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Integrate the Information Technology with Supply Chain Management : A Trend of the Electronic Business in the New Century

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Abstract

In the new century, the concept of e-business (EB) has to be redefined. It covers more than e-commerce (EC) which simply handles with electronic ordering and/or on-line payment. EB covers all the managerial and operational functions of a business. So the concept of EB is to be more extensive. More and more people and business firms have recognized the fact that the application of Internet will cover both the outward functions (such as marketing, supplying, etc.) and the inward ones (such as manufacturing, R&D, etc.), go from the surface layers to the deeper layers, and arrive at the core of a firm's business and the center of the social economy. From the point of view of a business firm, more realistic EB refers to replacement of the physical activities with electronic processes and to establish new cooperative relations with the suppliers and customers, and among all internal sections of the firm. It can be shown from an investigation and the author's observations that the trend of EB is to integrate the information technology with the supply chain.

Once business firms have completed the ERP (enterprise resources planning) or other internal integrated information systems, the business firm could develop CRM (customer relation management) or SCM (supply chain management) and so on, to get an external optimization with the internal optimal process. So EB will come true when the bases are ready and sound.

By establishing communications between the upstream suppliers and the downstream cooperators, a business firm should extend its integrated information system and its operational conformity to the whole marketing management and to the whole supply chain.

In years, the downstream links of a supply chain (B to C) may exist in various forms for that the customers have their individualized needs. But among the upstream links of a supply chain (B to B), the traditional business modes among business firms will certainly be replaced by EB.

All the business firms have to face such a fact that from the basic application of Internet to the real-time business on Internet, there is a long way to go. At present, all business firms must face a complicated environment. Starting with the analysis of the environment of EB, this

paper discusses EB's trend and its influence on the business development, and brings forward that modern EB requires the participation of the suppliers, enterprise employees, cooperate partners, government and service institutes altogether.

1. Introduction

Since most people recognized that e-business didn't mean the economy of web site, enterprises have begun to integrate their primary elements, such as products' R&D, manufacture, and marketing, with Internet. This trend has come into being since 2000 and assumed the following characteristics:

1. EB got developed with traditional enterprises as its core and the pattern of B to B as its mainstream. Recent studies by technology consulting groups show that more than one fourth of all B2B purchases will be transacted on the Internet by 2004—a dollar volume 10 times that of Internet consumer purchases[1]. International Date Corporation estimated that the total market turnover of the Internet in the whole world will exceed 425 billion dollars in 2002, more than 75% of which comes from B to B transactions.[2] Gartner Group further forecasted that in 2004 the volume of trade of B to B in the US will be more than 10 times of that of B to C at least.

2. EB is widely distributed not only into newly developed IT business but into traditional manufacturing industries and other service lines, such as circulation, securities and travel as well.

3. EB has got applied to a high degree. Many businesses have begun to make use of ERP, CRM and SCM, or even begun to conduct business integration both inside and outside the enterprise and established virtual firms.

In China, EB has experienced three stages or phases: the first phase (1997-1998): focused on IT manufacture and media; the second phase (1999-2000): focused on EB internet service; the third phase (2000-now): focused on traditional industries. In the third phase, enterprises are assuming the principle part of "e-transfer".

Such transformation is due to that (1) the consumption habits of consumers cause that it is impossible to expand B to C business in a large scale; (2)

commercial tension forced businesses to cooperate with their suppliers and clients more directly, and to make quicker response to any change. American Gartner Cooperation has predicted that any enterprise that still maintains the old style of mass production and keeps the control to marketing channels will become much less competitive in 2005. [3] The press originates from the below ten:

Table 1. The top ten business press enterprises face

More rapid commercialization of products	Relation-based competition (based on the quality of customer relationship, for instance)
Pressure from profits	Temporal-based competition (based on cycle of order, for example)
Increment of marketing channels	Special customers' requirements
More rapid launch of products	Globalized market
Web business requirements	Outsourcing relationship

SCM includes the optimizing of products, fund, and information transition between upstream suppliers and downstream cooperators. Therefore, it is a management of optimizing cost. On the other hand, the flow of various resources through the supply chains is an increment process. Hence, supply chains management can also be called incremental chain management.

