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E-supply Chain's Implementation in a Transit Economy

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ABSTRACT

In the worldwide, firms are increasingly paying their attentions to the integrated Web-based supply chains or e-supply chains because e-supply chains could enhance firms' efficiency and competitiveness. There have been some off-the-shelf products available for supplying activities. But how to establish an efficient e-supply system and how to successfully implement it in the supply process are not as easy as what expected. We propose an implemental and general supply chain framework with various techniques for different supply chain requirements in a transit economy. In a transit economy, the main challenge is to design an e-supply system such that it can be implemented efficiently according to the special supply chain environment of a transit economy.

Keywords: e-supply chains' implementation, efficiency and competitiveness, transit economy

1 Introduction

A supply chain refers to a chain which links each element of the manufacturing and supplying process from raw materials to the end customers, concerning with several organizational boundaries. Supply chain can also be further expanded to include recycling or re-use process. Recently, supply chain has been defined more practically as a connected network with organizations (e.g. suppliers, original equipment manufacturer, distributors, transporters, etc.), resources, and activities of creating and delivering various values in the form of both finished products and services [9] [16] [17] [7]. Nowadays, business firms are more interested in exploiting the integrated supply chains because they want to reduce cost, enhance efficiency and competitiveness, and accelerate the response to the market demand [12][18] [24] [20][26]. As business-to-business transactions based on the internet are increasing, it is becoming critical that firms rely on Web-based supply chains or e-supply chains to provide almost real-time response to market [16] [25] [13]. Thus, many famous IT companies such as i2 Technologies and Manugistics have provided a variety of supply chain software packages and some integrated

suites like mySAP and Oracle li. But for different firms, implementation solution can't keep same. How to figure out this problem? In this paper, we present a practical framework for e-supply chain in a transit economy, which not only can deal with the complexity of operations in e-supply chain system, but also be able to integrate the alliance of the supply chain. In the paper, we consider seven classes of firms with different level information asymmetry. For each level of firms, we proposed a uniform implementation solution based on their available information systems. We use the information asymmetry but not the complexity of operations to class the firms because information asymmetry is more critical than the complexity of operations in e-supply chain management. First, some operations are comparative simple, and need to be managed by IT tools due to the severe information asymmetry. Second, many complex operations are designed to avoid information asymmetry. Finally, eliminating information asymmetry can provide more evaluation to the performance of firms. In a transit economy, firms are developed in a different environment from usual. In many industries there exist some kinds of government intervention, which is

special serious in state-owned firms. So government regulation and role are important factors that shouldn't be ignored in establishing an implemental framework of e-supply chain system. We organize the paper as follows: in the section 2, we first describe the status quo of information system in transit economy which is based on the interviews with many directors of IT companies' marketing departments in a transit economy, and discuss the existed and latent challenges in a highly integrated supply chain from three perspectives: internal challenges, external challenges and government challenges. Section 3 dedicates to propose the implementation framework that identifies various solutions to the different e-supply chain related to the three key factors. Finally, we conclude the discussion and make some remarks about our research.

2 E-supply chain systems

2.1 Characteristic in a transit economy

In a transit economy, usually, many business firms have established considerable foundation in the infrastructure of information systems and in its application, and meanwhile, most business firms have realized that supply chain management can enhance their efficiency and competitiveness. First, hardware and related investment has been almost ready in large or even medium size business firms in a transit economy. Second, information isolated islands are being eliminated and integrated internal operation systems are coming into being. Finally, the concept of supply chain is more and more popular to business firms due to the spreading of media organization and accelerating of the government. However, there still left many deficiencies in a transit economy. First, there are still many firms that do not pay enough attention to IT. Second, few firms have accomplished the strategic enterprise systems. Third, although many industrial chain have coming into being, few firms extend their systems to outside and achieve integration on the entire supply chain. Finally, many firms do not fully realized the importance of e-business and haven't take actual steps to make good use of the internet-based system.

