World Academy of Science, Engineering and Technology
International Journal of Economics and Management Engineering
Vol:3, No:2, 2009

A Research in Relationship between ICT[1] and SCM[2]

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***Abstract*—**ICT and supply chain management (SCM) are two notions, which have attracted much attention among both academicians and practitioners during the last decade. However, the discussion of the relationship between the two notions has been limited and fragmented. In this paper, we will present a summary of the discussion of ICT components and SCM on an extensive literature review. Then, we will discuss the interrelation between ICT and SCM from some major components and applications of ICT perspective. After all, we can introduce e-SCM concept, that arisen recently in management literature, in order to cover the whole topic. The authors look at all of the major components of electronic supply chain management and demonstrate that the future holds tremendous opportunity for those firms that take advantage of all of its possibilities.

***Keywords*—**e-SCM[3], ICT, IT[4], SCM.

I. Introduction

THE traditional way of managing supply chains has changed dramatically over the last decade. Face-to-face management, manual tracking systems, paper-dominated order processing systems, and wired communication links were the primary management tools available to logistics managers. Today, they are obsolete [1].

The countries which have successfully experimented with the supply chain network and knowledge management in the private sector have definite experience to share and lessons and road-map to follow. It has been widely acknowledged that supply chain network has been successfully implemented by the business sector and governments [2]. SCM has gained importance in the marketing field as being one of the main marketing processes that has a positive influence on shareholder value [3, 4].

But there is a reality that indicates SCNs[5]are becoming complex for two reasons. First, a global imbalance in labor costs forces enterprises to source from countries with cheaper labor in order to control production costs to stay competitive. Second, consumers are becoming increasingly more sophisticated, demanding customized products that better meet their needs. The resulting increase in product variation makes demand forecasting more difficult as an enterprise now has to predict both volumes and option mix instead of a single demand pattern. Furthermore, increased product types result in a greater number of suppliers to manage and higher coordination costs. In addition to optimizing its processes within itself, the enterprises within a supply chain must now coordinate with each other [5].

Being a complex network of suppliers, factories, warehouses, distribution centers and retailers, the success of any SCMS depends on how well these system components are managed. In recent times information has become a key player in determining the productivity of a complex enterprise. The enterprise's ability to process information and make rapid but right decisions promises growth. In such a scenario it is necessary to forecast and estimate the demand, supply raw materials to the point of sale locations on and reorganize the business structure if necessary. To realize these goals a system must seamlessly integrate both information and material flow. Such a system can provide access to information, aid decision-making and execution.

At the other hand, The capital spending on information and communication technology is increasing in many countries [6]. The impact of ICT on many different aspects of economy has been discussed with the help of the conceptual models. However, only recently empirically grounded models have been presented, they found that ICT has a positive and significant impact on labor productivity and economic growth. The literature review identifies that ICT is expected to have a pivotal role in managing supply chains, now and in the future. In fact it seems that the use of ICT is crucial, especially in the fast moving industries: particularly for managing contemporary supply networks. Moreover, the close relationship of these two concepts, SCM and ICT, make it sometimes hard to assess which one contributes what benefits. For example, implementing a VMI[6]-model with EDI[7]-information transmission can lead to substantial reduction of inventories, and at the same time increase material availability. But could the benefits have been achieved without EDI by, for example, exchanging information via fax? Or, on the other hand, could the information exchange even

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[1] . Information and Communication Technology
[2] . Supply Chain Management
[3] . Electronic Supply Chain Management
[4] . Information Technology
[5] . Supply Chain Network
[6] . Vendor Managed Inventory
[7] . Electronic Data Interchange

have been possible in any other way? Finally, consideration is made of the lack of in-depth case studies describing optimum situations and recording the impacts and benefits of ICT.

This special issue provides managers and researchers with ideas on how the information and communication technology can improve the management of their supply chain systems.

II. Definition and Literature

A. Supply Chain Management

A-1 Defining SCM

Although SCM has gained in popularity, there remains confusion about its meaning and definition. Some field experts regard SCM as an operational process that involves the flow of materials and products. Other experts define SCM as a managerial philosophy or the implementation of a managerial philosophy. These deviations can be found in the following definitions [7]:

SCM as a managerial philosophy:

Supply chain management is an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user.

SCM as the implementation of a managerial philosophy:

The extension of integrated behavior to incorporate customers and suppliers through external integration is called supply chain management.

SCM as a set of managerial processes:

SCM is the process of managing relationships, information, and materials flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption.

A single and encompassing definition of SCM [8]:

Supply chain management is defined as the systemic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.

The last definition implies that SCM involves multiple firms, multiple businesses activities, and the coordination of those activities across functions and/or firms in their supply chain process. It is noticeable; there is another definition with comprehensive figure that shows SCMs components in this paper (section IV).

