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Collaborative Commerce

Timon C. Du

Eldon Li

Jacqueline Wong

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Timon Du
Department of Decision Sciences and Managerial Economics, The Chinese University of Hong Kong, Hong Kong
timon@cuhk.edu.hk

Eldon Li
Professor of MIS, Cal Poly State University, San Luis Obispo, USA
Professor and Dean, College of Informatics, Yuan Ze University, Taiwan
eli@calpoly.edu

Jacqueline Wong
Department of Decision Sciences and Managerial Economics, The Chinese University of Hong Kong, Hong Kong
jacquelinewong@cuhk.edu.hk

Abstract

Following the evolution of electronic business, collaborative commerce uses information technology to achieve a closer integration and a better management of business relationships among parties including internal personnel, business partners and customers. Recently, market and globalisation competition, customer oriented service strategy and product complexity have pushed enterprises a step further on in collaborative commerce. In brief, collaborative commerce is (1) a collaborative technology – similar to workflow collaboration, (2) a customer-driven technology – similar to a pull-type supply chain, (3) a functionally-integrated technology – similar to concurrent engineering and (4) a business-driven technology – similar to enterprise resource planning, for cross-organisational integration. The paper will illustrate the technologies and the critical success factors of collaborative commerce adoption.

1. Introduction

Many businesses today tie collaborative relationships between partners through the use of digital technologies. The level of collaboration has moved beyond buying-and-selling to planning, designing, developing, communicating, discovering information, researching and providing services among organisations. This new form of collaboration is called collaborative commerce. Following the evolution of electronic business, collaborative commerce is defined as using information technology to achieve a closer integration and a better management of business relationships among parties including internal personnel, business partners and customers [3] [12]. In responding to ever-changing global market demand, business collaboration will bring the whole supply chain to a competitive edge by decreasing product development costs, shortening the time to market and improving product quality.

The survey of over 300 business executives by Deloitte Research in mid-2002 shows that collaborative commerce has led to better business operation and information exchange and has provided a 70 per cent rise in profitability for those companies who adopted the technology compared with those who did not integrate with their trading partners [6]. Similar results were found in the survey conducted by NerveWire [8]. Companies with a 'very high', that is, level 4, external integration level appear to be more competitive in several metrics than those companies with lower integration levels. The average revenue of level 4 companies increases by about 40 per cent, which is about three times of that attained by companies at level 2 or 3. Moreover, cost reductions at level 4 are about two and half times of the average of those at level 2. This are all because the integrated environment can enhance the value chain of suppliers, business partners, customers and employees through flexible business processes, better product quality, rapid order fulfillment, improved reliability, improved capital efficiency and prompt information exchange and knowledge sharing.

The applications of collaborative commerce are various, including promising areas such as collaborative design, collaborative engineering, collaborative decision-making, collaborative forecasting, financial collaboration, sharing knowledge of human resources, collaborative inventory management and consolidating transportation. Moreover, several collaborative models are well known today. For example, collaborative planning, forecasting, and replenishment (CPFR) by the Voluntary Inter-industry Commerce Standards Association uses ERP and demand planning systems for collaborative facilities forecasting and planning. Collaborative forecasting and replenishment (CFAR), jointly initiated by Wal-Mart and P&G, provides no gap between what Mal-Mart plans to sell and what P& G plans to produce [5].

Two points need to be addressed better to understand collaborative commerce:

(1) *Collaborative commerce is the collaborative business*. Just as the terminologies between electronic commerce and electronic business can be used interchangeably, the term 'collaborative commerce' can be used interchangeably with 'collaborative business'. Note that commerce describes the buying-and-selling transactions between parties. However, electronic business has a

broader meaning in which more business operations, such as design, production and transportation, are involved. However, these two terms are sometimes used interchangeably in describing business transactions via the electronic media. Similarly, 'collaborative commerce' is not limited to a collaborative development in buying and selling goods and services. It includes all levels of the activities of business operations.

(2) *Collaborative commerce is an evolutionary technology*. Collaborative commerce evolves from collaboration in the workflow to concurrent engineering and the supply chain and beyond. Three dimensions can be used to describe the movement of these technologies: collaboration, organisational integration and business operations (see Figure 1). Workflow collaboration is an improvement on individual efforts in business activities to stronger co-operation. However, most of these activities belong to the transactional type, which means that a task is assigned to an employee either after another employee has completed his or her task or concurrently with that employee. In contrast, concurrent engineering has a deeper collaborative involvement with the employees.