2.1.1 Opportunities

To implement e-supply chain system, there are

some opportunities in a transit economy. First, because industries rapidly develop recently and many industry chains have appeared in a transit economy, it is time to develop e-supply chain systems to enhance the supply chains' as while as firms' efficiency and to provide better customer service. Second, available systems can be easily updated by new technology and off-the-shelf software. Finally, government is going to pay great attention to the industry/supply chain management and to promote the development of powerful supply chain by various supports.

2.1.2 Difficulties

There exist difficulties along with the development. First, the concept of supply chain accepted by most firms is far different from e-supply chain. Second, most firms are not so strong to support the implementation of an integrated e-supply chain system. Finally, there is a lack of leading firms in industry chains that have enough power to integrate the e-supply chain.

2.2 Implementation challenges in a highly integrated supply chain

We illustrate the complexity involved in creating and implementing the integrated e-supply chain system with the two tasks of the system. Both of the tasks were geared towards achieving competitive advantage by reducing inventory, avoiding delays, and providing better customer service. The two tasks are: (1) cooperatively planning among the supply chain and (2) rapidly responding to customer query [18]. Many studies have highlighted numerous problems faced by a firm in adopting complex systems like ERP for internal operations [10]. Similarly, the literature on inter-organizational systems has discussed the problems associated with the implementation of EDI systems that are largely limited to one-to-one relationships [14] [15][19]. But we found that the challenges involved in implementing integrated e-supply chains are more serious than the problems faced by an organization trying to adopt internal systems (like ERP) or inter-organizational systems (like EDI). Integrated e-supply chain systems are the extended enterprise resource planning systems in which diverse organizations need to work together virtually. We classify challenges to the organizations in a highly integrated e-supply chain system into three categories: challenges from inter-

nal of the organizations, those from external of them and those from government.

2.2.1 Internal challenges

Organizations invariably require considerable resources to implement the highly integrated supply chain systems. First of all, the software packages for creating e-supply chain systems are quite expensive and need several powerful computers, database systems, and communications links to support. Secondly, it is particularly expensive to secure the installed highly integrated e-supply chain systems because in such systems: (a) public Internet is used to transport data, (b) many more partners than in traditional EDI systems are usually involved, and (c) data exchanged tends to be highly sensitive. Thus, an organization that implements a highly integrated supply chain system has to expend financial resources that will greatly exceed the expenses on many other information systems. Thirdly, organizations that implement integrated e-supply chain systems need to have highly sophisticated technology infrastructure in place. The IS literature has discussed how organizations get overwhelmed by the technology infrastructure needed for implementing a complex system like ERP [10]. Indeed, the infrastructure that can support a sophisticated and highly integrated e-supply chain system is more technical than others. Finally, the implementation of an integrated e-supply chain system need more reengineering of business process than any other information system does because not only internal business processes need to be integrated, but also these redesigned processes should work synchronously with those of external partners as well. Thus, while the e-supply chain system redesigns the business flows, it must keep accord with its business partners. As given that integrated e-supply chain systems will cause more changes than ERP or EDI, more organizational resistance arises during the implementation of such systems. Senior managers have to involve in the implementing process and devote a lot of time for such system to succeed. Therefore, before a firm creates an integrated e-supply chain, its senior managers have to carefully assess if they have the sufficient commitment, time, resources and abilities to manage the whole process of the firm's reform.

2.2.2 External challenges

Challenges, called external challenges, which are related to bringing supply chain partners on-board and making them a part of the extended enterprise systems are as important as the internal challenges. Some literatures on inter-organizational systems have discussed the importance of business partners in the successful adoption of such systems. For instance, Hart and Grover in [15] and [14] respectively discussed the level of mutual trust which is needed for business partners to be willing to adopt electronic data interchange. In the implementation of an integrated e-supply chain implementation, mutual trust usually gets amplified because of the better relationship among business partners and because of the system's integrating strategies which is a major challenge and can improve firms' competitiveness in the system. While some business partners agreed to become a part of the system for their own benefit, others were reluctant in adopting e-supply chain systems due to resource, technical, relationship (trust and vulnerability) issues, or simply due to a resistance to change to a new way of doing business. On the one hand, the leading firm must have enough power or resources to make the partners adopt e-supply chain systems [15] [14]. On the other hand, in order to implement an integrated e-supply chain system the partners in the system also need large resources and a strong information technology infrastructure, somewhat comparable to that of the leading firm. Further, if the required functionality is built based on the partner's existing information systems, considerable amount of IT expertise for creating the interfaces of diverse systems will be needed. Finding such expertise in some partner organizations proves to be quite difficult, particularly if they are small [15] [14]. Thus, because of the massive financial, managerial, and organizational resources, a firm may give up the aim for a highly integrated e-supply chain. In this way, although the firm can minimize the challenges and reduce the risk of failure encountered during the implementation as while the firm also throws away the opportunities of cooperative development with the integrated supply chain. In order to figure out the paradox, we design some system-based implementation patterns for the different kinds of integrated e-supply chain systems such that the

