

The Role of the Internet in Procurement and Fulfilment Processes: A Comparison of Case Studies

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Abstract: Information and Communication Technologies (ICT), and in particular the Internet, have played a fundamental role in helping companies reach the goals of "supply chain integration". The Internet can change the role and type of relationships between the various players, creating new value networks and developing new business models. This work studies the impact of the Internet on company business, in particular on procurement and fulfilment processes. The analysis is carried out by considering and comparing 32 case studies regarding large Italian companies. An evolutionary model for e-business strategy is proposed. This model shows how ICT can evolve from being merely a means of communication to being an instrument which coordinates company processes through five stages: traditional communication tools, internal integration, Web-based communication tools, XML Web-based platform, and integrated enterprise.

1. Introduction

In recent years, a combination of economic, technological and market forces have forced companies to take a look at and redefine their supply chain strategies. Among these forces are the globalisation of business, the proliferation of product variety, the growing complexity of supply chains and the reduction in product life cycle. In order to remain competitive, some companies have tried to improve the coordination and collaboration of all the partners involved in the same supply chain. This approach has been called "supply chain integration" [3].

Information and Communication Technologies (ICT), and in particular the Internet, have played a fundamental role in helping companies reach the goals of "supply chain integration". In fact, the Internet can redefine the way in which some back-end operations, such as product development, procurement, production, warehouse management, fulfilment, post-sales support and even marketing, are managed. In each process, the Internet can change the role and type of relationships between the various players, creating new value networks and developing new business models. The word "e-business" can be used to describe the use of Internet to reach the goals of supply chain integration [11].

This work studies the impact of the Internet on company business, in particular on procurement and fulfilment processes. The analysis is carried out by considering and comparing 32 case studies regarding 32 large Italian companies. Even though, these companies' core business is completely different, their e-business strategies prove to be quite similar. Following the case studies, an evolutionary model for e-business strategy is proposed. This model shows how ICT can evolve from being merely a means of communication to being an instrument which coordinates company processes.

2. Procurement and fulfilment processes and the Internet

The supply chain encompasses every effort involved in producing and delivering a final product or service, from the supplier of raw materials to the consumer. Due to its wide scope, supply chain management must address complex interdependencies, such as those in an "extended enterprise". Today, material and service suppliers, channel supply partners (wholesalers/distributors and retailers), and customers themselves, as well as supply-chain management consultants, software product suppliers and system developers, are all key players in supply-chain management [9].

The Internet makes it possible to efficiently and quickly manage many relationships such as those involving wholesalers, taking on new resources, services, and technology, and purchasing semi-finished products, components and equipment.

Internet is used in Business-to-Business relationships on a wide-scale for two main reasons:

1. the open nature of the Internet network gives it an important advantage over other information networks (VAN, EDI, etc.) since it requires low set-up costs, limited operation costs and significantly reduced switching costs;
2. the possibility of creating high-interaction environments which make Internet useful both as a communication instrument and as a channel for marketing, thus leading to the development of more efficient inter-company relationships as well as opportunities for new co-operative networks.

Procurement and fulfilment are key processes in the supply chain and with the advent of Internet those which have had to be redesigned and reorganised. The new forms of procurement and fulfilment which take advantage of ICT in order to digitize certain stages of these processes are called e-procurement and e-fulfillment.

The stages of the procurement process can be summarized in the following points [7]: the need to procure a particular good or service; the search for potential suppliers and the definition of possible alternatives; evaluation of the alternatives; contact with suppliers to begin the negotiating process; evaluation of the offers; agreement on the type of supply. When an agreement is reached then a contract is drawn up and the contract is signed and the order sent.

The concept of fulfilment evolved from a word which described the distribution for companies which were involved in direct marketing and from a word which includes all of the processes in the customer-centric supply chain [13]. Fulfilment therefore means managing the following stages: receiving the order; managing the transaction; warehouse management; managing transportation; customer response; and reverse logistics management [6]. E-fulfillment makes it possible to satisfy customers who are demanding more and more in terms of faster service, regardless of geographical location. This, in turn, requires greater efficiency in the distribution process of the product [14].