Effective SCM can help lower production and distribution costs through seamless cooperation between business partners in their supply chain. In the meantime, the performance of supply chains can affect customers' satisfaction. Therefore, SCM can be seen as a source of competitive advantage and a lever for profit margin. Specifically, the goals of SCM can be categorized as the following:

- Decrease inventory costs by matching production to demand. This goal is consistent with the concept of JIT[8] inventory management;
- Reduce overall production costs by streamlining the products flow within the production process and improving information flow between business partners; and
- Improve customer satisfaction by offering increased delivery speed and flexibility through the seamless cooperation with the distributors and vendors.

A-2 Dimensions of SCM

A supply chain network is a series of value-added processes (also called tier, state or phase) owned by one or more enterprises. The chain starts with the raw material supplier and ends with the consumer. Each intermediate tier is a supplier to its adjacent downstream tier and a customer to its upstream tier. SCNs[9]are becoming complex for two reasons. First, a global imbalance in labor costs forces enterprises to source from countries with cheaper labor in order to control production costs to stay competitive. Second, consumers are becoming increasingly more sophisticated, demanding customized products that better meet their needs. The resulting increase in product variation makes demand forecasting more difficult as an enterprise now has to predict both volumes and option mix instead of a single demand pattern. Furthermore, increased product types result in a greater number of suppliers to manage and higher coordination costs. In addition to optimizing its processes within itself, the enterprises within a supply chain must now coordinate with each other. Supply chain management (SCM) has two goals:

(1) Coordinate the activities of each tier, as well as the transition between tiers to facilitate the smooth and efficient row of products down the value-added chain at the least cost and minimum delay,

(2) Match the supply with the market demand [5].

Any way, the development of SCM concept is a Consequence of a long-standing and ongoing development, taking place in the management of material flows and the transformation process itself. The development in this field aims to leverage strategic positioning over competitors mainly through improved operational efficiency. We believe that supply chain can be seen as a given structure of collaborating companies working together in satisfying customer demand, and SCM is a conscious development and guidance of these relationships in order to gain competitive advantage for the collaborating chain members over other industry players [8-10].

When collecting the most important dimensions of a successful SCM inevitably the first is the increasing strategic role and, in parallel, the increasing **strategic orientation** of operations [12,13].

The final goal is to increase the competitiveness of companies and make operations to be able to contribute to the execution of firms' strategies [11]. This can be accomplished through various programs and techniques, which appear within the company (e.g. ERP, new organizational forms) and along the supply chain both on the supplier side (e.g. vendor-managed inventories) and on the distribution side (e.g. efficient customer response, quick response, e-commerce).

[8] . just-in-time

[9] . Supply Chain Network

A-3 Functions of SCM

In a simplified supply chain, the following typical functions can be found in SCM [8]:

(1) Demand planning: Demand planning determines how much product should be made through data mining on the enterprise database.

(2) Supply planning: Supply planning covers replenishment requirements and it makes sure that safety stocks are at appropriate levels.

(3) Manufacturing scheduling: Manufacturing scheduling looks at available resources and prepares a production schedule based on real-world restrictions.

(4) Transportation planning: Transportation planning determines the best, most cost-effective method for warehousing and shipping.

Some less common functions can be found in certain SCM applications:

(1) Graphical supply chain modeler: Graphical supply chain modeler provides visible simulations for supply chain modeling. Especially in supply chain design, a graphical modeler enables rapid modeling of a supply chain, starting at the extended enterprise and proceeding down to lower levels. Designers can use intuitive click, drag and configure techniques to achieve swift development.

(2) Supply chain optimizer: Supply chain optimizer performs linear programming simulations for creating an optimized plan or schedule. Supply chain optimizer enables the enterprise to synchronize global purchasing, manufacturing, product flow and distribution while adhering to strategic objectives.

A-4 Driving Forces of SCM

The popularity of SCM is attributed to several driving forces, i.e. global sourcing, an emphasis on time- and quality-based competition, and their respective contributions to greater environmental uncertainty [8].

Corporations have increasingly networked with global suppliers for seeking effective flow of materials for manufacturing process. In today's market, the competitions are based on time and quality. Delivering a defect-free product to the customer on time is a requirement in the market place. In order to meet such requirements, a closer coordination with suppliers and distributors is desirable.

Global outsourcing and performance-based competition, combined with rapidly changing technology and economic conditions, all contribute to marketplace uncertainty. This uncertainty requires greater flexibility on the part of individual companies and distribution channels, which in turn demands more flexibility in channel relationships.

A-5 Evolution and history of SCM

The driving forces of SCM explain the sources of developing SCM. Historically, a firm was not likely to make either its supplier or customer a partner. In many industries, each firm played one supplier against another, demanding and getting lower prices [14].

The post-World War II supply chain was a set of linear, individualized processes that linked manufacturers, warehouses, wholesalers, retailers and consumers together in the form of a human/paper chain [15].

Beginning in the 1960s and 1970s, firms started to view themselves as closely linked functions whose joint purpose was to serve their customers. This internal integration was often referred to as material logistics management or materials management [16]. During this period, SCM innovations such as MRP[10] were developed. Those firms that successfully integrated these functions did improve their performance. However, some constraints, such as customers' or suppliers' unresponsiveness did hinder the improvements. These constraints prevented the firms from instantly responding to market changes.