system can be implemented efficiently with less challenges and risks.

2.2.3 Government Challenges

Above, we have analyzed major internal and external challenges involved in creating a highly integrated e-supply chain system. Now we turn our attention to the government challenges. Notice that many organizations in a transit economy usually have not had the resources, technical infrastructure, commitment, power over their partners, or resourceful chain partners enough to support the implementation of such complex systems, i.e., China is in a lack of powerful leading firms in industry chains. If only relying on the development of firms themselves, e-supply chain systems are too difficult to be implemented, which may delay to improve the firms' competitive advantage and lose the marketing chance. It is crucial for government to focus on some important industries and support them to integrate the whole value chain by e-supply chain system. These industries may include high technologies such as electronics, biotech and spaceflight, strategic industries such as automobile, steel and oil, former state monopolized industries such as banking, mobile and electric power etc. Government should play a different role to support firms at different developing stages to integrate an e-supply chain system. For example, for a newly arisen industry integrating e-supply chain system is unpractical and has no effect. The government should popularize the e-supply chain thought to firms along with favorable policies. When the industry grows up to an extent, there will be increasing need for sharing information and integrating supply chain, but usually few firms have enough power to lead this implementation. The government then can play a key role in promoting the establishment of an suitable e-supply chain system by providing an information platform and issuing some stimulant policies. Finally, how to set up and maintain the trust relationship between government and firms to avoid and punish cheat is a great challenge to a government.

3 An implementation framework of e-supply chain

Traditionally, the issue of e-supply chain implementation was studied based on following two

dimensions: complexity of a firm's internal operations and the firm's ability to integrate their external business partners into the e-supply chain. For complexity of operations, the determination of the suitable level of system's integration is critical [1] [21]. Usually, the complexity of operations is actually caused by information asymmetry. To eliminate information asymmetry rather than only to automate the operations, an e-supply chain system should be launched. Although many complex operations can be designed to avoid some kind of information asymmetry, some other kind of information asymmetry can only be reduced by e-supply chain integration. So, e-supply chain integration becomes a most promising area for the improvement of efficiency to the firm's whole value chain. A firm's ability to integrate its external partners into the supply chain refers to its ability to persuade the partners to participate in the chain, to create necessary infrastructure, and to redesign business processes to match the firm's supply chain system. Two main factors that will facilitate integrating external partners of a firm's supply chain are: trust between the parties and the power over the partners. The ability to persuade business partners to integrate their information systems with leading firm's is considered more important [15] [14]. On the other hand, for a developing country, business firms are not mature generally and they have not enough consciousness and power to integrate e-supply chain. To speed up the integration of e-supply chain in some important industries the government plays a pivotal role. In this paper, we propose the three-dimension implementation framework based on the consideration on information asymmetry, the firm's ability to integrate their external business partners into their e-supply chain and the government's regulation. As discussed above, the first dimension, the information asymmetry can apply to the firm's internal operations, external operations, or both (i.e., it has three levels). For the second dimension, the firm's ability to integrate partners into the supply chain, can be either high or low (i.e., it exists at two levels). For the third dimension, the government regulation in one industry may be strong or weak. Hence, we have $3 \times 2 \times 2$ situations to classify the approaches to implement an e-supply chain. Note that in the situation

where a firm's information are only internally asymmetric, it is not necessary for the firm to integrate external partners and the government regulation will not play any important roles in integrating the supply chain. We, therefore, fold the four cells of our classification corresponding to the internal information asymmetry into one. Additionally, when the firm's ability to integrating is high, there is no need for the government regulation. Thus we fold the two cells of our classification corresponding to the external information asymmetry and high ability to integrate into one. And the same is applied to the two cells corresponding to the internal and external information asymmetry and high ability to integrate. These reduce the number of distinct e-supply chain implementation approaches to seven.

