
Logistics in the Internet age: towards a holistic information and processes picture

Sarmad Alshawwi

The author

Sarmad Alshawwi is in the Department of Information Systems and Computing, Brunel University, Uxbridge, Middlesex, UK.

Keywords

Supply chain, Logistics, New technology

Abstract

It is unquestioned that the growth of the Internet is a significant phenomenon. Not only is there an exponential growth in the exchange of goods and services over the Internet, but the Internet has changed the way information can be accessed and used. This short paper posits that the Internet has made a fundamental change in the nature of the supply chain information within an organisation. It also describes how Internet technologies have changed the visibility of the processes in the organisation's supply chain. Visibility concerns both information about processes and the capability for interacting with these processes. We conclude by asserting why a horizontal wide-view picture of all partners in a supply chain has to be taken in order to reap the commercial advantages offered by the new technology.

Electronic access

The research register for this journal is available at http://www.mcbsp.com/research_registers

The current issue and full text archive of this journal is available at <http://www.emerald-library.com/ft>

Introduction

The supply chain takes an integrated approach to logistics management. It covers the flow of goods from suppliers through manufacturing and distribution chains to end consumer. Christopher (1992) suggests that the real competition is not company against company but rather supply chain against supply chain. In recent years, information systems (IS) have been seen as more than resources that support various business processes. It has been recognised that information systems have the potential to act as a force that can be used by companies to gain significant advantages over competitors. Gattorna (1998) states that information technology (IT) has transformed the way companies use their supply chain to achieve competitive differentiation. The global explosion in the use of the Internet and its related technologies has had a significant effect on the way consumers conduct their shopping which in turn affected the way Internet retailers structure their logistics. Implementation of Internet technologies is also causing multi-company enterprises to re-engineer their supply chain structures to achieve a wider picture to encompass all trading partners and in some cases even end consumers.

The paper tries to discuss and highlight the impact of these technologies on the enterprise supply chain processes, structure and information flow.

Supporting supply chain management through IT/IS

The adoption of IT is one of the most important issues facing manufacturing and service industries. In doing so, allowing the development of a responsive and integrated infrastructure that supports the penetration of supply chains through systems such as enterprise resource planning. Although several definitions have been offered to describe information technology, a useful definition of IT is:

A generic term that describes the convergence of computers, telecommunications, electronics and resulting technologies (Willcocks, 1994, p. 1).

Therefore, from this definition, it would appear that IT can be regarded as technology based resources, which include hardware,

software, peripheral and communication systems. However, although the terms IT and IS are generally used interchangeably, the concept of information systems is much broader than that of IT. Information systems encompass a whole range of business processes that support the gathering of information from suppliers, and as such involve human interaction. Such systems refer to how information flows meet the requirements of an organisation. This flow of information may involve formal or informal procedures, and be processed using computerised or non-computerised systems. As a result, the concept of a computerised information system is one that has a degree of formality, and is always based around IT resources. Hence, in the context of supply chain management, information systems are considered in their computerised form, and taken as a set of hardware, software, people and information exchange procedures, which are required to process data that then produces information that is acted upon within the supply chain. The conceptual form of a computerised IS is presented in Figure 1.

The implementation of a computerised IS provides a framework where employee performance can be improved, through interacting with IT. However, Liebenau and Blackhouse (1990) point out that improving the IS does not necessarily mean improving the IT. Conversely, improvement in IT does not always mean an improvement in the information system. However, substantial amounts of money continue to be spent on the purchase of IT, in the anticipation that in some way the deployment of new technology will offer itself as a panacea, and in the process help companies improve their business performance and develop a culture of knowledge/information management and sharing. Clearly, the development of a IS goes beyond the adoption of IT, and requires an account of those factors that complement IT

for strategic, tactical or operational gain, with the implications of such being as far reaching as benefiting the supply chain.