In late 1970s and early 1980s, US firms faced fierce competition from their Japanese counterparts. Especially in the automobile industry, Japanese carmakers utilized just-in-time delivery to achieve efficient inventory management. Detroit's Big Three had to find ways to communicate with suppliers effectively. The solution at the time was to communicate through batch orders and via a standard called EDI [17].

Since the 1990s, the pervasive adoption of Internet and Web technology have promised a ubiquitous and less costly way to tie companies and their business partners together in the supply chain. The great collaboration made e-Commerce buzzwords like "B2B" and "B2C" known to almost everybody in business circles. With the advancement of information technology, the collaboration of business partners will continuously improve the effectiveness of SCM. Gartner Group even gave a "c-Commerce" (collaborative commerce) tag to the emerging business model starting from the year 2000 [18]. A summary of SCM evolution stages is illustrated in Table I.

TABLE I
STAGES OF SCM EVOLUTION

Stage	Years	Milestone	Lessons Learned by firms
Introductory	1960s-1970s	MRP	Firms are closely linked Functions, Internal integration will help serve customers better
Growing	Late 1970s-Late 1980s	EDI	Just-in-time delivery demands for efficient communications with suppliers
Pre-mature	1990s-present	E-commerce, B2B and B2C	The Internet provides a ubiquitous and cost-efficient way to tie together companies and their business partners in the supply chain
Future (mature)	Starting from 2000	C-commerce	Collaboration of business partners will continuously improve the effectiveness of supply chain management

[10]. Material Requirement Planning

A-6 Challenges for SC management and future prospects

The challenges facing SCM as theory and practice stem from their interplay and misalignment. A research reveals the substantial gaps between theory and practice. They reported, one central challenge is to the very idea of "managing" the supply chain. Who could and should have this responsibility? Arguably one ideal would be a separate function independent of the existing array of functions which are partially but not fully involved. Such a developed function might act as the arbitrator of supply and demand. A number of their respondents envisaged that this development could be supported by the maturation of the 4PL[11] concept. Alternatively, some commentators suggest the need to redefine the purchasing role. A related challenge is to increase the scope of SCM involvement – the "arc of integration".

They declare, this challenge can only be achieved if the enablers identified above are harnessed more effectively – the greater transparency of information and knowledge, the formation of appropriate relationships, and the design and use of appropriate measurements [19].

B. Information and Communication Technology

There are many stories told about how information and communication technology and other related technologies are altering our way of life. Some claim that technology is radically changing business while others like Porter [20] predict that new technologies are only facilitating managerial changes and marketing exchanges. Between the two extremes of nothing or everything changing lies the answer. It should be said here that the Internet and most importantly the WWW[12] are not the only forms of information and communication technology. Information and communication technology has existed long before the internet and in this paper the term information and communication technology consists of all the technologies capable of transmitting and processing information. More precisely we use the following definition:

"Information technology is a term that encompasses all forms of technology utilized to create, capture, manipulate, communicate, exchange, present, and use information in its various forms (business data, voice conversations, still images, motion pictures, including those not yet conceived)"[21].

If you pay more attention, ICT and IT are two closed concepts which their components and applications are similar. Just the difference between them is "communication equipments", so when we use the term "IT", it can be used instead of ICT, but with respect to its necessary equipments. We will describe the components and applications of ICT (or IT) and the relationship of them with SCM in next section.

C. Literature of ICT Effects on SCM

A review of the existing literature shows the abundance of papers dealing with IT in SCM. Gunasekaran and Ngai [22] provide two literature reviews on the subject, although neither is comprehensive. Common terms for business models using IT are "e-commerce" and "e-business" – the former relating typically to web-based sales, and the latter to a more holistic use of IT. In many instances, however, e-business refers to the use of the internet [23]. In more recent literature, comprehensive discussion is given of the role of new information technology for SCM. According to Simchi-Levi et al. [24] the objectives of IT in SCM are:

- Providing information availability and visibility;
- Enabling a single point of contact for data;
- Allowing decisions based on total supply chain information; and
- Enabling collaboration with supply chain partners.

The most typical role of IT in SCM is reducing the friction in transactions between supply chain partners through cost-effective information flow. Conversely, IT is more importantly viewed to have a role in supporting the collaboration and coordination of supply chains through information sharing: for example, Lee and Whang [25] present IT as one of the key cures for bullwhip effect in supply chains. Third, IT can be used for decision support. In this instance the analytical power of computers is used to provide assistance to managerial decisions. For a detailed discussion of decision support systems for supply chain management, see [24, 26] for a review of analytical models in the supply chain management literature.

Finally, the literature review identifies that ICT is expected to have a pivotal role in managing supply chains, now and in the future. In fact it seems that the use of ICT is crucial, especially in fast-moving industries, and particularly for managing contemporary supply networks. Moreover, the close relationship of the two concepts of SCM and ICT sometimes makes it hard to assess which one contributes what benefits, so Extensive, focused, quantitative surveys are also needed.