Besides the above issues, managers need to decide whether to build the required e-supply chain functionality based on their existing systems or to buy an off-the-shelf software package to automate and integrate their e-supply chain. Although integrating existing information systems into the new supply chain system can increase the technical complexity of the task, it really can reduce some of the challenges and huge investment which the new system causes, for example, which may need less investment, reduce changes in business processes and changes in procedures, and do not need more trained employees in the use of the updated system, etc. In fact, it is enough for the firms which have already installed certain software to buy additional components of the best-of-the-breed supply chain-related software from vendors, and then customize and integrate them into their existing infrastructure. Therefore, while deciding the approach to create an e-supply chain suitably, it is also very important for a firm to decide whether to build a supply chain system over its existing IT infrastructure or to buy an off-the-shelf software package. We take into account this buy-versus-build option while discussing each of the seven approaches included in our framework. This buy-versus-build decision has been considered to be a major issue in the system development [5][4] [22][23].

3.1 Strategic enterprise systems

A firm that falls in this cell mainly has internal information asymmetry and need more external integration than internal integration. This situation may happen, for example, when a firm has complex manufacturing operations, but most of its components and sub-assemblies are made in-house. Complex manufacturing operations are devised by multiple manufacturing facilities, assembly lines and numerous inventory storages for raw material, work-in-process, and finished goods inventory. How to share information among all these processes? The firm needs an internal integration so as to ensure the smoothly flowing of its information. Since external partners do not play a critical role in the manufacture of the product or its distribution, the firm does not need to concern with integrating business partners with an e-supply chain system. Sometimes, this approach may also be chosen when the firm does not have enough resources to manage both high internal and external integration simultaneously and it believes that it can more easily or effectively handle internal integration. Government here should stand by and give some general guidance. Under this scenario, if the firm's investment in its legacy systems is small or if such systems have outlived their usefulness, the firm may want to buy and adapt a standard software package. A suitable strategy for such a firm is to install strategic enterprise systems such as ERP systems. Since in this situation external linkages are less important, an appropriate e-supply chain strategy for the firm would be to share the output of its ERP system with external partners over a Web-based EDI linkage [2]. Complicated off-the-shelf packages for supply chain planning, execution, and logistics for integration with external partners will not be effective for such a firm. In the above approach of the e-supply chain implementation, the challenges that the firm encounters will be mostly internal, for example, how large amount of resources, how strong IT infrastructure, and how significant change in management effort. The requirement for the system security is limited in such cases because few internal data and networks need to be secured.

3.2 Operational external systems

A firm in this cell has mostly external information asymmetric and it mainly needs external integration while its need for internal integration is limited. This case may happen, for example, when a large number of components and subassemblies for the firm's production are provided by external partners, the firm mainly focuses on in-house assembly. In such a situation, it is important for the firm to create sophisticated linkages with external partners in order to optimize its external value chain. However, if the firm does not have a high ability to integrate business partners into a sophisticated e-supply chain system, it should aim for a limited integration with its partners. Thus, the appropriate strategy for such a firm is likely to create an operational external linkages in the areas like procurement and logistics. Thereafter, the firm can gradually expand the supply chain functionality to more strategic functions like collaborative planning, forecasting, replenishment, and integrated CRM. However, some firms may already have certain valuable legacy procurement and logistics applications that they may be using for achieving integration with partners through traditional EDI. In this case, instead of investing in new off-the-shelf applications and redesigning business processes for procurement and logistics to suit such software, the firm may simply establish a Web interface with these existing applications. During the implementation of this strategy, challenges will be mainly related to external partners because changes in internal operations are minimal. The firm will be required to devote resources to redesign operational external processes with its partners. To secure the supply chain data and network is important because the data are mainly exchanged in the external systems among partners when the firm has highly integrated external linkages.