Concurrent engineering brings employees with different expertise together for product development. These activities involve more functional operations, such as product design, procurement and human resources management. Recent technology in supply chain collaboration, focuses more on inter-organisational integration than on the workflow and concurrent engineering. However, the supply chain linking organisations together to share information is rarely involved at this functional level. Therefore, the trend towards moving workflow collaboration, concurrent engineering and supply chain collaboration to a profound level of functional integration is apparent. This is the origin of collaborative commerce.

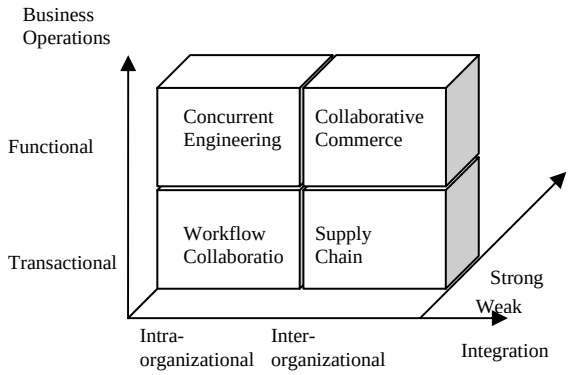

Figure 1. Collaborative Comommerce is an evolutionary technology

While the term 'collaborative commerce', abbreviated as 'c-commerce', was first coined by the Gartner Group in 1999 as the next trend of e-business models and IT investment in B2B world, it was conceptualised as a new form of business model that had been enabled and leveraged by the Internet and integration technologies [3]. Soon after Gartner's coinage of the term, major software vendors including ERP vendors and individual B2B software vendors, such as IBM, i2, SAP, AMR and so on, were competing to provide ways of conceptualising their own way of enterprise collaboration over the Internet.

Although they varied in the way they implemented c-commerce they were all clamouring for the rewards and the competitive edge brought about by the c-commerce business model. In general, collaborative commerce integrates business processes such as demand planning, planning and scheduling, order management, product development, vendor management, sales support and knowledge sharing between partners through sharing information electronically (see Figure 2). Moreover, collaborative commerce is a set of techniques to allow companies to maintain better relationships with their trading partners through automating their cross-enterprise process logic, rules, heuristic and workflow.

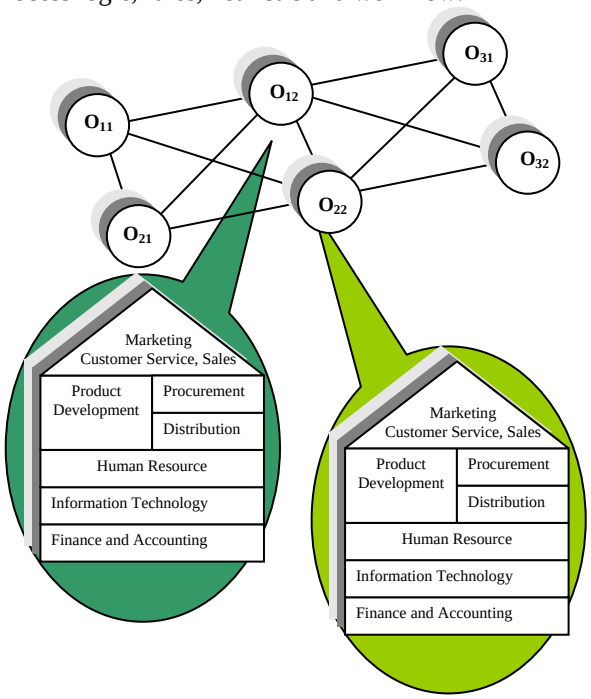

Figure 2. Collaborative commerce integrates business processes across collaborative partners O_{11}, O_{12}, O_{21}, O_{22}, O_{31}, and O_{32}.

The emergence of the collaborative commerce model articulates the succession of continuous improvements in supply chain management. To continue maintaining the competitive edge of an enterprise in the digital economy, several efforts in improving business processes and operations have been made during the past decades. First of all, enterprises adopted enterprise resource planning (ERP) to centralize originally isolated information modules within an organisation. Such efforts result in the increase of information efficiency and integrity. Later, enterprises recognised the benefit of information transparency in the supply chain. Therefore, solutions for the exchange of valuable business information within the supply chain become the focus of efforts to manage supply chain performance. Such efforts reflect the benefit of information synergy on eliminating the bullwhip effect [5].

