Supply Chain Resource Planning Systems: A Proposal

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ABSTRACT

We present a novel model of IT-based supply chain integration that responds to the increasing need for better supply chain-wide coordination of resource allocation and offers an alternative to the traditional approach of supply chain integration based on ERP systems. We explore possible governance structures for our model and propose a stylized implementation process. The paper concludes by outlining three areas for future research.

Keywords

Supply Chain Integration, Enterprise Systems, ERP, CPFR, Inter-organizational Information Systems

INTRODUCTION

In a fascinating paper, Markus et al. (2002) have explored the future of enterprise integration and have suggested the possibility of a centralized supply chain management system. In this paper, we aim to bring to life this idea by assessing the desirability of supply chain-wide coordination of resource planning, outlining the idea of a supply chain resource planning system, evaluating possible governance structures for such a system and proposing a stylized model for its implementation. Our main aim, however, is to encourage further research into alternative forms of enterprise integration and we will conclude by outlining fields of research that we consider to be promising and interesting in the realm of IT-based supply chain integration.

In this conceptual paper we propose a model that can be considered to constitute a new class of very large business applications. On the one hand, this type of system extrapolates trends that have resulted in the now dominant class of business applications, namely ERP systems. On the other hand, our model may be interpreted to offer an alternative route to supply chain integration that radically breaks with the traditional ERP-based approach.

ERP AND EXTENDED ERP IN HISTORICAL PERSPECTIVE

The evolution of business application systems is often portrayed as one of increasing scope and reach. For example, Moller (2005) has characterized this evolution through five stages with each stage dominating one decade, beginning with inventory control systems (1950s), and continuing with material requirement planning (MRP) systems (1960s), manufacturing resource planning (MRP II) systems (1970s), computer-integrated manufacturing (CIM) systems (1980s), and culminating in ERP systems in the 1990s. While this is a valid characterization of ERP system evolution, we submit that there are other important aspects that also characterize the long-term change in business software use and development. These are standardization, integration, and outsourcing.

Before the name 'ERP' was coined by Gartner Group (Moller, 2005), such systems were often referred to as 'standard software' since they reversed the development process typical for software development. Rather than first soliciting user requirements based on which new software was written, one of the main ideas of SAP's founders (the company that is usually credited with having pioneered ERP systems) was to develop a new 'licensing model' in which the costs for software development were spread across a large customer base (Plattner and Zeier, 2008). This required that a common software was created which could then be used to build such systems through configuring the software to specific customer requirements. As a consequence, implementation of this standardized software became a major issue for practitioners as well as for academics, spawning a large literature on ERP implementation issues (Esteves and Bohorquerz, 2007). Porter (2001) has warned that increasing use of ERP systems will lead to standardized business processes, threatening distinctive competitive advantages on which companies depend to build their strategies. Thus, along with the innovative 'licensing model' created by SAP, user companies tend to align their business processes with the software and thus standardize business processes across firms.

A further dimension characterizing the evolution of business systems concerns the degree of data integration. In a highly stylized manner this evolution may be characterized as an increasing degree of data integration (Alter, 1996). Beginning with the automation of particular tasks, such as material requirements planning, several tasks where integrated into processes that used a common data basis. Originally, such integration was limited to functional areas such as production planning, purchasing and financial bookkeeping. With ERP systems, a single integrated data base was used to integrate business processes of a whole company.

Finally, the evolution of business application software may be characterized through increasing degrees of outsourcing (McFarlan, 1995). The term 'MIS' used to refer to the IT department of a company because IT departments were responsible for developing 'management information systems', a broad term covering all types of business software. The emergence of software firms implied that development of business software was externalized or outsourced while maintenance of these systems was still in the hands of corporate IT departments. With the rise of ERP systems, maintenance was outsourced too as the ERP vendor continuously updates the software to accommodate new legal and functional requirements. The rise of hosted ERP solutions, pioneered by Salesforce.com, implied that operation of business systems was outsourced too.