3.3 Strategic external systems supported by government

Firms in this cell need the same external integration of an e-supply chain as firms in the cell of Operational external systems cell. Usually, the firms in this cell are comparable small in size but large in number. For each firm, it is inefficient to create operational external linkages separately.

But for the entire value chain, a industrial alliance linked by an e-supply chain may lead to great efficiency. Government can play the key role in supporting and organizing the alliance. Another case is that in some industries such as real estate, there will be great revenue due to information asymmetry and firms in these industries are reluctant to implement e-supply chain systems which means the decreasing of revenue. But for planning the whole country's resources, it is urgent to eliminate the kind of information asymmetry. Only the government have the motive and power to push the implementation of this kind of e-supply chain systems. The main options for the government are to establish information exchange platform, to constitute credit systems and to set up information publicizing platform, etc. Information exchange platform is to provide an exchanging channel for operational information. Based on this platform, firms in the value chain can share manufacturing, inventory, logistics and other operational information. Credit system is to constitute trust relationships among firms in a value chain. By this way strategic external systems can be set up in a much shorter period and integrate areas like collaborative planning, forecasting, replenishment, collaborative product design, and integrated CRM, which is called government support strategic external system. Information publicizing platform is mainly focus on the reducing inefficiency in the economy. Therefore, there are mainly two conditions that need the government to intervene. One is to support the setting up of e-supply chain systems to improve the efficiency of the whole value chain in which no firms has enough power to do this in spite of large number of firms in the chain. The other option is to force the implementation of e-supply chain systems to eliminate information asymmetry in some industries with unfair high profit. These two situations may mostly occur in the newly arisen and developing industries and also, there will be a lot of problems and chances in such industries. So the government should pay them enough attention and make them develop in the right direction. E-supply chain integration is a effective way to go through.

3.4 Strategic external systems

Similar to the previous cell, a firm in this cell mainly has external information asymmetry and need external integration with limited internal integration. However, this firm differs from the firms in the previous cell because it is able to more effectively integrate its external partners into the supply chain. The firm falling in this cell should seek supply chain integration with external partners in strategic areas like collaborative planning, forecasting, replenishment, collaborative product design, and integrated CRM. The firm falling in this cell will benefit from strategic external systems like the ones available from suppliers like Dichain, i2, Manugistics, etc. This option is particularly appropriate if the firm has made only marginal investment in legacy supply chain planning software or if its legacy supply chain planning software has run out of its useful life. These supply chain systems can, in turn, be linked with some standard database management software that may be sufficient to handle the firm's simple internal operations like inventory management and accounting. The firm needs to be conservative in its approach toward integration of the internal system, as high internal integration is not really needed in its operations. As such software packages like mySAP and Oracle11i that emphasize high internal and external integration may not be suitable for such firms. However, if the firm already has some valuable installed IT infrastructure, it may follow a different approach to creating its supply chain solution. For example, in the case that the firm may already have a system that it uses for demand planning, in order to create the e-supply chain system, the firm needs to create linkages between the existing demand planner and other internal systems as well as port the demand data over a Web interface for external connectivity, which will be substantial to build the effort on the part of the firm. Local IT solution provider such as Ufsoft, Kingdee, Dichain and Bokesoft are suitable for such firms. Main challenges in implementing systems of this cell's firms will be to get the necessary resources for supply chain integration with external partners in strategic areas like collaborative planning, forecasting, replenishment, and integrated CRM. The firm and its partners will also require technical sophistication to implement and

secure such systems. Additionally, the organization will face the challenge of redesigning business processes jointed with external partners in order to make the implemented systems efficient.