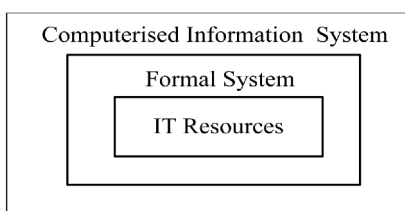
The logistics factor

Point-and-click shopping has arrived! Consumers surfing the Internet's World Wide Web now have dozens of places where they can spend money. Retailers have opened virtual storefronts to sell clothes, books, house appliances, and computers. In fact, almost anything found in the high street shops can now be obtained through the Internet. Although information-technology providers have worked out most of the bugs in Internet commerce, the question remains: How good are retailers in operating logistics that can ensure delivering products direct to the customer's doorstep? After all, consumers accustomed to ordering products with the click of a mouse will expect instant delivery of their purchases, intact and damage-free. Even a few days' delay in delivery would be totally against the new culture of the Internet. This electronic shopping culture is providing a new world of opportunities for carriers and third-party logistics companies that can handle the fulfilment and distribution for Internet sales. At the moment, though, only FedEx has announced definite plans for seizing the Internet. Logistics is the most neglected element of the core services in the on-line retail value chain (Cooke, 1999).

Although difficulty and time-consuming factors in purchasing goods the "usual" way are causing consumers to change their manner of shopping, retailers will still have to convince shoppers to purchase products at a virtual store rather than the one at the high street shop. How important then will the ability to handle home delivery be to the success of Internet retailing? Some, like John Browne, Microsoft's Internet commerce product manager, do not believe that logistics services will offer the defining difference for retailers on the Internet. He argues that there are many tough problems with selling on the Web, but shipping services is not one of them.

However, other industry experts take the opposite view. They contend that building electronic storefronts is the easy aspect of Internet retailing, whereas prompt, accurate order fulfilment and fast delivery are the most difficult part. Logistics will quickly become

Figure 1 Where IT and IS integrate together



Source: Modified from Liebenau and Blackhouse (1990)

the mechanism that distinguishes successful Web retailers from the not so successful. This all depends on how quickly firms realise the need to use logistics as a differentiating factor. The big winners in Web retailing will be the companies that re-engineer their logistics structures to offer new services and products that go beyond what is found in the electronic catalogues now being posted on the Internet. The change in logistics opportunity alters the whole spectrum of services offered on the Internet (Burgess, 1998; Cooke, 1999).

Clearly, Internet virtual stores have the potential to create a huge new sales channel in the twenty-first century. Although retailers will look to their mail-order experience for insight into how to manage home delivery, distribution will play a role as crucial as the information technology in getting customers to try and stick with on-line shopping. The home-delivery aspect will surely provide new opportunities for transportation and third-party logistics providers, especially if Web retailers discover that customer service is what matters most to consumers (Mougayar, 1998; Yannis, 1998).

Supply chain holistic view model: more visibility

Supply chains come in all sizes and shapes. Some have many links; others do not. Some chains emanate from manufacturing, while others are woven around marketing. They stretch across different industries and geographical boundaries. They handle different production requirements and move their products by different modes of transportation (Christopher, 1992).

No matter the type of chain, the purpose of supply chain management is to focus on meeting customer demand while minimising inventory of both raw materials and finished products. Yet as companies work together in an extended enterprise, the chain itself tends to gain more links and become more complex to manage.

Such complexity requires a shift in corporate thinking and re-engineering of its processes. An enterprise is no longer a single corporation; it is a loose collection of trading partners that could contract with manufacturers, logistics companies, and distribution organisations (Gattorna, 1998).

The supply chain has to have a holistic, end-to-end enterprise point of view.

The Supply Chain Council, an organisation that focuses on supply chain practices, has defined four processes common to all supply chains, namely plan, source, make, and move. Although that definition applies broadly, many practitioners (Cooke, 1999; Gattorna, 1998; Trent and Monczka, 1998) note that it best describes a single company rather than an extended enterprise. As mentioned above, nowadays many companies have multiple customers and multiple suppliers. The council's definition of a supply chain strikes many as too one-dimensional to describe the intricate cross-links that exist in a multi-organisation supply chain. Plan-source-make-move represents too linear an approach as companies focus mainly on the end consumer. What is required is that they also have to have an equal focus on the interests of their supply chain partners.