By Internet, Extranet and Intranet, IT united all the business including upstream and downstream into supply chains of the whole manufacturing system, and formed a dynamic, virtual and global net of supply chains by combining with supply chains of other business and manufacture. Thus, purchasing cost and logistics activity cost are reduced, and every process of the whole net of supply chain are optimized. To the most important, enterprises' response to market and ultimate customers' requirements is made quicker, and the market competition of a business firm is promoted.

Supply chain management based on IT is an open

management pattern. Therefore, it is easier to achieve more personalized products and service with less production cost and quicker response.

As far as China is concerned, to achieve the more normative market environment and the more lucid information, IT-based SCM is a favorable choice for various enterprises involved in cooperation, which will make all enterprises, whether big or small, definitely benefit.

2. The Role of Information Technology (IT) in SCM

Enterprises' information technology includes three basic elements: Internet; Extranet and Intranet [4], which will make SCM adapt to e-business

Comparing with other communication means, Internet is the most resourceful and the cheapest. This facilitates enterprises to collocate their supply chains with lower cost within the whole world.

Extranets are dynamic wide area networks that link a company's employees, suppliers, customers and other key business partners in an electronic online environment for business communication. In manufacturing, setting up an Extranet linking business partners directly allows the handling of purchase order, receiving, invoicing to be done electronically over a secured network. The Extranet is a powerful form of infrastructure required for sophisticated SCM software that allows business partners to benefit from better response time, removal of non-value added inventories and reduction of overall inventory level in the chain by managing the information flow among business partners.

The Intranet allows the internal manufacturing operations to run smoothly and coherently by managing and providing information in a real-time manner to enhance resources planning process. Dispersed applications are linked together through client-server architecture [5].

Fig.1 illustrated how IT is permeated into supply chains and get used inside an enterprise and among enterprises.

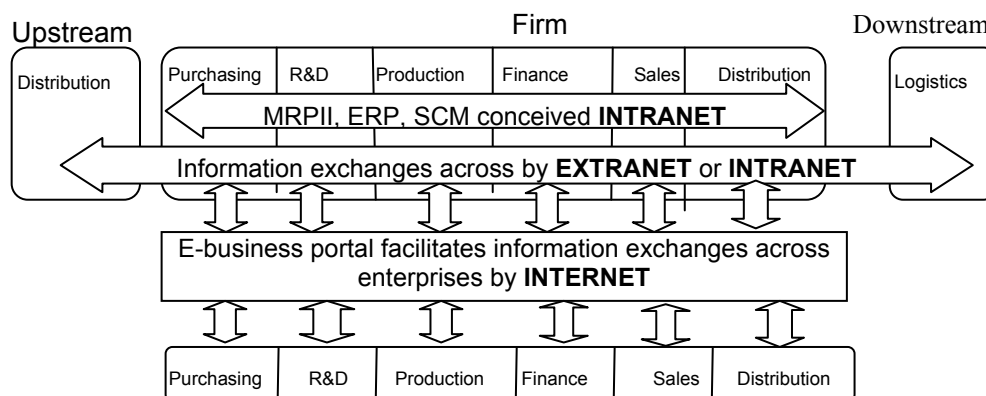


Fig.1. IT permeating into supply chain

Among the three streams in supply chains (that of material, information, and case), information stream is the most difficult to control. Information distortion is magnified gradually as it transmits from downstream to upstream of supply chains. This is so called 'the bullwhip effect'. [6] That is, orders given to upstream manufactures and supplier will fluctuate severely when there is only a tiny change in customer's requirements. IT improved SCM from three aspects.

1. Owing to IT, information transition and share among business partners within supply chains are changed from a linear structure to a network structure. This realized the direct relation between any two knots on the network and prevented information distortion caused by multi-layer prediction in the hierarchy structure. [7]

2. EDI provided criteria for global e-business. [8]

3. It is helpful to know the market instantly, and met ultimate personalized requirements.

As a kind of modern business management strategy, SCM owns a set of integrated strategic and tactical thinking, ECR, JIT, for instance. But only with the support of IT can the advantage of supply chains be fully taken.

3 · Why the SCM Based on the IT will be the Trend of E-Business?