3.5 Strategic enterprise and operational external systems

A firm in this cell has information asymmetry both internally and externally, and, therefore, has a strong need for internal as well as external integration. However, since this firm does not have a high ability to integrate its external partners into the supply chain, it needs to carefully think through its e-supply chain implementation strategy. While it may appear attractive to the firm to create sophisticated e-supply chain systems that integrate well with business partners' systems, in the absence of adequate partner integration, the firm's efforts may not bear much result and may be an unnecessary drain on its resources. An appropriate strategy for such a firm is likely to be to focus on integrating their internal systems and create external linkages in areas like procurement and logistics. It can defer expansion of the supply chain functionality to strategic functions like collaborative planning, forecasting, and replenishment, and integrated CRM. If the firm does not have a strong existing IT infrastructure of value, the firm should consider the option of scrapping the existing systems and building this e-supply chain system from scratch. The firm in that case can create the requisite supply chain functionality by opting for some off-the shelf strategic enterprise software that enables integration of internal processes, and by creating operational linkages for procurement and logistics. On the other hand, if the existing information systems of the firm are adequately serving its needs for internal integration and the firm also has some applications in place for procurement and logistics, the systems building option for the firm could be to integrate procurement and logistics operations with the application for internal operations and establish linkages over a web interface with external partners. Major challenges in implementing systems corresponding with this cell will be related to implementing a strategic enterprise system and integrating its existing legacy systems with it. Thus, it will need considerable amount of resources, technical expertise, and internal pro-

cess redesign. The firm will also be required to devote resources to redesigning operational external processes jointly with its partners and to securing data and the network. However, considering the fact that the data exchanged is not likely to be so strategic in nature, a high degree of trust with the business partners is not very critical for implementing the external linkage.

3.6 Government support strategic extended enterprise systems

The government's role is similar to that described in Government support strategic external systems.

3.7 Strategic extended enterprise systems

Similar to the analysis in the previous systems, the firm in this case has information asymmetry both internally and externally. Therefore, it needs an e-supply chain solution to incorporate both internal and external integration. Moreover, the firm in this cell has high ability to integrate business partners into a sophisticated e-supply chain system. The firm can take two ways to integrate its internal operations and supply chain system: either through an off-the-shelf integrated software package or through a customized solution that integrates best-of-the-breed software packages and ports its output over a Web interface, as done by the electronics manufacturer. Two major initiatives in the off-the-shelf integrated category come from SAP (called mySAP) and Oracle (called Oracle11i). Both mySAP and Oracle 11i are relatively new systems that have not been widely installed. In fact, problems of compatibility with some existing applications that Oracle11i is reported to have, seem to have made some companies hesitant in implementing this software. Thus, the firm's IT experts may have to get deeply involved in the implementation process of these complex software packages and be ready to trouble-shoot some unforeseen problems. On the positive side, both SAP and Oracle have been in the market with their enterprise integration software for a long time and have the necessary expertise to facilitate the successful implementation of their systems. The second scenario might be that the firm has invested already in

some type of systems, e.g., internal connectivity software like ERP or supply chain software from vendors like i2 and Manugistics. Thus, it may not wish to scrap its investment in existing software solutions and start afresh with a solution like mySAP or Oracle 11i. In fact, it might retain of the best-of-the breed functionality offered by software from vendors like SAP, i2, Ufsoft, Kingdee, Dichain, Bokesoft, Manugistics and Siebel instead of committing itself to a single vendor software like mySAP or Oracle 11i. In such a situation, the firm faces with the task of integrating various systems at its end with those of its supply chain partners through a Web interface. This is indeed a complicated exercise and there are likely to be several implementation difficulties. Major challenges in implementing these supply chain systems will be those of integrating multiple systems within the firm as well as integrating them with business partners' systems. Considerable amount of financial resources and technical expertise will be required to make such integration possible and to secure the data and the network. Besides, the firm and its business partners will also be required to undertake substantial process redesign necessary for supply chain integration in strategic areas like collaborative planning, forecasting, replenishment, and integrated CRM.

4 Remarks and Conclusion

Usually, the e-supply chain system is a comparable new concept to the firms in a transit economy. Though the idea is promising and many off-the-shelf products may have appeared in the market of a transit economy, how to implement E-supply chain system is still a great challenge to the firms. It is sure that there is not a uniform solution which can fit the different requirements and the various legacy system bases. This paper mainly analyzed the different roles of firms and government in the implementation of E-supply chain system and proposed an framework to implement e-supply chain systems in a transit economy.

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