III. The Relationship between ICT and SCM

IT in general, and IT in SCM, is argued to enable great opportunities, ranging from direct operational benefits to the creation of strategic advantage. For example, Benjamin et al. and Porter and Millar [27,28] argued in the 1980s for the strategic possibilities of IT for business. Porter and Millar [28], in particular, advocate that IT changes industry structures and rules of competition, creates competitive advantage, and creates new business opportunities. In the logistics/supply chain context, Bowersox [9] outlined that IT is key in supporting companies creating strategic advantage by enabling centralized strategic planning with day-to-day centralized operations. A common view is that IT has a profound impact on managing supply chains. Using case studies in six Finnish industrial supply chains as data, Kemppainen and Vepsa¨la¨inen [29] argue that IT is, alongside specialization and outsourcing, a key precondition for networking of organizations. One group of scholars argues that because of information technologies, supply chains become less integrated and more market-oriented. Williams et al. [30] suggest that electronic SCM (in their discussion, "electronic" relates to the use of the internet) combines the structural benefits of SCM with the efficiency benefits of an arm's length approach, enabling, for example, lower cost

[11] . Fourth party logistics
[12] . World Wide Web

through possibilities of selecting from a larger supplier base. The landmark work of Malone et al. [31] proposes that the value offerings through IT are electronic communication (speed of communication), electronic brokerage (by IT providing a "lean", automated intermediary for resolving market transactions), and electronic integration (coupling of processes). IT seems to be particularly important in fast clock speed industries or when flexibility and agility are needed [32]. Many theoretical papers have addressed the value of IT in SCM [25, 9 and 33]. For example, Levary [33] suggests that IT in SCM provides a reduction in cycle time, a reduction of inventories, a minimization of the bullwhip effect, and improvement in the effectiveness of distribution channels. There are also a number of articles presenting empirical findings on the benefits of IT in SCM. The results of these articles are, unfortunately, diminished because of the typically narrow focus of discussion, for example estimating the dollar value of EDI in automotive manufacturer-component supplier-relationships or the impact of enterprise resource planning (ERP) on order completion performance under a period of one year after the implementation of the system [34]. Reporting the benefits of IT in SCM on a general level, is fraught with problems, because, as noted insightfully by Walton and Gupta [35] in their discussion of the benefits of EDI. Some benefits are dyadic (or multilateral), depending on both (or a number of) supply chain parties, and some benefits are individualistic. The magnitude of change differs from slight to significant process change to the creation of competitive advantage and benefits depend on where EDI is implemented. Thus, the benefits of IT in SCM are manifold, and can vary according to the implementation method. Moreover, the use of IT is closely related to process changes. As such, SCM can be viewed as a process change that is helped or enabled by IT. This makes it difficult, or even in many cases a profane academic exercise, to separate the origin of the benefit, whether derived from IT, process change, or both. Finally, with regard to the impact and benefits of IT, the controversial phenomenon of the productivity paradox of IT cannot be avoided. Macroeconomic studies in the US identified that despite growing IT investment, overall productivity statistics showed poor performance. However, several firm-level studies have argued for the non-existence of a productivity paradox. For example, in a longitudinal firm-level investigation showed that IT has a clear impact on firm output. More recently, Devaraj and Kohli [36] argued that the conceptual problem relating to the productivity paradox of IT is that in many studies only IT investment, not actual usage, is considered. They showed how the observed use of IT was positively and statistically significantly related to revenue and quality improvements with a specified time lag, while investment in IT, as such, with the same data, was not. In addition, David [37] draws a parallel between the IT productivity paradox and the introduction of a revolutionary electrical dynamo at the turn of the 20th century, and concludes that this innovation did not at first affect productivity, and argues that there are common problems with the introduction of new technology, which may realize productivity gains only after a considerable time lag.

Then, Appropriate use of "ICT, Knowledge Management and Information" sharing gave further boost to the benefits of the companies. In general, the companies could successfully utilize the ICT and obtain benefits such as:

- Giving more focus on reducing response time
- Redesigning the business processes
- Streamlining logistic activities across the supply chain to reduce cost and improved efficiency
- Developing high valued supply chain relationships
- Enhancing customer services for competitive advantage, and
- Trying to attain global standard and access to world market.

Most of the companies had considerably invested in the development of probable integrated ICT infrastructure solutions for logistics and supply chain network management in terms of computer hardware, software, and connectivity by means of EDI, BCS[13], ERP, Intranet, Extranet and Internet. It shows the importance and role of ICT in supply chain. The role of ICT in supply chain has emerged as under:

- Negotiating Multilateral trade agreements
- Finalising Bi-lateral trade agreements
- Expediting communications and transportation of data/information
- Lowering the cost and time reduction [2].

According to Simchi-Levi et al., [23] objectives of IT in SCM are:

- Providing information availability and visibility
- Enabling single point of contact of data
- Allowing decisions based on total supply chain information
- Enabling collaboration with supply chain partners

Elaborating on the commonly viewed functional roles of IT in SCM, the following classification can be adopted (Fig. 1).