Given the numerous connections between supply chain partners, a more appropriate depiction of an extended enterprise would be an organic entity model. An organic entity representation will convey the synthesis of the numerous dynamic interactions that must occur among supply chain partners to fulfil consumer demand. Supply chains have to evolve from plan, source, make, and move to a holistic view of how multiple enterprises are going to co-operate to make efficient use of resources to get a product delivered. A holistic view of the supply chain would have to encompass the entire community of participants. Most consumer products supply chains involve participation by a multitude of enterprises before the product actually reaches the consumer. Take a supply chain for potato crisps as an example (adopted from Cooke (1999)). It would include the farmer who grows the potatoes, the package manufacturer who supplies the bags, the actual maker of the potato crisps, the food distributor who handles the product, the trucking company that performs store delivery, and the supermarket where the product is sold, to name just the prominent ones. There could be 30 or 40 enterprises working together just to enable potato crisps to be put on a store's shelf.

With so many companies involved, visibility becomes critical to the extended enterprise's success. Trading partners require visibility about activities throughout the pipeline in

order to co-ordinate the supply chain (Ellran, 1991; Cooper *et al.*, 1995). Even the farmer should have knowledge about potato-chip sales projections to plan his planting and harvesting of a potato crop. Likewise, the potato crisps maker should have information about crop conditions to plan his production schedule. At any point in time, supply chain members should know both quantity and status of inventory. For example, the manufacturer should be informed by the retailer the moment the product arrives at the store.

The importance of being connected

Goods cannot flow without information: information allowing, forbidding, directing physical flows; information checking and confirming; information to provide proof and audit trails for taxes and billing. Because the information flows are so intimately connected with the physical movement of goods, it is sensible to deal with them as part of the same system.

IT provides the means for trading partners to share intelligence to handle a complex supply chain. Instead of supply chains being driven by physical flows, they will be driven by information flows. Business software can help an individual supply chain partner track product demand and forecast sales in an effort to synchronise production with consumer takeaway. Most companies that do well have comprehensive systems that are proactive in terms of planning and forecasting (McFarlan, 1984). What should be worked towards is to try to provide real-time access between every partner in the supply chain.

But success for all supply chain members will not be possible unless the trading partners themselves integrate their disparate computer systems and hardware, thus creating connecting portfolios of IT applications (O'Brian, 1999). For instance, a supplier may connect his advance planning and scheduling system to a retailer's warehouse management system in order to predict future production requirements more accurately. The ability to assemble the correct portfolio of applications is really the next big step in technology advancement.

Such systems and application integration, however, may be just the first step required. In the future, each member of a supply chain

community will have to build its own control centre, which will act as an information repository for all data required to manage the flow of materials. Smaller trading partners in the community may even have to subcontract with third-party logistics providers or IT companies to obtain access to such data-control centres (Cooke, 1999).

Intranet, extranet and XML

Supply chain partners must take advantage of new Internet technologies to provide "just-in-time" information. For example, when a customer sends a retailer an order over the Internet, the retailer, using similar technology, in turn would query its carrier (supply chain partner) on rates and delivery availability.

Intranets help employees collaborate on business processes such as product development or order fulfilment, which create value for a company and its customers. Specifically, intranets centralise the business process in an easily accessible, platform-independent virtual space (Martin *et al.*, 1999). Successful intranets allow employees from a variety of departments to contribute the different skills necessary to carry out a particular process. While each department of a company may have its own virtual space, intranets should be organised primarily around the business processes they help employees carry out, rather than the organisational chart of the company.

Focusing on processes rather than departments is a widely hailed business trend. Recent shifts in corporate structure point to the emergence of communities of process. Companies are moving away from vertical, hierarchical organisational lines towards horizontal, process-oriented groups that link cross-functional teams focused on the same set of business tasks (Mougayar, 1998). The trouble is that this requires significant interaction between departments, functions, and even countries. Enter the intranet, the ideal vehicle for creating and empowering process-based corporate communities.