In order to better manage e-procurement and e-fulfillment and to make them more efficient, models generally called electronic marketplace or trade exchange marketplace can be used to implement these processes. These models bring many different players together into one virtual environment, making the creation of e-supply networks possible. By considering the classification proposed by Tapscott [15] and by adapting it, three main categories of trade exchange marketplace can be identified:

- Independent Trading Exchange (ITE);
- Private Trading Exchange (PTE);
- Collaborative Community Exchange (CCE).

Independent Trading Exchange is a many-to-many model which focuses on the physical transaction in the process between buyer and seller. This model tries to minimize the transaction costs within a specific industrial sector. It allows members to have greater access

to information, such as the price of a given product and the availability of alternative products.

Private Trading Exchange is a marketplace which is the property of a company or of an influential member in the supply chain. The players using the PTE have very strong pre-existing co-operative relationships. It is a one-to-many model and is directly managed by the leader company. This marketplace can be used by the leader company to improve collaboration, control the various processes and improve efficiency, and thus reduce costs.

The Collaborative Community Exchange model is a hybrid which attempts to combine into one model the benefits of a reduction in transaction costs, characteristic of an ITE, and the benefits resulting from the strong partnerships, characteristic of an PTE. Belonging to a CCE allows a company to make strategic and operational plans with its partners with the goal not of winning the battle between one company and its competitors, but rather of winning the battle between rival communities, i.e. inter-supply chain competition.

3. Research Design

More than 70% of Italian companies are presently developing or have already developed projects geared towards simplifying company processes by using information networks, and Internet in particular. The first activities carried out online were company-customer relations, using a company's own Internet site. During the next stage, suppliers and customers became actively involved in company processes by being given the possibility of consulting warehouse availability and the state of the order in real time. Then some of the stages of procurement were transferred online using the Internet.

The aim of this study is to identify some of the variables which can influence the development of a company getting involved in e-business. In particular, the study focuses on how the procurement and fulfilment processes are supported by ICT.

Our analysis follows the logic of grounded theory [8], developing a multiple-case study methodology [5]. This method has been successfully employed in the emergent field of strategies in high-tech environments [2] and specifically Internet-based strategies [10]. We based our sample of a few on the high visibility of the case studies [12]. By analysing 32 case studies of large Italian companies belonging to different markets and manufacturing sectors, the aspects which influence the complex relationships between the companies and the other players in the supply chain are defined. The relationship between these complexities and the e-business strategies used is then analysed. Finally, an evolutionary model which describes how e-business strategies develop over time is proposed.

4. Case study analysis

We visited 32 companies and the following table describes the distribution of our cases in the industries considered.

Mechanical	11	Footwear	3	Electronic devices	2
Furniture	5	Food	2	Plastics	1
Textile	5	Electro-mechanical	2	Paper mill	1

Table 1: Distribution of cases per industry

This analysis takes into consideration the main factors that lead a company to adopt e-business strategies, in particular e-procurement and e-fulfillment. Some of these factors depend on the type of relationship existing between a company and its suppliers and customers. These factors can be seen as catalysts to e-business applications. As far as the company-supplier-customer relationship is concerned, the most significant variables are:

- number of suppliers or number of customers;
- design complexity;

- product complexity;
- number of product codes for suppliers/customers;
- sales contract with the customer (single-brand; multi-brand);

As the complexity of these factors increases, so does the complexity of the company-supplier or company-customers relationships. This is then accompanied by a significant number of information exchanges with the players involved. Speed, integrity and security in information exchanges are the pre-requisites for managing relationships with a significant number of players.

The following table shows the relationship between e-procurement and e-fulfillment strategies and the complexity of a company's relationships.

		Complexity of relationships with suppliers	
		Low	High
Complexity of relationships with Customers	High	e-fulfillment	e-procurement and e-fulfillment
	Low	Traditional communication systems or EDI	e-procurement

Table 2: Relationship between strategies and complexity of relationships.