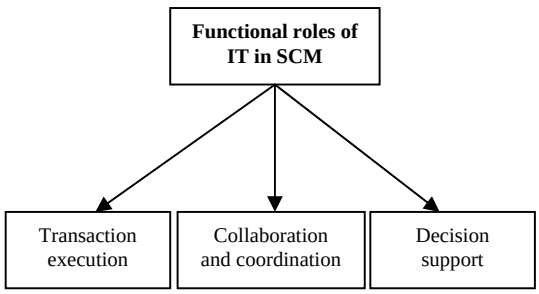

Fig. 1 Functional role of IT in SCM

The most typical role of IT in SCM is reducing the friction in transactions between supply chain partners through cost-effective information flow. Conversely, IT is more importantly viewed to have a role in supporting the collaboration and coordination of supply chains through information sharing. Third, IT can be used for decision support. In this instance the analytical power of computers is used to provide assistance to managerial decisions.

[13] . Bar Code System

Instead of consideration the relationship between SCM and ICT as a whole, we suggest to discuss the interrelation between them, from some major components and applications of ICT perspective. The components such as internet (web), e-business, e- internet marketplaces, e-procurement, intranet and extranet**.**

A. Internet (web)

The WWW provides new channels for product promotion, sales, and distribution with substantial benefits to consumers and producers alike. These new channels change the business ecology in dramatic ways and can make or break existing businesses in a short period of time. Adopting electronic commerce via the Web has become a key strategy to manage the supply chain [5].

We consider that the impact of Internet on SCM comprises one or more of the following aspects:

1. e-commerce: Internet consists on a new commercial channel where firms sell their products and services: New supply chain processes must be defined in order to answer the challenges of this new channel. For example the order fulfillment process, needs activities different from the traditional distribution channels.

2. Information sharing: Internet is the medium to access and transmit data and information among supply chain partners. This flow of information within the supply chain is, in our days, crucial to carry out an effective and efficient collaboration and integration along the supply chain. Internet offers a high-speed and global medium to enable this flow, which given its open nature, has advantages over other information networks, such as VAN[14], EDI, etc. One example of this information sharing is the impact of Internet on the procurement process, known as e-procurement (that will discuss in this paper).

3. Knowledge sharing: Internet not only enables the supply chain partners to access and share information, but also to access data analysis and modeling to jointly make a better planning and decision making. Knowledge is considered, in the Information Systems Management area, the result of applying analysis, interpretation and modeling to information. The access to this knowledge will enable companies not only to share information but also to share planning and decision-making. This collaboration among firms will lead to cost reductions and a better and faster response to the market. Decision technologies that offer the access to this knowledge, or the tools to obtain it, will become an important issue in the future. One example of this knowledge sharing is the collaborative forecasting. The availability of analytical tools (such as forecasting models) to translate sales data into meaningful knowledge and business intelligence can lead to a rapid decision-making to respond to customer demands.

4. Design an efficient supply chain: Managing communication, collaboration and competition is critical to ensure a high level of responsiveness and to maintain an effective cost structure of the supply chain. Internet permits to have access to information and knowledge in a faster and inexpensive way, however, this is not enough to ensure responsiveness and efficiency. To achieve them, there is the need to design the supply chain in such a way that it leads to an efficient flow of goods [38].

At the other hand, the growth of the Internet has presented supply chains with many significant opportunities for cost reduction and service improvements. These opportunities include:

1. On-line vendor catalogs from which buyers can find, select, and order items directly from suppliers without any human contact.
2. The ability to track shipments using a wide variety of modes including truck, rail, and air transport.
3. The ability to contact vendors or buyers regarding customer service problems from late deliveries, stock-outs, alterations in scheduled shipment dates, late arrivals, and a wide variety of other service issues.
4. The ability to reserve space in public warehouses for anticipated deliveries to market locations.
5. The ability to schedule outbound shipments from private and public distribution centers on a 24-hour basis.
6. The ability to provide 7-day/24-hour worldwide customer service.
7. The ability to receive orders from international customers.
8. The ability to check the status of orders placed with vendors.
9. The ability to place bids on projects issued by government and industry buyers.
10. The ability to notify vendors of changes in configurations in products that are produced to order.
11. The ability to pay invoices electronically and to check outstanding debit balances.
12. The ability to track equipment locations including rail cars, trucks, and material handling equipment.
13. The ability to directly communicate with vendors, customers, etc. regarding supply issues on a 7-day/24-hour basis via E-mail.
14. The ability to schedule pickups and deliveries.
15. The ability to be more responsive to customer service problems.
16. The ability to reduce service costs and response time [39].

Finally we can conclude, The Internet fosters the integration of business processes across the supply chain by facilitating the information flows necessary for coordinating business activities. However, the Internet also supports the use of market mechanisms, such as auctions, that foster price competition. Using market mechanisms is less likely to generate a sustainable competitive advantage, but they might offer the opportunity to purchase some items at a lower price. Managers have the challenge of selecting the Internet-enabled coordination mechanism that best fits the needs of a variety of business situations in the supply chain [40].

