
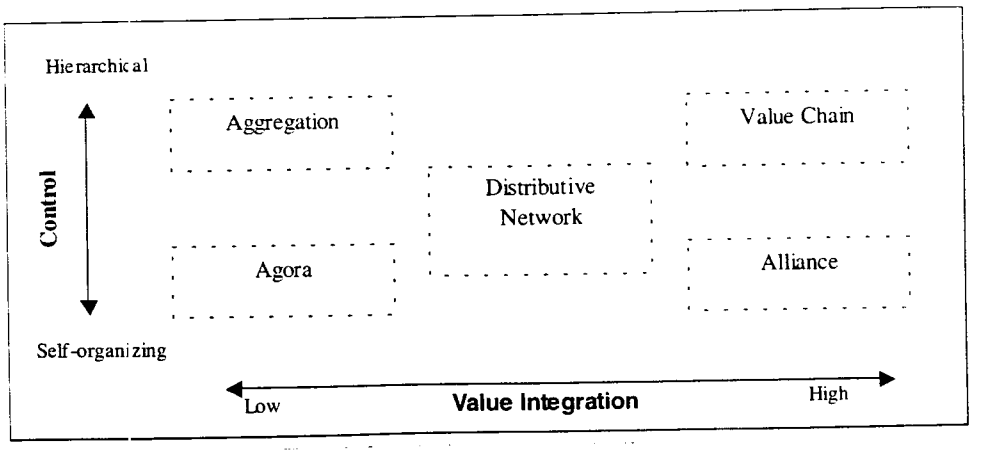


Figure 6. Distributive Network

Based on the earlier defined variables (value integration and control), the five analysed organizational structures may be correlated as in Figure 7.

Figure 7. Organizational Structures Classification



MANAGERIAL CRITERIA

Models to manage relationships among different actors within an e-supply chain are another deeply discussed topic. With this respect, Nøkkentved, (2000) offers an useful taxonomy, based on the earlier works of Ferrari (2000). Such a classification is based on two variables: market fragmentation and product\process complexity. The first one is defined as the number of actors (suppliers, manufacturers, distributors and consumers) that operates inside the network. As a consequence, the more the fragmentation, the more the need for a leading company which coordinates other business actors within the e-SC. The second variable is defined as a mix of various components, among them, highly-specific user needs, product life time, market volatility. Also in this case, when the complexity of product/process increases, a greater integration among different actors is badly needed.

Based on such two variables, Nøkkentved identifies six different models to manage relationships within the e-supply chain. The first, named Auction House, is suggested for managing exchanges of standardized products in B2C markets. Within this e-SC, different actors have the same power and their main objective is reducing transaction costs (Williamson, 1975). Therefore, the model is suitable for managing networks with low levels of fragmentation and product complexity.

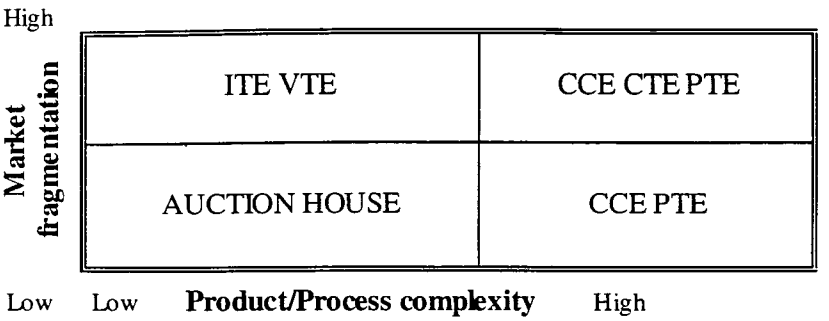
The Independent Trading Exchange (ITE) is another many-to-many model, aiming to the efficiency of a specific industry, such as in the neoclassic perfect competition. Despite Auction House, it is suggested for standardized products in B2B contexts. More specifically, two different configurations of such a e-SC are possible:

a) Vendor-Trading Exchanges (VTE): is adopted when a technology vendor (especially IT ones) interacts with companies focused in a specific industry and adopting the same technology;
b) Consortium Trading Exchange (CTE) resembles the electronic version of an industry cartel. More specifically, different competitors decide to interact in order to increase market efficiency, for instance unifying supply activities and gaining bargain power.

On the contrary, Private Trading Exchange (PTE) is a one-to-many model, in which an enterprise having specific assets (for instance, a prestigious brand) induces other actors to collaborate. Traditionally, this model is adopted to establish long-term, contractual supplier relationships. For its characteristics this model is suitable for goods many differentiated.

Finally, Collaborative Community Exchange (CCE) joins two type of advantages: efficiency - typical of ITE – and collaboration among the actors, which characterize CTE. As a consequence, while CTE is composed only by competitors, in CCE firms at different levels of value chain reciprocally interacts. Based on such features, business models may be classified with respect to earlier discussed variables (figure 8).

Figure 8. Managerial Criteria Classification



CRITICAL ACTIVITIES

In previous sections, networks organizational structures and ways to manage relationships among business partners were investigated. However, e-SC performances depend also on activities implemented for managing relationships within firms. This topic was deeply analyzed by several authors (Biemans, 1195; Johnsen *et al*, 2000). With respect to our work, Zheng *et al.* (2001) seems to offer useful insights. More specifically, they propose the concept of e-supply network, defined as "a set of inter-connected supply chains, embedding the flow of goods and services from original sources to end customers" (2001, 896; Harland, 1996; Lamming *et al.*,

2000). These networks represent an evolution of b-web proposed by Tapscott *et al.* (2000), being considered also "lateral links, reverse loops and two-way exchanges".

Authors define four different networks and explicit competencies must be owned in order to manage relationships among business partners. This is based on two variables (figure 9): the first is the leader firm degree of influence, that is, its ability to define, manage and control actions of different actors.

This power may derive from several factors, such as its contribution to the value creation, its dimensions or ownership of critical assets. As a consequence, when the degree is high, the most critical skills are partner selection and decision making ones. On the contrary, when leading enterprise has a little influence, the most requested competence is partners motivation, in order to induce them to share risks and benefits. The second variable is the e-supply chain dynamism degree. This, in turns, depends on both, market and production process dynamics. The latter is related to the variety of production processes and volumes. Market dynamics, on the contrary, depends on the number of suppliers offering the same product/process, switching costs needed to change supplier and frequency of product/process innovation. As a result, in stable environments, actors must pay major attention to process innovation and optimization, while in dynamic network the attention must be focused on technological and product innovation. Therefore, in the first case human resources and knowledge management are the most requested competencies; while in dynamic contexts equipment integration and information processing becomes more relevant.

Figure 9. Critical Activities Classification

Focal firm supply network influence	Routinised Network — Level of dynamism	Dynamic Network
High	partner selection decision making equipment integration information processing	partner selection decision making human resource integration knowledge capture
Low	motivating risk & benefit sharing equipment integration information processing	motivating risk & benefit sharing human resource integration knowledge capture

Figure 9. Critical activities classification

CONCLUSIONS

In this paper, main factors affecting e-SC performances have been identified, namely organizational structures, models for relationships management and critical activities. Future research works will be aimed towards developing an integrated framework for e-SC analysis. Based on such analysis it will be possible to design new or re-design existing e-SC, taking into account specific features of business environment (e.g. number and types of actors, product/ process attributes, industry constraints).

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