This short characterization of the evolution of business systems suggests that current notions of 'extended ERP' or 'ERP II' only consider the first dimension, that of ever growing functional scope. For example, de Búrca et al. (2005) characterize extended ERP systems as including "… additional modules such as CRM, supply chain planning, integrated e-commerce, sales force automation, decision support and human resources to the core foundation modules of internally focused established ERP systems …" (p. 428). Moller (2005) sees ERP systems at the center of ERP II with newer components arranged in concentric circles. Jaiswal and Kaushik (2005) similarly see ERP systems as hubs which are, however, extended through connecting them to systems of other organizations, e.g. through EDI-links, thus increasing their reach. However, it seems to us that the literature has, so far, not yet attempted to explore extrapolation of the other three dimensions to formulate a possible concept of future business systems.

THE NEED FOR SUPPLY CHAIN-WIDE COORDINATION

Simon (1991) distinguishes between two types of coordination: price and quantity adaptation. The difference between these two coordination mechanisms can be characterized in a stylized fashion as depicted in Figure 1 (Reimers, 2003). Any imbalance between supply and demand can, in principle, be adjusted in two ways. Assuming that aggregate demand shifts and thus distorts an existing equilibrium (in Figure 1 from D to D'), the price can be adjusted to create a new equilibrium, as illustrated on the left hand side of Figure 1. This is the usual text book case. However, the more common, albeit less discussed mechanism to re-balance supply and demand consists of shifting aggregate supply as well, as illustrated on the right hand side of Figure 1 (from S to S').

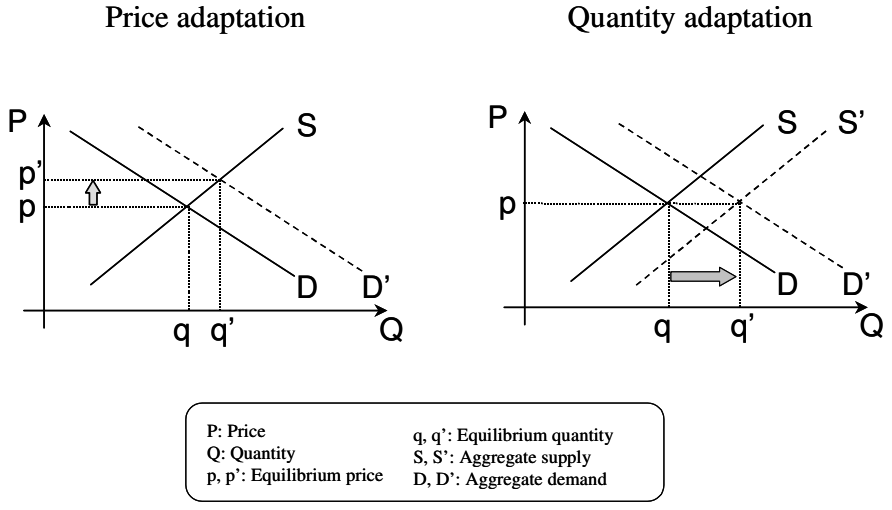

Figure 1: Price and quantity adaptation

We argue that an essential role of enterprise resource planning systems is to support adaptations of supply quantities. Such systems are concerned with adjusting production, distribution and procurement quantities. The fact that most ERP systems

also enable financial analysis of planning decisions should not distract from their focus on quantity adaptation. For example, analyzing the profit impact of shifting production volumes among product categories typically serves the purpose of utilizing a given production capacity in a profit-maximizing fashion. Similarly, pricing decisions supported by ERP systems are typically made in view of a profit-maximizing objective taking into account a customer's credit status, historical data and other information, often drawn from an ERP system. However, such decisions ultimately need to be understood against the background of a company's limited production, procurement, and distribution capacities. ERP systems help managers and operators to optimize allocation of production, procurement, and distribution capacities. In contrast, the price adaptation mechanism works by adjusting prices, rather than quantities, to accommodate given distribution, production, and procurement capacities. For example, instead of shifting production volumes among product categories, managers may decide to increase prices for those goods which, under the existing production planning regime, are in short supply while lowering the prices for those goods which are produced beyond currently demanded quantities. To be sure, such decisions may also be supported by ERP systems; however, that is not their dominant purpose and use. In essence, when pricing decisions supported by ERP systems are made this is not done in order to adjust demanded quantities to a given production capacity but in view of maximizing profits under certain constraints such as customer importance and credit worthiness. In contrast, when quantity decisions supported by ERP systems are made this is done in order to adjust given production, procurement, and distribution capacities to demanded quantities in view of the goal of profit maximization or some other, possibly strategic goals.