Recently, market and globalisation competition, customer oriented service strategy and product complexity have pushed enterprises a step further on in business collaboration. To outsource minor business functions effectively and focus on core competitiveness, enterprises need to integrate their information systems with external systems owned by their collaborating partners. In this way the information shared among partners and business processes could flow seamlessly from organisation to organisation. Such system integration brings multiple enterprises to collaborate in shared business opportunities.

In summary, collaborative commerce is (1) a collaborative technology – similar to workflow collaboration, (2) a customer-driven technology – similar to a pull-type supply chain, (3) a functionally-integrated technology – similar to concurrent engineering and (4) a business-driven technology – similar to enterprise resource planning, for cross-organisational integration. The following sections will illustrate the technologies followed by the infrastructure of system integration. Finally the critical success factors of collaborative commerce adoption will be discussed, together with our conclusions.

2. Collaborative Technology

Collaboration is the focal point in collaborative commerce. Traditionally the workflow is created to deal with specific *cases* in an organisation, such as mortgage applications and engineering tests. Each case has a unique identity and a limited lifetime. That is, a case should be completed within certain time limit and will exit the workflow system when the work is completed. That also means that attributes are needed to describe the state and content of the workflow. The work in a workflow can be identified as *tasks*, which represent the indivisible units of works. The tasks are carried out by *processes*. When the processes are carried out in a workflow they follow a specific sequence, which determines which tasks need to be performed next. There are four different types of sequences: *sequential*, *parallel*, *selective* and *iterative* routings. The sequential routing confines one task to be executed before another task while the parallel routing allows two tasks to be performed without having any result on the other. Similarly, selective routing provides the choice between or among tasks and iteration allows the same task to be performed more than once.

During implementation, the process needs to be enacted to perform a task. The enactment is triggered by *events*, such as external events (a new order having arrived), resources (an employee making a request), or time signals (at eight o'clock every morning) [1]. Note that tasks are assigned to designated *roles* of an organisation following principles such as the separation of duties, least privilege assignment and data abstraction [11]. These principles assure the successful implementation of the workflow. For example, the separation of duties assigns two sensitive tasks to two exclusive roles so that conspired perpetration can be avoided. On the other hand, the least privilege policy, also called the 'need-to-know' policy [4], provides only minimum information for completing the task. In collaborative commerce, a number of organisations, including supply chain partners or even competitors can collaborate in the workflow of an organisation. This implies that better control of access and degrees of collaboration are expected in collaborative commerce.

The workflow management system (WFMS) manages the workflow on a day-to-day basis in various application domains such as office automation, finance, healthcare, telecommunication, manufacturing and production [2]. To allow workflow collaboration across organisations, four elements need to be carefully designed: DBMS, WFMS, administration functions, and applications monitoring. The DBMS manages conventional database tasks, such as data maintenance, data integrity, concurrency control and recovery of current data and historical data. The DBMS needs to manage data sharing among organisations. WFMS deals with the workflow process definition, activities and control. Access to WFMS is across the collaborating organisations. This creates a high degree of complexity.

The applications provide services such as ERP and its corresponding data are normally managed by DBMS. The sharing of applications involves the complexity of both the data level and the functional level. The administration and monitoring element handles administrative tasks which fall outside the scope of the DBMS and WFMS, such as statistical analysis, resource management and operational management. This element also implements some access control mechanisms, especially those

mechanisms related to other organisations. For example, collaborators may be allowed to refer to the statistical data of total sales rather than sales of individual items when designing a product collaboratively.

3. Customer-Driven Technology

Collaborative commerce should be customer-driven, similar to the theme of the pull-type supply chain – pulled by the customer rather than pushed by the manufacturer. Note that the supply chain links organisations together to share information, products, and funds to fulfil their customers' requests efficiently. Supply chain processes can be identified as belonging to four cycles: the customer order cycle, the replenishment cycle, the manufacturing cycle and the procurement cycle [5]. A successful supply chain should be driven by the customer order cycle to the procurement cycle. The shorter the propagation channel, the quicker the response of the supply chain can be. The customer order cycle links customers with retailers to fulfill the customer's orders. The activities in the customer cycle include order entry, order fulfillment and order receiving. The replenishment cycle focuses on replenishing the retailer's inventory by co-ordinating between retailers and distributors.