When the complexity of relationships with both suppliers and customers is low, companies continue to use traditional means of communication or hierarchical information networks, such as EDI. The fewer players are involved in the supply chain, the lower the cost is to co-ordinate these players. When this is the case, it doesn't seem to be any real value in investing in ICT. Companies which manage their own sales network with single-brand dealers are placed in this category as well since they can be considered to have a limited number of customers. In this case, the company can impose its own standard and way of operating on all of its dealers in the same way. Low complexity of relationships can also be defined by few product codes in both supply and sales. In these circumstances it is not necessary to invest in Internet ICT because of the simplicity of co-ordinating and transferring product information.

These considerations can be used to create a mapping (Figure 1) which describes the present situation of each of the companies studied. From the data gathered, it results to be useful to develop a diagram that expresses the initiatives of e-procurement and e-fulfillment inside the firms. The diagram's axes represent the company's processes supported by Internet toward the company's customers and toward the company's suppliers. In the positioning, we consider what phases of the process of procurement and what phases of the process of distribution have been digitized using ICT. The search for the suppliers and the evaluation of the alternatives are phases of the process of procurement that can easily be managed with Internet. Other phases as the contracted on lines, need private networks that guarantee the safety of the information transfer. This strategy is expensive and need human resources and competencies inside the firm. The situations can then be compared and the following figure depicts the distribution of our cases.

The area in the lower left-hand corner, called Traditional Communication Tools in the evolutionary model presented in the following paragraph, corresponds to low complexity of relationships with both suppliers and customers with the consequent use of traditional communications systems. The area characterised by the combined application of e-procurement and e-fulfillment, in the upper right-hand corner, is called Integrated Enterprise in the evolutionary model.

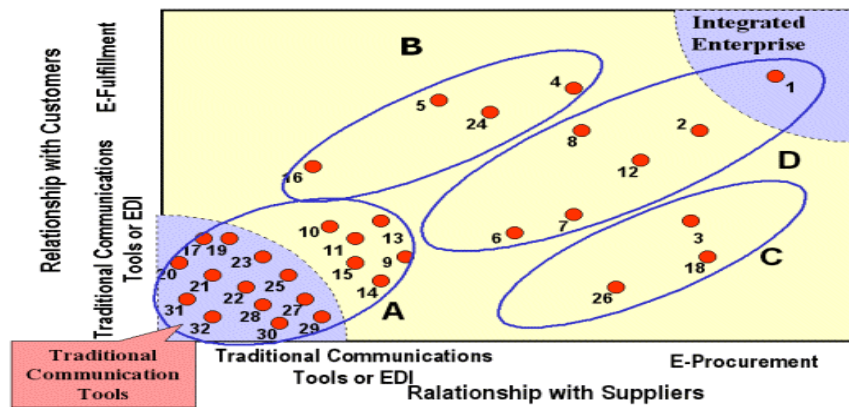


Figure 1: Positioning of cases analysed

A large amount of cases is concentrated in the inferior left-hand corner (Area A). This sector is characterized by firms that communicate with their own clients and suppliers through traditional tools of communication (fax, telephone, papery forms or dedicated computer networks like EDI).

Two other areas can be distinguished (identified with the letters B and C). The firms that belong to the areas B and C are developing or they have developed projects of e-fulfillment and e-procurement.

Area C is characterized by firms that belong to supply chain with many suppliers and with few clients. Through Internet the companies of area C have eliminated all the manual procedures performed during the order to its own suppliers. The main issue is represented by the necessity to have to adapt the Internet procedures with the management information systems inside the firm.

The project of e-procurement allows the suppliers to enter through Web to a reserved, with login and password. In the private area they can take vision of the offers and to begin the negotiation. The main advantages are the simplification of the procedures and the rapidity with which they is performed.

Through the Web-based applications a lot of activities without value added can be eliminated. The e-procurement allows: to reduce the lead-time; to reduce the communication errors; to improve the monitoring of the processes of purchase; to share data and information among all the companies functions.