In their seminal paper, Lee et al. (1997) describe distortions in a supply chain resulting from un-coordinated resource allocation decisions within the individual companies constituting a supply chain. Specifically, they argue that sequential demand forecast updating, order batching, price fluctuations, and rationing behavior may induce companies to make wrong resource allocation decisions. For example, sequential updating of demand forecasts often causes each company in a supply chain to add a safety margin to their planned order and/or production quantities. Similarly, order batching may be misinterpreted to signal an increase in demand and thus erroneously lead companies to increase planned output volumes. Promotional price discounts (price fluctuations) may lead companies to build up stock in components and materials, thus, again, signaling increased demand when demand has actually not changed. Rationing of goods in short supply can have the same effect as companies artificially bloat order quantities, knowing that orders will be filled only partially. Lee et al. (1997) offer a number of remedies such as sharing of demand data across the whole supply chain, virtual integration through vendor managed inventory (VMI) and continuous replenishment programs (CRP) as well as dis-intermediation, shortening of lead times, reduction of order lot sizes, refraining from promotional price discounts, and changed rationing practices. However, they stop short of recommending an obvious solution to the problem: centralized supply chain wide resource planning.

A variety of supply chain management techniques have been proposed to address such problems. Apart from recommending add-on modules for ERP systems geared towards better supply chain management, in line with notions of extended ERP systems described above, the concept of collaborative planning, forecasting, and replenishment (CPFR) has been developed by industry to improve supply chain-wide coordination of resource planning (Sherman, 1998). A major focus of both add-on SCM modules and CPFR is on better demand forecasting. In the case of SCM modules, this is achieved through improving forecasting algorithms and possibly drawing on a broader data set. CPFR is, as the name suggests, based on a collaborative planning approach. In a recent white paper, published by the industry group acting as a curator for the CPFR concept (VICS, 2010), the relationship between enterprise-wide planning -- called sales and operations planning -- and supply chain-wide planning -- i.e. CPFR -- is addressed. Specifically, that paper defines a maturity model which, in addition to a collaborative planning stage, also includes a strategic stage in which executives of supply chain members engage in a joint planning effort, including financial planning. This proposal is meant to overcome limitations of traditional CPFR which often commences only after supply chain member companies have made their sales and operations plans independently. As the planning horizons available for collaborative planning are thus severely constrained in the traditional CPFR approach, many of the dysfunctional effects observed by Lee et al. (1997) still manifest themselves. The integrated approach proposed by VICS (2010) aims to eliminate these effects.

While we believe that this integrated approach is valid and promising, we argue that it is not suitable for every type of industry and institutional environment. On the one hand, the VICS-approach assumes that participating companies have advanced ERP systems that are tightly connected with one another across the whole supply chain. On the other hand, this approach assumes that companies command roughly equal bargaining power in a supply chain. As an alternative to integrated supply chain-wide collaborative planning, we propose a centralized supply chain resource planning system, possibly operated by a third party.

SUPPLY CHAIN RESOURCE PLANNING SYSTEMS

A supply chain resource planning system (SCRP) has two main characteristics. 1. It centralizes relevant business data on production, procurement, and distribution capacities and plans in a single (logical) data base. 2. It provides a common master plan for production, procurement, and distribution quantities for all supply chain members. In essence, a centralized SCRP system replicates the idea of an ERP system on the level of a whole supply chain. (In the following, we will use the terms 'SCRP' and 'centralized supply chain management system' synonymously). Such a system would extrapolate the three trends that we have identified above as (also) characterizing evolution of business applications. It would integrate business data management across a whole supply chain, outsource significant portions of resource planning, and standardize business processes across a whole supply chain.