3.1 Transformation of internal production organization patterns

In order to realize economies of scale, traditional industries usually adopt vertical solution production organization pattern. That is, the core enterprise united its raw-material suppliers into a cooperation organization by internal construction, merge and acquisition. This organization pattern confronted with three severe defects in 1990s when global economic environment changed a lot: (1) bulky business organizations couldn't make quick response to the complicated and ever-changing market requirements; (2) limited resource consumption in diverse field made it difficult to form conspicuous nuclear advantage; (3) the frequent economic fluctuation made it difficult for a company to receive the risk of investment and construction cycle resulted from internal construction, merge and acquisition. So the production organization patterns of many businesses have begun to transit from vertical solution to horizontal solution, a new production and management pattern.

Under the vertical solution pattern, supply chains within an enterprise are generally long. But for the management conformity within the enterprise, united information system and supply chain management system, it is comparatively easy to realize the best distribution of resources along the supply chains. And under the horizontal solution pattern, the supply chains to provide customers with integrated services are composed of many enterprises. Their connection doesn't take the form of 'chain' purely, but that of a complicated 'supply network' (virtual enterprises). As the interests conflicts among enterprises are prone to lead to the delayed transit and

distortion of information, the SCM becomes even more complicated. In this case, enterprises on the 'supply network' enter into a dynamic alliance or interests community, in which each enterprise only need to pay its attention to its own comparative competitive advantage in the value incremental chain. The new management pattern is not only capable of greatly promoting each enterprise's nuclear competitive competence, but also making it possible to reduce the investment and risk each enterprise undertakes, for they are dynamically organized. Therefore, supply chain management under horizontal solution has increasingly assumed the focus of both academic and industrial world. And the emergence of Internet and EB provided means to solve those issues. [9]

3.2 The information-sharing management of exterior uncertain demand

At the age of e-business, thoroughly changes take place on the relationship between producer and consumer, which can attribute to the emergence of new markets. At the electronic space time beyond the tradition physics space time, the different demands of the customer gained further satisfied, which bring about even more complex and levity requirements. At the same time, since all sort of recourses become virtualized at the EB terrace, producers, to a greater extent, possess the throughput which can satisfied the increasingly changeful demands. So the result is that the relationship between producers and customers change from the push phase in which producers push their products to customers via 4Ps(Product, Price, Place, Promotion) to the pull phase in which producers are pulled by customers via 4Cs(Consumer, Cost, Convenience, Communication)

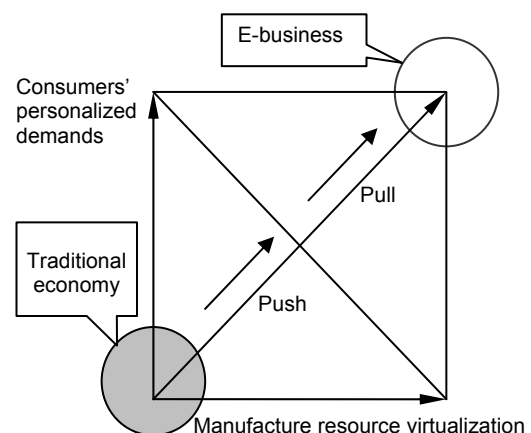


Fig.2 The change of relationship between producers and customers

Fig.2 shows the change. From the point of view of SCM, with the degree of produce recourses virtualization and the pull power of consumers enhancing, the headstream which supply power to the flow of logistics

and information changes from the producers to the consumers. That's to say, at the traditional mode, the SCM is focused on how to make use of the producers' predominance in the production technique and management method. While at the age of e-business, it is centered on how to ensure the customers' driver status, how to make use of information by analyzing the uncertain demand, and how to create value by sharing the information on the whole supply chain.

4. The E-Business Cases in China

Viewed from the fulfillment result, most enterprises that carried out e-business have got profits, such as Haier and Legend. Integrating the information technology with SCM in Chinese large business enterprises has become the main body EB's application.

4.1 Haier Group

4.1.1 Background

Haier Group is the biggest home appliances producer in China. Haier now produces a wide range of household electrical appliances in 86 categories and 13,000 specifications. Its products are exported to 160 countries. A total global sale of Haier in 2001 was 7.28 billion dollars. Haier's international promotion framework encompasses competitive globalize trading design, production, distribution and after-sales service networks. Haier now operates 18 design institutes, 10 industrial complexes (1 in USA, 1 in Pakistan, 8 in China), 58,800 sales agents and 11,976 after-sales services throughout the world.[10] Haier operation capital in one year has 12 billion dollars and average 33.4 million dollars a day. Haier receives 0.9 million order which involve 10,000 specifications around the world every month, and need to stock 0.26 million kinds of raw and processed materials. So if Haier did not carry out SCM and information technology management, it is difficult to maintain current operation, not to speak of development.