Successful process-oriented intranets look and work as differently as the processes they enable, but they share several common characteristics. First they are built on smart information design. Second, they focus on tasks, not documents, and aim to integrate

those tasks into distinct processes. Finally, the best intranets encourage collaboration by creating shared and familiar spaces that reflect the personality of the company and create a common ground for all departments and employees.

Many organisations are allowing people and organisations to have limited access to their internal intranets. For example, authorised clients could dial into a portion of an organisation's intranet from the public Internet to obtain information about the cost and features of its products. Private intranets that are accessible to selected outsiders, are called extranets. The organisation can use firewalls to ensure that access to its internal data is limited and remains secure. The extranet is especially useful for linking organisations with customers or business (supply chain) partners, with many used for providing product availability, pricing, shipment data and information (Deborah, 1997)). Figure 2 outlines a holistic view of a typical organisation's supply chain processes, support activities and business (supply chain) partners, and how they link via Internet, intranet and extranet.

Extensible markup language (XML) has attracted considerable attention from enterprises interested in employing dynamic information exchange over the Internet between trading partners (Angeles, 2000). XML is a more advanced language than the Hypertext markup language (HTML) which is currently used to exchange data on the Internet. XML allows for the use of special tags before a message that would allow a browser to identify the message. Through the use of those tags, the browser could immediately recognise whether, for example, a sequence of numbers refers to a purchase order or an advance shipment notice.

For an extended enterprise engaged in supply chain management, XML tags could be placed on such common messages as the purchase order or the advance shipment notice. A Web browser capable of decoding XML then would be able to ascertain quickly the nature of the messages from a supply chain partner. Furthermore, it would become possible for one member's computer system to respond automatically to information requests from another member's system. XML thus could provide an alternative to electronic data interchange (EDI), which has

been limited so far to big companies willing to make the investment in the requisite computer services and hardware. Many see XML as "new age" EDI (Cooke, 1999).