The first aspect characterizing SCRP may be usefully elaborated by comparing the concept with that of hosted ERP systems, known as application service provisioning (ASP). According to the ASP model, companies do not install an ERP system on their premises but access a system remotely installed on the premises of a service provider. In addition, the licensing model is varied in that users often pay based on a monthly rate or on the actual volume of use rather than based on a fixed number of users as is typical for standard ERP licensing arrangements (Seltsikas and Currie, 2002). Adoption of the ASP model has remained far behind original expectations (ibid.) although it was praised as a suitable alternative especially for small and medium sized firms. A likely reason is that small firms are often pressured by their large business partners to adopt the same system that these large firms use internally (Benders et al., 2006). In any case, the advantages of the ASP model are limited to cost savings when compared to standard ERP deployment, in the form of lower licensing costs as well as more efficient system operation, while it does not tap the potential for increased efficiency through providing a higher level of data and planning integration across a whole supply chain, as is suggested with the SCRP model.

If the SCRP model were limited to supply chain-wide data integration, analogous to the (logically) single, integrated database of an ERP system, its only advantage would consist in cost savings as well. Specifically, the costs of interfacing independent and often incompatible ERP systems through EDI-type linkages would be eliminated. However, the main advantage of the SCRP model is associated with a new approach to supply chain-wide planning. Strictly analogous to an ERP system, the integrated data base provides only the basis on which a consistent and coordinated plan can be created for the unit of operations under consideration. In the ERP case, that unit is an enterprise while in the case of an SCRP system, that unit is a supply chain. Thus, the second aspect of the SCRP model is most usefully compared to the CPFR model described above as characterized by the highest level of maturity according to VICS (2010). Both concepts aim to facilitate an integrated planning process for a whole supply chain which minimally comprises two tiers, typically a manufacturer and a retailer, but which can be extended to include suppliers, distributors, and further supply chain members. Under a CPFR regime, senior executives of all participating companies jointly negotiate their sales and operations plans (VICS, 2010). In contrast, under a SCRP regime, a third party takes over significant portions of supply chain-wide planning (we will discuss this in more detail below). Thus, the SCRP model promises significant benefits through better coordination across a whole supply chain, analogous to the CPFR model in its, as yet unrealized, highest maturity incarnation. Essentially, these benefits result from elimination of distortions of resource allocation decisions described by Lee et al. (1997) as summarized above.

Both aspects, supply chain-wide integrated data base and new planning approach, imply that business processes are standardized across supply chain companies. This, again, is strictly analogous to the effects of ERP systems on the company level. For example, supply chain companies need to agree on common codes for product designations as well as on common ways to handle critical inventory procedures such as selling or reserving inventory.

In sum, the SCRP model is characterized by: (1) creation and administration of an central data base that contains all relevant business data of companies constituting a whole supply chain; (2) outsourcing of data administration as well as significant portions of traditional sales and operations planning processes; (3) further standardization of business processes.

GOVERNANCE OF SCRP

While we have hinted at clear benefits of the SCRP model over the standard ERP approach (whether hosted or installed on the premises of the user company), it implies that companies rely on a third party for managing their core business data as well as for significant portions of their resource planning. While entrusting crucial company data such as inventory data and production plans to a third party may seem infeasible and undesirable, it should be noted that current practice already involves significant degrees of outsourcing of functions that were once considered to be core to enterprise management. Specifically, by implementing third-party ERP systems, companies have effectively handed over responsibility for updating their core IT infrastructure to an external party over which they have no direct control. Companies may find that ERP vendors fail to accommodate future requirements or go out of business all together in which case they will be in dire straights

indeed. Thus, significant external dependencies already exist and the step towards a centralized supply chain resource planning system may not be so big after all.