B. e-business

What we now call e-business arose through the proliferation of the internet as a platform for IOS[15] in the late 1990s and has been particularly significant for developments in the operation and strategic management of supply chains and

[14] . Valid-Added Network

[15] . Inter-Organisational Systems

networks. This is not a surprise, the rise of the internet as a communication channel (and its supporting systems and software) has changed the economics of information, gives rise to opportunities, new forms of affiliation between organisations, new forms of relationship between organisations and new forms of transaction between organisations.

A significant theme for research into IOS has focused on their impact on governance structures. Employing transaction cost terminology and theoretical construct, much of the IOS literature has explored conditions under which electronic markets and electronic hierarchies exist. Two opposing views have been posited: On one side, Malone et al. [31] for example, argue that since developing inter-organisational electronic networks improves co-ordination between firms to reduce the costs of searching for appropriate goods and services (which they call electronic brokerage effects), one of the major effects of inter-organizational networks would be a shift from hierarchical to market relationships. On the other side, others have contested that greater collaboration supported by IOS favours the development of electronic hierarchies rather than markets.

The impact of e-business on the supply chain is recognized in the information strategy (IS) literature. With the advent of IOS, and e-commerce in particular, it is clear that questions of alignment go beyond what we have come to know as the business – IT alignment issue. It is no longer simply a case of internal alignment alone. Such issues now include alignment with collaborating companies' business and IT strategies and customer requirements (recent heightened interest in customer relationship management).

In other words, e-business/e-commerce has a significant impact on level of analysis issues in management research, specifically broadening the perspective to analysis of supply chains and networks.

There is some debate about the scope of supply chain management, some considered it as the planning and control of the total materials flow; they viewed it as an alternative form to vertical integration; and others have defined it as the management of a network of organisations or entities. One way of dealing with the diversity of definitions is to concentrate on some of the core processes and functions relating to the management of supply chains – namely sales and marketing, fulfillment (i.e. logistics, warehousing and distribution) operations planning and procurement. Naturally, this is not an exhaustive approach, but we would contest that it can provide sufficient scope for an analysis of the key initiatives being undertaken by organisations in their supply chain management. From this perspective we have seen discussion of the implication and impact of e-business on supply chain processes pointing to greater integration and collaboration across e-business supported supply chains. Some claim that as supply chain integration increases as a result of e-business, stronger relational ties develop between the companies across supply chains. Focusing specifically on the implication of e-business for supply chain management, they identify potential for improvements arising from adoption of e-business systems in the following areas:

- Cost performance (from improved productivity and lower input prices);
- Customer service (service quality);
- Process capability (quality consistency); and
- Productivity and dependability (from increased control of material flows along the supply chain).

For industrial marketers, e-business has triggered a growth in interest in network (rather than dyadic) levels of activity which concentrates decision making on issues of supply chain optimization. We can highlight the contribution of e-business to supporting value added services to the end customer and improving relationships between customer and supplier.

In the fulfillment field, a major impact of e-business is its role as a mechanism for improved control of supply through collaborative planning, forecasting and replenishment. An integrated control system supported by e-business infrastructures allows companies to benefit from reduced inventories, total cost reduction and increased service to customers. According to a recent white paper from the management consultants, e-fulfilment makes it possible to satisfy customers who are demanding more and more in terms of faster service, regardless of geographical location, thus requiring greater efficiency in the distribution process of the product.

E-business can thus be seen to impact on supply chain structures; supply chain coordination and supply chain relationships [41].

C. e-procurement

Like Lancioni et al., Presutti posits that the impact of Internet technologies will more than reduce costs, but rather decrease assets on hand and increase revenues. Presutti focuses on the creation of value within the supply chain utilizing e-procurement and supply management. Using the EVA[16] model, Presutti provides a conceptual framework or model for firms to use in strategic decisions regarding the deployment of Internet technologies within their supply chain.

Assuming Internet technologies are integral to the firm's strategic choices, Min and Galle profile adopters and Non-Adopters of e-purchasing in their paper ''E-Purchasing: Profiles of Adopters and Non-Adopters''. The authors surveyed both adopters and Non-Adopters of Internet technologies to identify relevant contextual variables (organizational readiness, user characteristics, and information infrastructure) that influence firms' adoption decisions. Broadly, this study reveals that firms in information intensive industries are more likely to adopt e-purchasing than firms in less information intensive industries [1].

D. Extranet and Intranet

Extranet facilitates information sharing between strategic partners as well as the customers. It connects multiple and diverse organizations online behind virtual firewalls, where those who share in trusted circles can network in order to achieve commercial-oriented objectives. It extends the business enterprise to include strategic partners, suppliers,

[16] . Economic Value Added

distributors, contracts and others that operate the physical walls of the organization but are nonetheless critical to the success of business operations.