Activities such as retail order entries, retail ordering, fulfilment of retailer's order and receiving goods are involved. The activities between distributors and manufacturers are considered the manufacturing cycle. In this cycle, the replenishment of the distributor's inventory is the focal point. The activities include the arrival of the order from the distributor, retailer, or customer; the manufacturers' production scheduling, the manufacturing and shipping of the item and receiving it by the distributor, retailer, or customer. The last cycle is the linkage between the manufacturers and suppliers, called the procurement cycle. This cycle ensures that the materials are available for manufacturing by considering orders based on the manufacturer's production schedule or the supplier's stocking needs and the supplier's production scheduling and shipping.

There are many famous implementations of the concept of the supply chain. For example, in the customer order cycle, the online catalogue is a useful implementation for putting products online for customers. This provides significant advantages in giving up-to-date information to customers. Similarly, sales force automation (SFA) automates relations between sellers and buyers by providing product and price information. In the replenishment cycle, vendor-managed inventory (VMI) allows the distributor or manufacturer to manage inventories and the wholesalers or retailers continuous replenishment programmes (CRP) allow suppliers to replenish the inventories of retailers regularly, based on POS data.

In the manufacturing cycle, advanced planning and scheduling (APS) develops the detailed production schedules about what to make, where to make it, when to make it and how to make it by considering the availability of materials and plant capacity, among other business objectives. The objective of an organisation is to optimize the capacity of manufacturing, distribution and transportation resources based on the data collected from ERP or legacy systems. In the procurement cycle, a content catalogue that focuses on the activities between the manufacturer and its suppliers can simplify the procurement process and allow the manufacturer to keep track of the parts, specifications, prices and order processes of the supplier.

However, to maintain the supply chain relationship, the high degree of trust is needed. In general, trust is nurtured from deterrence-based trust, knowledge-based trust and identification-based trust [12]. Deterrence-based trust uses a variety of formal contracts to ensure co-operation between parties while knowledge-based trust is built on the knowledge of the other trading partner (trustee), which allows the trustor to understand and predict the behavior of the trustee. However, to build a strong relationship, identification-based trust, which allows each party to consider the other party's objective as identical to its own, is beneficial. The same idea is applied to collaborative commerce. Moreover, it should be noted that the partners in collaborative commerce also include competitors, which is not common in the supply chain. Therefore, the degree of trust and the need to do access control are especially important.

4. Functional-Integrated Technology

The degree of collaboration in collaborative commerce should go down to the level of functional integration, similar to that in concurrent engineering (CE) – a systematical approach to integrate product design and manufacturing process support to minimize product development time. Prasad [9] conceptualized the functionalities for CE as two wheels. The first CE wheel represents the integrated product and process organisation while the second concurrent wheel defines the integrated product design and development.

Both wheels have three rings to represent the three essential elements of CE. The inner ring is the hub of the wheel and includes the four Ms: models, methods, metrics and measures. Basically, the four M elements provide the fundamental methodologies for CE implementation. The middle ring focuses on the work groups which drive the wheel forward. The elements in the middle ring for both

wheels are identical: personnel teams, virtual teams, logical teams and technological teams. The centrality of these teams emphasizes the importance of team work. Logical teams are formed to deal with the work process and to ensure that the sub-process interface with one another logically (similar to the tasks in the workflow).

The personnel team is responsible for assigning tasks to roles. The virtual team is formed to assist the personnel team only when conflictions need to be resolved or missions need to be achieved. The technological team manages the quality of products. The outer ring for both wheels functions to implement the CE. In the product and process organisation wheel, the functions are manufacturing competitiveness, life cycle management, process re-engineering, CE definitions, system engineering, information modeling and the whole system product realisation taxonomy. The functions for integrated product development are concurrent function deployment, total value management, development framework and architecture, decision support systems, intelligent information systems, life-cycle mechanisms and CE implementation guidelines.