The predominant framework for evaluating the outsourcing option is transaction cost economics (TCE) as elaborated by Williamson (1987). The overall approach consists of comparing discrete institutional arrangements under a transaction cost logic. Essentially, it is predicted that institutional arrangements with relatively lower transaction costs will (and should) be adopted. Williamson defines a single transaction as the unit of analysis which implies that institutional arrangements are considered for particular economic activities rather than for whole organizations. Moreover, he has identified three principle factors that influence the level of transaction costs, namely asset specificity, uncertainty, and transaction frequency. Finally, he focuses on the costs of adapting resource allocation decisions to changing economic conditions which are difficult, i.e. costly, to predict.

From a TCE perspective, the two aspects characterizing the SCRP model, centralized planning and data management, need to be separated. Entrusting the management of business data to an external party corresponds to the 'market' or 'buy' option while internal management of business data implies the 'hierarchical' or 'make' mode of production. In contrast, centralized planning suggests that companies submit to a new authority as this authority may impose various decisions on participating companies while collaborative planning implies that participating companies determine their sales and operations plans in a market-like negotiation process. While outsourcing sales and operations planning to a third party may superficially appear to imply a market mode of production, it seems more true to the spirit of transaction cost economics to conceptualize such an arrangement as hierarchical coordination since its essential characteristic is that participating companies subject themselves, for a specific activity, to the authority of a third party. Such authority relations are considered by Williamson (1987) to constitute the essential characteristic of hierarchical coordination. We will consider possible governance structures for these two aspect separately.

The main source of transaction costs are different types of hold-up problems. Williamson focuses on the case of investments that are specific to one particular customer or supplier, so-called asset specificity (Williamson, 1987). If the business relation is severed, the value of that investment will be drastically reduced, thus exposing the investing party to potentially opportunistic behavior by customers or suppliers. A SCRP regime sets up two different types of hold up-problems. First, entrusting an external organization with managing crucial business data exposes the company to opportunistic exploitation by that external organization. For example, the third party may decide to save costs by lowering efforts to sufficiently secure data against misuse and theft. As a consequence, companies will outsource data management only if they can set up sufficient safeguards against such opportunistic behavior. Rather than proposing specific possible safeguards for this purpose, we submit that there are indeed similar cases in economic life that can serve as models for this situation. Specifically, commercial banks have long taken over the 'management' of crucial data for their clients in that they keep accounts for clients and, on behalf of their clients, perform certain actions on these accounts such as crediting and debiting. Similarly, it might be argued that third party SCRP providers manage inventory data for companies and, on their behalf, increase and decrease inventory data according to commercial transactions. For example, selling an item would imply that the inventory of the seller is deducted accordingly while the inventory of the buyer is increased by the proper amount. Banks have obviously succeeded in gaining the trust of clients which may carry over to their operating SCRP systems. Moreover, banks were among the first firms to automate information processing on a large scale as described by Bonin (2004) and increasingly come to resemble information processing firms.

For a company to subject itself to a central planning authority, in contrast, is tantamount to a specific form of hierarchical integration. Williamson does not specifically address possible hold-up problems within hierarchies. However, he argues that the main advantage of hierarchical coordination lies in lower adaptation costs in cases of unanticipated environmental shifts. Rather than having to negotiate adjustments to such changes, hierarchical coordination allows for a simpler form of adjustment which works through commands. Milgrom and Roberts (1990) have argued that an often overlooked cost of hierarchical coordination consists of 'influence costs' as members on lower ranks try to influence management decisions in their favor. A similar problem can be anticipated in the case of a centralized SCRP system. However, again we note that in other sectors of economic life solutions have been found to this problem. For example, the role of investment bankers in evaluating assets of firms implies that they are 'immune' to such influence activities. Companies who consider to merge accept the evaluations of investment banks rather than engage in costly haggling, which could provide a model for a centralized SCRP system.