The e-fulfillment strategies of firms (Area B) are very similar. The companies have created an Extranet which links the stores and the customers directly to the company. In this case, the differences between the companies' dealers can lead to some problems. Since most of company's dealers are multi-brand dealers, a dealer may be hesitant to adopt one company's information system which is not compatible with other companies' systems. On the other hand, some companies have only single-brand dealers, so that adopting the company's platform is less complicated than in the previous case. The advantages of an e-fulfillment project are better control of sales, optimization of warehouse stock and better understanding of market trends.

The firms belonging to area D have very complex supply chains. In particular, they have relationships with many suppliers and with many customers. The e-business projects concern both the relationships of procurement and fulfillment. The advantages of this strategy are similar to those defined both for the area B that for the C.

Other characteristics which can influence the development of e-business are the size and contract power of the company. Large companies have the investments needed to develop personalized applications which can be integrated into their own management information systems. The companies considered here are all large companies with significant contract power. In fact, all of them have pushed either their suppliers or customers to adopt their own

personal information system. Companies have used the Private Trading Exchange model. They did not choose the ITE model, this choice depends on the lack of trust in online auctions and public marketplaces. Finally, the companies did not adopt the CCE model because the conditions needed to carry it out are still lacking: there is no coordination between these companies and others working in the same sector.

The companies which have set up or are currently setting up integrated e-procurement and e-fulfillment projects are characterized by very complex relationships with suppliers and customers. The e-business strategies are an attempt to create the best flow possible of products along the supply chain.

The main advantages of applying e-business strategies are:

- Fewer mistakes in data acquisition and transfer and greater reliability;
- Better coordination with suppliers;
- Greater external visibility of company process; increase in the amount of information customers have access to (product availability, sales forecasts, coordinated production and delivery, product tracing);
- Better control over the bills of materials;
- Less overstock;
- Possibility of having more product information on line.

5. An evolutionary model of e-business implementation

An analysis of the literature and case studies makes it possible to define a model which can describe the evolutionary path which takes place when Internet is adopted to more efficiently manage inter-company relationships and processes. The model involves two variables: network integration and technological integration.

Network integration is the sharing of resources and co-participation in a common environment where the relationships in a supply network are co-ordinated using information networks. Technological integration is a company's ability to have information systems which can be used to control many different company functions and which interact with each other either using similar communication protocols or adopting interfaces to allow different systems to communicate.

The model presented here proposes five stages for the implementation of e-business within an existing company: traditional communication tools, internal integration, Web-based communication tools, XML Web-based platform, and integrated enterprise.

Traditional communication tools. In the first stage, the information flow between the various players in the same supply chain and the company in reference is managed using traditional communication systems. These systems are very inefficient in that they do not make it possible for information to be transferred quickly with a low probability of error.

Enterprise Integration. In this stage, the company integrate the company's functions in a management information system. The implementation of these systems is difficult and high cost proposition that places tremendous demands on corporate time and resources.

Management information system provides two major benefits that do not exist in non-integrated departmental systems: (1) a unified enterprise view of the business that encompasses all functions and departments; and (2) an enterprise database where all business transactions are entered, recorded, processed, monitored, and reported [4]. This unified view increases the requirement for, and the extent of, interdepartmental co-operation and co-ordination. Management information systems take a lot of time and money to implement, they can disrupt a company's culture, create extensive training requirements, and even lead to productivity dips and mishandled customer orders that, at least in the short term, can damage the bottom line [16].

Web-based communication tools. During the third implementation stage, on the other hand, Internet is used to communicate with suppliers as well as with all of the players

involved in the supply chain. In this case, an environment is created where the players can access and use various services via the Web. This solution does not integrate the Web environment with the company's internal management system. Therefore, some of the interfacing activities between the different information systems must be carried out manually. Compared to the previous stage, the time needed for the various players to communicate is reduced (faster information flow) and the accuracy of the information transferred increases, with a significant reduction in the number of mistakes. Dealers and retailers can access a series of forms via Web which allow them to place orders. This solution is particularly appropriate for small suppliers and retailers since there are no significant investments required with regards to technology or skills.