4.1.2 The processes and the effects

1. Strategically adjusting the organizations is the basis of the realization of general information management.

Haier changes from former function management which junior was responsible for superior to the flow management which every department was responsible for markets. Haier's organization is also reformed from a pyramid pattern to a flat style, and converging every subsidiary's logistics, capital, information flow departments to headquarters. And it carries out purchase, physical distribution, storage and conveyance globally. All of these form the main procedure of operation of Haier.

Haier integrates its function management recourses to form 3R departments (R&D, HR, CR---customer recourses) which develop orders and form 3T departments (TCM, TPM, TQM) which ensure the

fulfillment of orders. 3T and 3R are function departments that had been registered as independently working service company.

Haier saves more than 13 million dollars every year from its interior recourses integration.

2. Carrying out the reconstruction of information SCM based on marketing chain

Haier e-business Company comes into existence in 2000, which carries out B to B for suppliers and B to C for customers. By e-business purchase and customization terraces, Haier establishes close relationships with suppliers and marketing terminals by Internet and thus strikes up dynamic business enterprise alliances. Haier's business process is shown in Fig.3

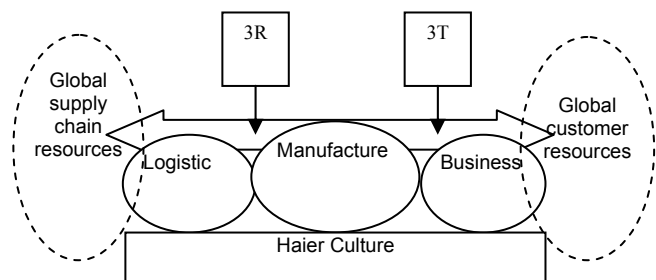


Fig.3 Haier's business process

On the basis of BPR, Haier's SCM has formed a closed loop system. Now, all of Haier's purchase order and 20% of the payment come from the Internet. The performance of inviting public bidding and competitions of price on the Internet makes the prices management more transparent.

The application of computer network cuts down the period of purchase from 10 days to 3 days and reduces the cost of SCM, the sluggish material by 73.8%, the area of warehouse by 50%, and the storage capital by 67%.

3. Interior agile manufacturing

Haier's e-manufacturing adopts CAD and CAM to construct CIMS (Computer Integration Manufacture System). On the basis of DSS (decision support system), ERP, JIT, agile manufacturing system, and concurrent engineering which can correspond with the design and manufacture by network, Haier realized the change from volume-product to mass custom-made.

4.2 Legend Group

4.2.1 Success of China Legend Group

Legend Group is the largest computer manufacturer in China.

The successful establishment of EB terrace makes the producing, marketing and purchasing related each other, and saves capital 0.25 billion dollars only from shortening the stock cycle.[11] In 2000, Legend made profit of 0.1 billion dollars after the establishment of basic EB terrace.

Tables 2 and 3 are the aspects of its marketing and operation management.

Table 2. The aspects of marketing

Year	1998 (Before actualizing EB)	2000 (After actualizing EB)
Sale quantity (million sets)	0.791	2.618
Sale (billion dollars)	2.13	3.43
Market share in China (%)	10.7	30

Table 3. The aspects of operation management

Year	1995	2001
Stock cycle (days)	72	22
Turnover days of receivables	28	14

Legend only invested 3.63 million dollars in ERP and invested 18.2 million dollars to construct three EB terraces including date, process and decision-making.

4.2.2 The developmental process of EB of China Legend group

Legend considers that the aim of B to B is to extend exchange. The integration of enterprises' interior and exterior recourses by ERP is the basis of B to B, and is the necessary guarantees of sustainable development of B to B.