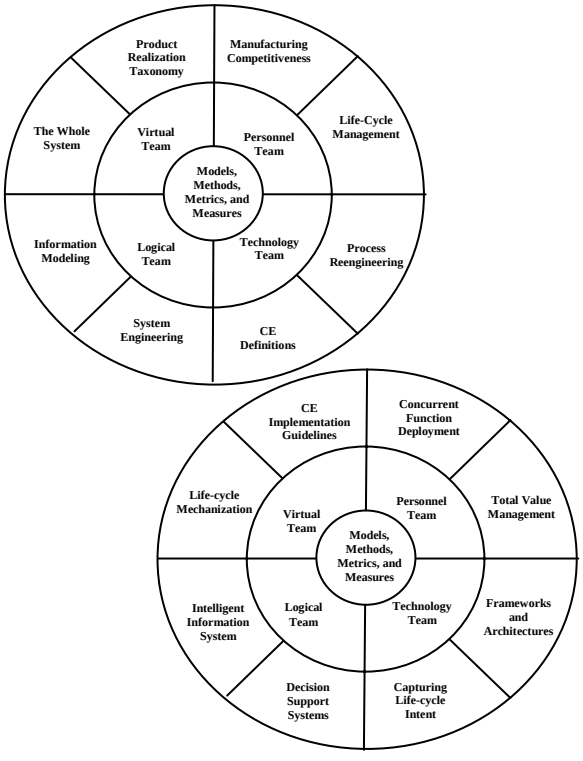

Figure 3. Concurrent engineering wheel [9].

Concurrent engineering tightly links all functions involved in the product development cycle in an organisation. A successful implementing mechanism for cross-functional integration is therefore very important. Fleischer and Liker modified the five co-ordinating mechanisms proposed by Henry Mintzberg [7] to concurrent engineering to improve cross-functional integration. The mechanisms are (1) direct supervision though the appropriate design of organisation architecture and project management; (2) mutual adjustment through various cross-functional teams, (3) the standardisation of design and performance metrics; (4) the standardisation of work processes, such as operational procedure, planning and scheduling systems, monitoring systems and development process tools and (5) the standardisation of worker skills.

However, the organisation culture which emphasizes collaboration is the most important factor that glues together cross-functional integration. The same idea can be applied to collaborative commerce, which encourages cross-functional and cross-organisational collaboration. Both the ‘hard‘ factors, such as the five mechanisms, and the ‘soft‘ factor, that is, the collaborative culture, are all critical to success.

5. Business-Driven Technology

Business-driven technology creates the possibility of better information technology adoption. Successful information technology adoption can be traced back to the history of the adoption of enterprise resource planning (ERP) against computer-integrated manufacturing (CIM). In the 1960s material requirement planning (MRP) was adopted by most manufacturers to find out ‘what are we going to make‘. To deliver products to customers, the company needs to examine ‘what it takes’ to make the products and ‘what we have now‘. Then, if we do not have sufficient materials to make the products, we must decide ‘what we have to get‘.

With a little help from computers, these questions were easy to answer in that age since the business operations were simple. However, gradually, the manufacturers wanted to manage both the quality and quantity of the products so that they could deliver them to happy customers on time. This requires an integrated shop-floor control system, which controls the activities of all resources through capacity requirement planning (CRP), scheduling, shop-floor control and other mechanisms. That brings us to a full-scale shop-floor control system, called the manufacturing execution system (MES).

In the 1970s, the focal point of the manufacturers became how to integrate both MRP and MES so that they could manage orders as well as shop-floor production. The new system is called manufacturing resource planning (MRP II). The key to the success of MRP II is in the integration of individual modules and information flow. Fortunately,

a new generation of both the hardware and software was evolved by the growth of information technology. This trend nourished the integration of MRP II. At the same time, parallel to the growth of MRP II, accountants found they needed to handle tasks more than just credit and debit data: they needed methods of internal control. Internal control provides a reasonable way of protecting the business process of an organisation from the misuse of assets. At that time, the accounting information system (AIS) delivered its promise and prevailed in service industries. It is not then surprising that some functionalities of both the MRPII of manufacturing industries and the AIS of the service industries have overlapped in some degree.

In the mid-1980s the new integrated system, called computer-integrated manufacturing (CIM) was proposed by CASA to accomplish functions such as marketing and sales, engineering, R & D, quality assurance, warehousing and distribution, shipping and receiving goods, finance and accounting control, information systems, human resources, customer service and manufacturing material management. The architecture was again represented by SME as an enterprise wheel in 1993 [10]. This architecture integrates both the MRP II and AIS and beyond by introducing inventory management and sales management, financial functions and human resources to MRP II manufacturing and engineering functions to AIS. Enterprise software such as MAPIC/DB from IBM was one of the pioneers in this area.