While we needed to consider possible governance structures separately for the two aspects that characterize the SCRP model, the model as a whole can be related to the CPFR model as providing an alternative institutional arrangement. The CPFR model combines a supply chain-wide collaborative planning approach with the traditional ERP model of internal data management while the SCRP model combines centralized master planning with supply chain-wide data integration. Whether,

in specific cases, supply chain companies opt for a CPFR or a SCRP model will depend on the specific magnitude of the costs considered here and possibly other factors. Moreover, in many cases, neither the CPFR nor the SCRP model will be economically viable. However, our considerations point to the possibility that a SCRP model is feasible if third parties operating an SCRP system offer sufficient safeguards against their possibly opportunistic behavior and also against possible influence activities that might distort their planning outcomes. Surprisingly, commercial and investment banks appear to be promising candidates for this task. However, it is unlikely that a full-fledged SCRP system will start from scratch. Rather, it might evolve over several stages which we will consider next.

IMPLEMENTING SCRP

A major problem in implementing the CPFR model turned out to consist in what might be called a recursive relationship between two planning levels: the enterprise level and the supply chain level. Sales and operations planning usually starts with forecasting demand on which basis resource allocation decisions are made. However, assumptions made on this level about future demand may become invalid as companies engage in CPFR. Specifically, the basis on which company-wide plans have been made may be undermined through a joint (collaborative) demand forecasting process. Moreover, joint (collaborative) resource allocation decisions on the level of a supply chain may alter the input parameters on which company-wide planning is based. Based on these insights, the consortium developing the CPFR model has proposed an integration between supply chain-wide CPFR and company-wide sales and operations planning (VICS, 2010), as summarized above. Their analysis shows that a weakness of the traditional approach to CPFR lies in a specific solution to the problem of the recursive relationship between the two planning levels. Specifically, companies have integrated these two planning levels through staggered planning horizons: company-wide sales and operations planning has a long-term time horizon the outcomes of which are then used as input values for short-term CPFR. Naturally, reversing resource allocation decisions on the short term often becomes infeasible or prohibitively expensive (ibid.). As a consequence, the benefits of CPFR have often been limited.

A similar recursive relationship threatens the viability of the SCRP model. We argue that centralized resource planning has to be limited lest the autonomy of firms is completely destroyed so that, in effect, a supply chain becomes a vertically integrated firm. As a consequence, there are still two planning levels that need to be integrated. This can be done by designating supply chain-wide resource planning as providing a master plan which then sets the parameters for company-wide resource planning (in contrast to the CPFR model where company-wide planning has priority over supply chain-wide planning). To integrate these two levels, the responsibilities for each need to be clearly defined and separated. Moreover, this relationship may evolve over time and thus suggest alternative implementation processes. In the following, we will outline a highly stylized implementation model in order to clarify the underlying issues and to demonstrate the possibility of evolving the SCRP model rather than having to implement it in a Big Bang approach.

We use a distinction between three different type of business data as our main, admittedly highly simplified analytical tool. These are inventory data, order/delivery data, and production and distribution plan data. Inventory data document existing stocks of goods and materials. Order/delivery data document expected changes in inventory data. Production and distribution plan data document commitments companies have made with regard to their production and distribution capacities. Implementation of the SCRP model can now be thought of to proceed in three steps, with each step centralizing one more data type as defined above. Thus, the first implementation stage consists of centralizing inventory data, the second of centralizing order/delivery data, and the final one of centralizing production and distribution plan data.

In the first stage, the SCRP agency thus manages all inventory data in the supply chain. Based on knowledge of inventory levels across the whole supply chain, the agency prepares a demand forecast for each supply chain member which is then used as a common basis (a master plan) for company-wide sales and operations planning. The latter now only includes decisions about orders and deliveries as well as about production and distribution capacity use, i.e. companies do not engage in their own demand forecasting. The second stage consists of centrally managing inventory plus order/delivery data. This extends the basis on which the SCRP agency creates demand forecasts for each member company. In multiple planning rounds the SCRP agency can now issue updated demand forecasts on the basis of which member companies adjust their delivery and order decisions which, in turn, are documented in real time in the SCRP system, providing a new basis on which the SCRP agency creates and updated demand forecasts. The number of these iterations needs to be decided based on practical considerations and experiences with the approach. Finally, all plan data about allocating production and distribution capacities are integrated centrally and used for making demand forecast in a similar fashion.