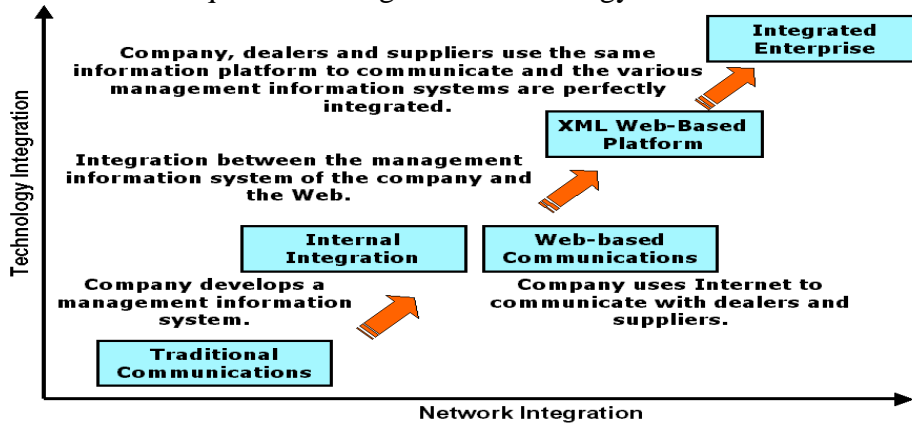


Figure 2: Evolutionary model of e-business implementation.

XML Web-based platform. The fourth implementation stage involves more integration between a company's internal management system and the Web environment. At this stage an interface between the two environments must be developed. Not all of the companies in the supply chain can carry out this type of implementation, rather, only medium- to large-sized companies which have significant contract power with regards to their suppliers and customers can. In this case, the leader company develops a software which allows the main suppliers and customers to see the situation of the warehouse in real time. Whereas in the previous stage, orders placed via Web were transferred manually to the company's internal management system, in this stage they are automatically converted from the Web channel and transferred to the leader company's management system. Access to the system is directly controlled by the leader company; at the beginning, only the main partners have access. In this way, the manual activities are reduced, as is the lead-time, and all of the stages of procurement and fulfilment can be traced. The technology needed to make all of this possible is offered by XML applications.

Integrated enterprise. The fifth stage represents a probable evolution of information and communication systems. In particular, the information system being developed would have to bring together different companies working in the same field into a sort of consortium. By using Web interfaces, a platform is created in which many suppliers and customers can collaborate to make some processes more efficient.

The adoption of strategies to integrate the supply chain offer much more than just an improvement in company efficiency. Some companies are discovering new ways of carrying out business and new opportunities which were previously not possible. In fact, at this level, all of the logistical flows are redefined and there is a move towards the creation of a "supply network". The players involved in these networks can create new products together, work towards mass customisation and penetrate new markets and new customer segments. Some companies considered here are presently using XML Web-based platforms. However, the specific need to integrate more and more all of the players in the supply chain was expressed during the interviews.

6. Conclusions

Even if the companies studied are geared towards different markets, the strategies they have used are quite similar. As far as e-procurement and e-fulfillment are concerned, the players involved are suppliers or customers that the companies already have a stable and trusting relationship with. As far as the technological aspect is concerned, the companies created platforms at the beginning of the supply chain which allow suppliers to take part in a private environment where they can access the companies' production plans. This way each supplier can manage its own virtual warehouse and plan its own production from a distance without having to invest in software systems to carry out in-house management.

Further studies will have to be carried out to better understand the evolution process involved in implementing e-procurement and e-fulfillment projects in companies. In particular, it is important to understand if there is an evolutionary path which aims at integrating the procurement and distribution stages into one single virtual environment. It would be interesting to study which stages of the procurement and distribution processes are made digital, if this takes place in the same way for the two processes and if this can be applied to different industrial sectors. Furthermore, it is necessary to evaluate if the evolutionary path changes according to the product which is being commercialized and what effects this may have on the entire process. The "supply network" will be the field of research of further studies.

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