Legend adheres to channel sale system and adopts B to B model from original telephone and fax to dynamic information issuance system. Now, Legend has realized the integration of B to B's former system with the ERP terrace, so the agents can learn the orders including the information such as the time of shipment, the warehouse of the consignment, the circumstance of goods on transportation, the railway and air parcel's indentures and conveyances. Its exchange volume from e-business broke through 1 billion dollars in 1999 and accounted for 50% of total exchange in 2001.

5. New Characters of IT and SCM

5.1 Shortened and virtualized supply chain

The essential characters of production in communication society are to shorten the intermediate link between manufacture and consuming and to create value by responding to targets quickly and directly. The digital network provides a realistic and reliable foundation for cutting the unnecessary inter-link processes. The supply chain on EB is no longer a complex multi-level network, which is shortened and virtualized. That is, for business reasons, a manufacturer and a supplier can form strategic fellowship, but once the exchanges finished, their fellowship ended. The exchanging costs are reduced and the products become individualized.

5.2 The flat and netlike inner-organization

On EB, the information communion is no longer subject to space-time restrictions. The communications among various departments within an enterprise, such as marketing, designing, manufacture and stocking become smooth. The management scope of the departments becomes blurred and the management span was extended. Therefore, the corporation groups' management system transforms from the multilayer pyramid style to an information-based flat and netlike style which takes the projects as longitude and takes the manufacture flat roof, the marketing flat roof, the administration flat roof as the latitude to administrate. As a result, the administration cost is descended and the market reaction to the customer needs is accelerated.

5.3 Information can create new value

In supply chain of EB, the information does no longer perform the assistant support function, but bring new value by aggregating, organizing, selecting, composing and distributing. The enterprises can utilize the information to enhance value on three phases: the first phase is visible management; the second phase is reflection ability; the third phase is constructing new customer relationship by IT. At the age of industrial economy, the value increment is manifested by substance increment, but at the age of information, it becomes more and more dependent on the information and knowledge.

5.4 The weakened predominance of economies of scale

In supply chain of new EB with agility manufacturing, economies of scale will not possess great predominance than ever. The extremely important thing is to give prominence to core competencies in the supply chain and the value chain. Together with the transparent information and opening supply chain connection, there are more opportunities to small and medium enterprises (SMEs).

Many of the e-business portals are developed by large corporations for free participation, there lie the opportunities for SMEs to access part of varieties of trading communities. For example the Legend Group has 2000 agents around China and the Haier Group has 1000 agents around the world. Fig.4 shows the opportunities of SMEs in participating in e-business portals.

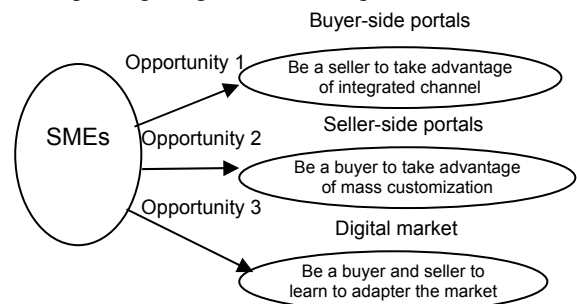


Fig.4 Opportunities for SMEs participating in EB

6. Conclusion

EB is changing the world economy drastically, and this alteration is more rapid than any other economy transform in history. Many experts have assumed that e-business in emerging markets will evolve along the same lines as it has in the US, North America, and to a great extent, in Western Europe. This assumption fails to take into account the differences that exist between the economic infrastructures of emerging markets and those of the developed markets of the West. China's economic infrastructure, which like the infrastructures of most emerging markets is much less highly developed than the industrial West's, will influence the development of e-business in China [12].

The network revolution and the EB revolution caused by network revolution are global. How to find a new development path that makes China enterprises linking with the world experiences is an urgent task to be solved.

As this paper has discussed, the construction of China e-business should start with the building of infrastructure facilities altogether with the participation of enterprises as the cells of economy. The timorously development of SCM based on the information technology is the preparatory work for massive introduction of EB. All the business firms have to face such a fact: from the basic application of Internet to the real-time business on Internet there is a long way to go. On the current stage, all business firms must face a complicated environment. Starting with the analysis of the environment of EB, this paper discusses EB's trend and its influence on the business development, and brings forward that modern EB requires the participation of the suppliers, enterprise employees, cooperate partners, government and service institutes altogether.

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