Security and access privileges are two of the most important issues in Intranet/Extranet. Companies want to link up the computer systems within their organization boundaries as well as outside the boundary but at the same time prevent illegal access. The most common practice is to set a firewall around the company's information system, and sometimes between departments. The firewall proxy server or router programs scrutinize messages from outside the firewall to determine whether they are allowed inside the firewall. Partners of the company are given accounts and passwords to access the company's systems via Extranet.

There are three justifications for developing an Extranet. The first is to leverage existing investments in information technology. Many companies already have their documents on line and also have Internet access. Some of them have also adopted EDI to coordinate with the channel partners. By choosing to deploy an Internet-based application that is already supported by the technology already in use by the partner, companies will avoid a lot of hassles associated with custom clients. Second, because the Internet is governed by standards, any extranet applications developed to these standards will be virtually guaranteed to work with the browsers, reducing the application developing time. Third, it is possible to customize extranet applications to match the business model of individual partners. This approach reduces the cost to staff human service representatives. Furthermore, these applications are available and accessible on a 24 hours basis, improving customer satisfaction.

The components of an Extranet generally include network access, servers, business applications and interface software. Since an Extranet spans multiple remote organizations, Internet connectivity is required among the participants. Connections may be via dedicated Internet lines or dial-up via modem. Extranet servers house the tools required for a successful Web presence which include the functionality's like security, access control, transaction management, site operations, multiple-platform compatibility, deployment versatility and an extensible and scaleable architecture. Business applications provide the functionality for Extranets to serve as valuable tools for electronic commerce or other collaborative business objectives. Extranet solutions must be extensible enough to include the addition or modification of applications as business goals and objectives evolves. Interface layers are bridges between system software and graphical user presentation that exist within any software product. Effective Extranet interfaces address four interaction scenarios: individual, one-to-many, two-way, many-to-many interactions.

Three types of extranet models have arisen in general practices: secured Intranet access model, specialized application model and electronic commerce model. The secured Intranet access model allows partners directly into the corporate Intranet, either through the Internet or via a direct, dial-up connection. This type of Extranet is suitable for strategic partners that are crucial to the enterprise. With the specialized application model, the Extranet is an application developed specifically for partners that may also be part of the Intranet. This type of Extranet is suitable for important partners that are important, though not key to the survival of the enterprise. The electronic commerce model uses electronic commerce techniques to service a partner segment, including similar security architecture and transaction processing. This type of Extranet is suitable when the partners segment contains hundreds of companies. In general extranet applications should be simple and work reliably. Security is imperative as trust may be compromised. A ramification of a breach in security could be far greater than whatever data was lost.

The Extranet makes information sharing and customization strategies possible. One of the original reasons for building an Extranet is to link an enterprise to its business partners. By sharing process information such as manufacturing schedule and production capacity and external information such as consumer demand, an enterprise is able to better coordinate its activities with those of its upstream and downstream partners. The bullwhip effect demonstrates how lack of accurate consumer demand information causes inventory problems that compound as orders travel up the supply chain.

Extranet also allows low-cost customization for both consumers and producers by facilitating information exchange. Consumers are able to initiate customization by selecting information that they are interested in receiving. From the consumer selections, producers are able to construct consumer profiles that allow producers to better design products/services to meet consumer preferences.

Extranet facilitates the selection and negotiation activities in the procurement process. Fig. 2 shows an online bidding process. A 3rd party acts as a broker to provide the place in which the bidding commences including maintaining a database of bidding information and negotiation tools like group ware systems. A manufacturer submits its product specifications to the pool of suppliers, who evaluate them and submit their bids. The manufacturer then selects a supplier and the two parties negotiate the contract on-line via the Extranet. The supplier fulfills the terms of the contract and sends the required product to the manufacturer who pays for it. The Web technology reduces the time taken to transmit bids between suppliers and customers, and also gives accesses to greater pool of suppliers and customers respectively [5].

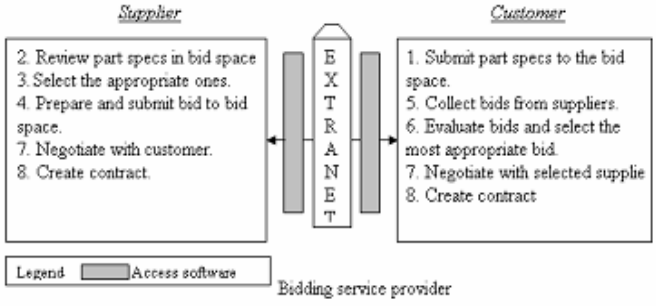

Fig. 2- Online bidding process

E. e-Internet Marketplaces

e-IMPs or IEMP[17]s are defined in terms of participants, using acronyms B (for businesses), C (for consumers), and G (for governmental segments) (see Fig. 3). An IEMP, where business suppliers sell goods and services to private buyers, is thus a Business-to-Consumer (B2C) IEMP. Examples for B2C IEMPs are Amazon.com, the online bookstore, or Letsbuyit.com. The more widespread IEMP types are B2B IEMPs like Transora, Covisint, and VerticalNet. We define for our purpose an IEMP as a place on the Internet, where many business buyers and suppliers meet, trade, and collaborate. Our definition excludes EDI, fax, or telephone linkages between two actors as well as simple information exchange, as IEMP is done over portals, search engines, and the Internet itself amongst private customers and governmental institutions [42].