Money flow visibility

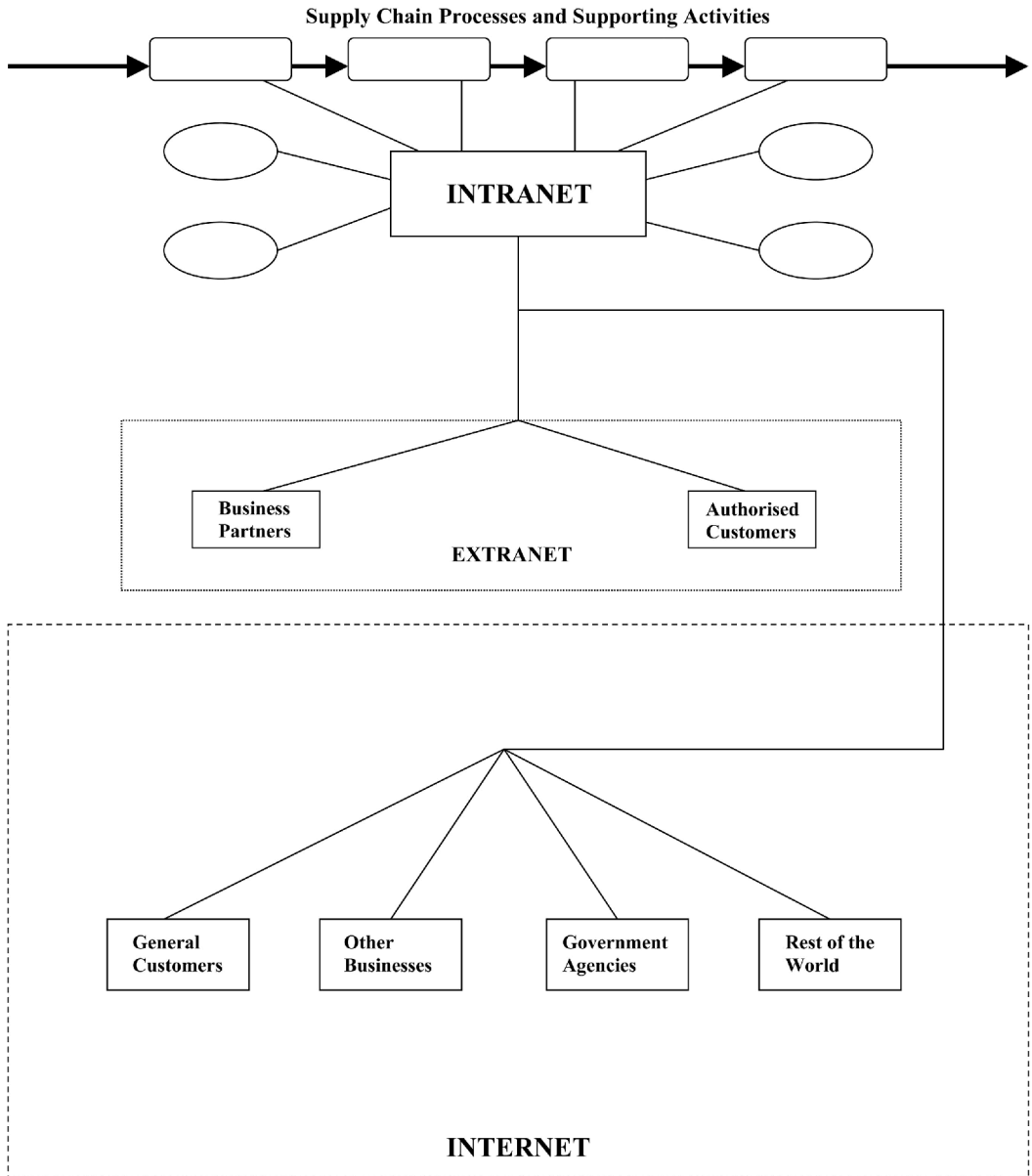
Although software can help channel the information flow required to co-ordinate material movements, there is another element that is often overlooked – fund flow between the trading partners. Trading partners in the supply chain also need a clear picture of how money is moving, and so far the fund flow side of the supply chain has not received the attention it needs. Some companies are working to address that. Several retailers are considering an experiment with a pay-on-scan arrangement. Under that plan, every trading partner in the supply chain would get paid when the consumer makes a purchase at the retail checkout counter. When everybody ends up getting paid when the consumer pays, everybody in the supply chain has an incentive to keep inventory levels lean.

Supply chain flexibility

A supply chain must do more than provide visibility over materials, information, and money. It also must be flexible enough to offer business partners the ability to make changes in their operations or products. For example, the members of the potato-crisp supply chain might decide to produce potato sticks as an alternative snack food. A supply chain should have enough built-in flexibility in order to handle such changes without the need for interrupting activities or major restructuring. Such flexibility may become more important in the future as manufacturers embrace configuration management. Such a strategy requires that a manufacturer customise a product for a particular set of clients, for example higher-income customers.

Of course, someone in the supply chain has to decide what is best to make for the end consumer. In any given supply chain, someone has to take charge and control the process. The captain of the supply chain should be like the captain of a team, who has to select players and put the whole team together.

Figure 2 Enterprise supply chain view within the Internet context



In some cases, for example, the captain of the extended enterprise might be a powerful retailer. In others, it would be a strong manufacturer. One organisation tends to be the captain, and the team only stays together as long as everybody feels there is a benefit.

That unity will be taxed as supply chain partners make decisions and weigh the trade-offs between inventory and production capability necessary for speedy throughput of product to the customer. To maintain the co-operation, companies will have to adopt a big-picture perspective on what is required from each partner. A complete supply chain view has to be taken, as opposed to optimising some components at the expense of others (Cooke, 1999).

Concluding remarks

Logistics just might turn out to be the crucial element that separates the successful Internet retailer from all the others.

Companies today need to move beyond plan, source, make, and move to take a holistic view of the supply chain if they want to score a market hit, or indeed to survive.