This approach can, for illustrative purposes, be elaborated by distinguishing it from the CPFR model on the one hand and from vertically integrated firms on the other hand. In contrast to the CPFR model, demand forecasts are not created collaboratively but through a third party. Moreover, this third party has real time access to business data which document

resource commitments made by member companies while, in the CPFR model, this common data basis has to be created first by the several collaborating companies. In contrast to the highest maturity level of the integrated model presented in VICS (2010), the SCRP model does not assume that member companies engage in joint financial planning nor that they need to coordinate their resource allocation decisions directly. Rather, such coordination comes about through multiple planning rounds that are moderated by the SCRP agency.

A crucial difference with a vertically integrated firm is that the SCRP agency has no goal of profit maximization across the whole supply chain. Rather, financial planning remains strictly bounded by company boundaries while the SCRP agency aims at stabilizing expectations about total demand across the whole supply chain and facilitates the coordination of resource allocation decisions under the constraints of -- company-wide -- profit maximization.

DISCUSSION AND CONCLUSION

This paper has outlined the concept of supply chain resource planning systems characterized by two aspects: supply-chain wide integration of crucial business data and outsourcing of significant aspects of resource planning. We have discussed the need for better supply chain-wide coordination of resource planning and shown how the proposed system addresses this need. We have further explored, from a transaction cost economics perspective, the conditions under which companies might be willing to participate in such a system and have outlined a possible approach to evolving a SCRP system. We acknowledge that the concept, so far, is rather rough and cannot serve as a template for implementation yet. Instead, our main purpose was to encourage research that might provide a firmer basis on which companies may be willing to experiment with proto-forms of the proposed system. Further, we note that the model might be suitable for industry and institutional contexts more common in non-western countries such as China. For example, a large distributor of electronics products, Digital China, has started to develop a system that would allow its customers to manage their inventory data (McFarlan et al., 2004). The electronic market Taobao has, from the very beginning and in sharp contrast to its international rival eBay, targeted small businesses and engaged in efforts to develop an IT infrastructure that its members can use to manage their operations. Finally, the Tradecard system (see Yuan, 2007) developed in Singapore ventures well into offering an IT infrastructure that allows companies to manage processes that were formerly performed on internal systems.

More generally, Hempel and Kwong (2001) and Martinsons (2004) have argued that the western model of supply chain integration based on internal ERP systems and extensive EDI linkages may not be feasible in the Chinese business environment. Thus, our proposed model might seem as an attractive alternative in a non-western context. Thus, exploring the influence of national and institutional contexts on modes of supply chain integration is an exciting and promising area for future research. For example, Kwok and Tadesse (2006) have argued that, whether banks play a significant role in an economy also depends on national culture. As we have identified banks as possible operators of a SCRP system, this might be an important mediating variable. More generally, we propose to study the role of meso-level economic organizations in view of supply chain integration. Granovetter (1994) has argued that the important role of business groups has been neglected by both sociology and economics and has made important contributions to understanding their role in the Asian context. Gregor and Elliot (2002) have specifically explored the role of third-party facilitation in developing inter-organizational information systems and emphasize the need for an ‘honest broker’ in such projects. Regarding possible roles of banks, Ekbia and Kling (2005) point out that, in order to better understand the functioning of manufacturing networks, it is important to adopt a broader perspective that includes, among other organizations, banks in facilitating such networks. Thus, exploration of this meso-level seems to us to constitute an exciting second topic that arises from our discussion. Finally, the issues that we have raised in this paper may also encourage further research into the societal impact of electronic commerce. Heng (2003) has argued that the main impact of e-commerce will be second order in that new institutions will arise that significantly affect the organization of economic activity. The model that we have outlined in this paper may well be the origin of a new type of institutions that we have called SCRP agencies.

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