However, as implied by its name, the core of CIM is in manufacturing; a fact that does not attract enough attention from top executives. This causes some problems, especially when integration obstacles are encountered. Few successful cases in CIM adoption were reported during that period. However, another integration approach blazed the trail in the 1990s. It is called enterprise resources planning (ERP), which compiles similar but fewer functions than CIM. The driving force of ERP is in financial functions, the most interesting function in the enterprise system to top executives. The successful implementation of ERP from companies such ASP, BAAN, PeopleSoft, Oracle and J.D. Edward has opened a large market for enterprise system.

However, an integrated enterprise resource planning system does not provide enough competitive advantage to companies. Therefore, strategies such as linking the ERP system to electronic commerce to sell products to consumers, to suppliers to provide supply chain partnerships, to customers to provide customer relationship services, to share among employees so as to provide employee management to distribution centres to provide consolidated logistics service have been adopted. The outreach of ERP has created a new phenomenon, a development from an integrated intra-organisation system into an inter-organisation system, called EERP, or the enhanced ERP.

As will be observed from this history, the successful adoption of collaborative commerce should be business-driven rather than manufacturing-driven. Fortunately, collaborative commerce, as part of its name implies, has built upon the current technologies such as e-commerce, mobile commerce, ERP and the supply chain. This provides the better ground for nourishing its growth.

6. Conclusions

Application platforms have improved in the last decades together with the implementation of enterprise systems. Previously a MRP system sharing information with a department a LAN setting was considered suitable. Then MRP II moved the focus from intra-department integration to inter-department integration. At that time, the single LAN moved to multi-LANs and WAN. The Internet has become the conveyer of information to almost everywhere in the world. At the same time, the system infrastructure also evolves from peer-to-peer linkage to client-server architecture and eventually becomes a three-tier architecture. This evolution supports the growth of enterprises from regional enterprises to global enterprises, which grows collaborative commerce itself.

To provide Internet access, most the commercial enterprise systems moved to the Internet-based ERP in the late 1990s. Nowadays, the new generations of telecommunication technology such as the current 3G technology and the anticipated 4G technologies integrates the wire or wireless Internet with the wireless telecommunication network. This allows the business process to be executed truly anywhere and any time. Will the new generations of telecommunication technology change the implementation of enterprise systems? Or, more precisely, will the high speed wireless transmission change the applications of enterprise system? Collaborative commerce no double will be one of the business models if that ever happens. But the types of collaboration may be present in many different formats. To accomplish a collaborative vision of commerce, several factors considered to enable such collaboration.

(1) *Better relationship management*. Since the collaborative commerce business model allows multiple organisations to weave a collaborative network, each collaborator should have the ability to manage the resulting dynamic business relationship. This is especially true when the collaborative community is expanded to a cyberspace marketplace.

(2) *Better business process integration*. Collaborative commerce represents the most efficient way of doing business, where enterprises unwrap their core and competitive business functions to their collaborative partners. The commitment is risky but highly rewarded. The migration to collaborative commerce is equivalent to changing business relationship from independent units to mutually dependent ones. As a result the business process of each collaborator should be understood by every partner. The business process may also need to be decomposed into smaller components so that the integration and collaboration between collaborators become possible. Moreover, the degree of concurrent operations can also be improved if the tasks can be divided into disjoint sub-tasks. The success of seamless collaboration can therefore be achieved by harmonizing all the business process in the network.

(3) *Better knowledge and information sharing*. Since the business processes are contributed to over distributed and heterogeneous networks, it is important to have a superior information infrastructure to allow the information and knowledge to be shared during the processes such as product development. Also, the better sharing of information is rewarded with better access control of the organizational data. Although sharing information is encouraged, it is not difficult to understand that all companies have their own proprietary knowledge, which is not intended to be shared with collaborators, even in the closest relationships. The company may also want to share some general information with specific partners at certain time for certain projects.

(4) A *Better collaborative culture*. Collaborative commerce brings the most talented workers together to develop products to meet consumer demands. Since the workers come from different organizations, they are influenced by different organizational cultures as well as being encouraged by different incentive schemes. Therefore, the successful building of a collaborative atmosphere across organizations determines the success of the collaborative commerce.

In conclusion, an integrated and intelligent system supporting knowledge sharing and collaboration can help companies to distinguish themselves from their competitors. There are many application areas and issues that need to be considered in the collaborative commerce. These topics include areas such as the management of a business infrastructure, capital markets and the virtual economy, improvement of data quality, support of decisions and group systems, enterprise strategies, entrepreneurship and creativity, enterprise process management, innovation and product development, Internet law and compliance, Internet security and privacy issues and knowledge management business ethics.

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