The key to supply chain excellence will be the ability to extend the business into customers and trading partners. Those companies that are highly successful with supply chain management will compete on their ability to work rapidly with customers and trading partners to create new and unique products and solutions. The speed at which they can integrate the community together is

what they compete on. The impact that IT has on managing the integration of the supply chain community is profound. However, it has to be realised that integrating systems is more than just linking computers. Integrating systems is integrating business processes, data, and then systems.

Companies will have to work harder than ever at constructing and managing the complex supply chains that will take shape during the twenty-first century. Supply chains will become more complex as people sell through more diverse channels like the Internet or in other parts of the globe.

The extended enterprises operating these supply chains will face the enormous challenge of co-ordinating many activities simultaneously. Although that task appears daunting, leading companies today have shown that it can be done if they mind the details.

In the end, though, companies will not achieve a supply chain breakthrough until they realise that no company can run or build the chain itself. Instead, companies must work in collaboration and adopt a holistic view of the supply chain.

To date enterprise systems have been designed to focus on a standard data model, standard business processes, and a standard business model. This is all fine within the confines of an enterprise where standards, processes, and data can be dictated, but it cannot apply to all companies in a supply chain. What is needed is an architecture to connect supply chain partners to resolve information understanding (meaning of data) between very different processes used by the various supply chain partners.

Indeed, in the end, getting a handle on such problems has the power to transform a company. What must ultimately happen, is that the Internet way of doing business extremely fast, with a customer focus, permeates and finally becomes the established standard for the entire company.

References

- Angeles, R. (2000), "Revisiting the role of Internet-EDI in the current electronic commerce scene", *Logistics Information Management*, Vol. 13 No. 1/2, pp. 45-57.
- Burgess, R. (1998), "Avoiding supply chain management failure: lessons from business process re-engineering", *The International Journal of Logistics Management*, Vol. 9 No. 1, pp. 15-23.
- Christopher, J. (1992), *Logistics and Supply Chain Management: Strategies for Reducing Cost and Improving Services*, Pitman Publishing, Boston, MA.
- Cooke, J.A. (1999), "Beyond plan-source-make-move", *Logistics Management and Distribution Report*.
- Cooper, J., Browne, M. and Peters, M. (1995), *European Logistics – Markets, Management and Strategy*, Blackwell Publishers, Oxford.
- Deborah, L. (1997), *Extranets: Building the Business-to-Business Web*, Prentice-Hall, Englewood Cliffs, NJ.
- Ellram, L.M. (1991), "Supply chain management – the industrial organisation perspective", *International Journal of Physical Distribution & Logistics Management*, Vol. 21 No. 1, pp. 13-22.
- Gattorna, J. (1998), *Strategic Supply Chain Alignment – Best Practice in Supply Chain Management*, Gower Publishing, Aldershot.
- Liebenau, J. and Blackhouse, J. (1990), *Understanding Information*, Macmillan, Basingstoke.
- McFarlan, F.W. (1984), "Information technology changing the way you compete", *Harvard Business Review*, Vol. 57 No. 2, pp. 115-26.
- Martin, E., Brown, C., DeHayes, D., Hoffer, J. and Perkins, W. (1999), *Management Information Technology, What Managers need to Know*, Prentice-Hall, Englewood Cliffs, NJ.
- Mougayar, W. (1998), *Opening Digital Markets: battle Plans and Business Strategies for Internet Commerce*, McGraw-Hill, London.
- O'Brian, J.A. (1999), *Management Information Systems. Managing Information Technology in the Internet Worket Enterprise*, McGraw-Hill, London.
- Trent, R.J. and Monczka, M. (1998), "Purchasing and supply management: trends and changes throughout the nineties", *International Journal of Purchasing & Materials Management*, Fall, pp. 2-11.
- Willcocks, L. (1994), "Introduction: of capital importance", in Willcocks, L. (Ed.), *Information Management: The Evaluation of Information Systems Investments*, Chapman and Hall, London, pp. 1-27.
- Yannis, B. (1998), "The emerging role of electronic marketplaces on the Internet", *Communications of the ACM*, Vol. 41 No. 8, pp. 35-42.