	Government	Business	Consumer
Government	G2G	G2B	G2C
Business	B2G e.g. Gatetrade	B2B e.g. Transora Verticalnet, Covisint.com	B2C e.g. Amazon.com, Letbuyit.com
Consumer	C2G	C2B e.g. Priceline.com	C2C e.g. eBay.com

Fig. 3 Participant segments for IEMPs

Goldsby and Eckert, in their article ''Electronic Markeplaces: A Transaction Cost Perspective'', investigate the value of ETM[18]s on supply chain networks, using a TCP[19]. The authors frame the decision to utilize ETMs as a ''make'' (maintain in-house control over transportation procurement) or ''buy'' (outsource the transportation procurement) decision and attempt to predict which scenarios are ripe for using ETMs and the most appropriate form of ETM to choose. Those firms that value supply chain relationships are suggested to avoid impersonal ETMs. The success of ETMs is shown to rest on proving that they not only lower administrative costs but also create efficiencies and ease for customers.

Similarly, Skjott-Larsen et al., in ''Electronic Marketplaces and Supply Chain Relationships'', present an evaluation of the experience firms have had with on-line exchanges in supply chain management and present new ideas on designing exchanges to fit the types of buyer– supplier relationships [1].

IV. Introducing E-Supply Chain Management Concept

In order to define e-SCM, we need to establish what we understand by SCM. In spite of different definitions of SCM presented in this paper (section 2-1-1), we have adopted the definitions of SCM proposed by Lambert, Cooper et al. [43]. For SCM, they suggest to follow The Global Supply Chain Forum. The members of this forum defined SCM in 1998 as *"the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders"*. The definition entails a supply chain perspective from first supplier to end-user and a process approach. Then, SCM ideally embraces all business processes cutting across all organizations within the supply chain, from initial point of supply to the ultimate point of consumption. For Cooper, Lambert et al. 1998 [43], SCM embraces the business processes identified by the International Center for Competitive Excellence (see Fig. 4).

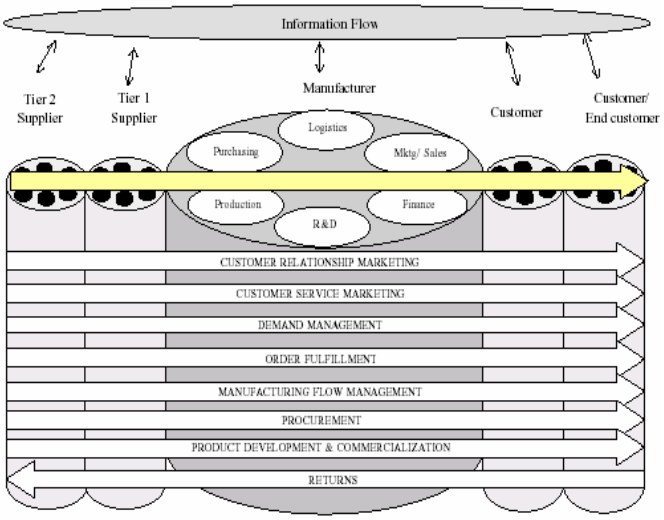

Fig. 4 Supply chain management [43]

We understand by e-SCM the impact that Internet has on SCM. Accordingly, e-SCM will refer to *" the impact that Internet has on the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders"* [38].

E-SCM has traditionally been referred to the impact of e-commerce in the logistics activities; however we indicate that ICT has a very important effect on SCM that has been very often forgotten: the coordination and integration aspects.

V. Conclusion

The traditional way of managing supply chains has changed dramatically over the last decade. Face-to-face management, manual tracking systems, paper-dominated order processing systems, and wired communication links were the primary management tools available to supply chain managers. Today, they are obsolete. The article provided an overview of some of the new tools discussed in this issue, including e-business, electronic internet marketplaces, extranet and intranet, e-procurement and the use of the Internet in managing supply chains. We pondered the impacts of information technology and digitization on supply chain and supply chain management. For this goal, we studied different components and aspects of ICT and made it easier to see how this components or in fact ICT (as an extent concept) effect the different parts of SCM. This special issue provided managers with ideas on how the ICT can be employed to improve the management of their supply chain systems. Additionally the

[17] . Internet-driven Electronic Marketplaces
[18] . Electronic Transaction Marketplace
[19] . Transaction Cost Perspective

growth of the Internet has presented supply chains with many significant opportunities for cost reduction and service improvements. Moreover it can be concluded that Internet permits to have access to information and knowledge in a faster and inexpensive way, however, this is not enough to ensure responsiveness and efficiency. To achieve them, there is the need to design the supply chain in such a way that it leads to an efficient flow of goods.

All in all, the authors look at the phenomenon of electronic supply chain management and demonstrate that In a nutshell, the future holds tremendous opportunity for those firms that take advantage of all of its possibilities.

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