



Trends in  
**Applied Sciences  
Research**

ISSN 1819-3579



Academic  
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## **Application of Web 2.0 in Supply Chain Management: A Brief Overview**

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### **ABSTRACT**

Information Technologies (IT) has been applied to Supply Chain Management (SCM) for more than three decades. Past technologies include Electronic Data Interchange (EDI) and E-commerce. However, there are still many challenges for implementing these technologies in the SCM of organizations due to their cost as well as low adoption among the supply chain participants. Recent development in web technologies has resulted in new possibilities and potentials for the application of Web 2.0 to SCM. This study provides an overview of Web 2.0 and how Web 2.0 can be applied to SCM.

**Key words:** Supply chain management, Web 2.0, Malaysia, information technology

### **INTRODUCTION**

The concepts of SCM have been discussed widely in recent years due to its ever increasing role the competitive business environment faced by companies (Chong and Ooi, 2008b). Recent economy problems from countries such as United States, Iceland and even Greece have created a very uncertain business environment for companies. Companies today need to remain competitive and be efficient in order to survive in the current business environment (Chong *et al.*, 2009).

The pressure for the business environment is also being faced by fast growing countries such as China and India. Although China's economy continues to grow, the Chinese government understands that it is not possible for the economy to continuously relying on attracting investors and growing through low cost production, especially the price on labour factor contribution. One way for countries that rely on having lower costs to remain competitive in the long run is to have an efficient SCM. Chong and Ooi (2008a) stated that Malaysia's electrical and electronics (EandE) industry which in the past have attracted foreign investments and is one of Malaysia's major contributors to their GDP, can no longer compete with lower cost countries such as China and Vietnam. White *et al.* (2004) further stated that the EandE industry was losing as much as \$3.9 billion annually due to inadequacies in the supply chain. Although the example mentioned focused on the EandE industry, the challenge faced by EandE industry is also could be similar or applicable to all the manufacturing industries in general. One way to having an efficient SCM is through the implementation of IT. Past IT tools that have been applied to SCM include EDI, E-Commerce and even Collaborative Commerce (c-commerce) (Chong *et al.*, 2009; Chou *et al.*, 2004). Although these tools have been examined and discussed in the past, recent developments in the IT field in particular the Internet technologies have presented an opportunity for companies to improve the

collaboration in their SCM. A collaborative and integrated supply chain has always been companies main supply chain objective. However, even with tools such as e-commerce and c-commerce, the level of collaborations among supply chain partners remained low and supply chain collaboration remain a major challenge for organizations. Recent developments in web technologies such as Web 2.0 applications have opened up the window of opportunities for organizations to improve their SCM. This study will present an overview of Web 2.0 technologies and how these technologies can be applied to SCM. A discussion of possible future research directions in this area will also be presented.

**Applications of IT in SCM:** IT has been applied to SCM as early as the late 1970s and early 1980s. One of the main applications of IT in SCM during those period was EDI (Electronic Data Exchange). EDI was widely adopted by American automobile industry due to fierce competition from the Japanese carmakers (Chou *et al.*, 2004). Japanese automobile makers were able to have a more efficient inventory management when compared to their American counterparts due to their just-in-time delivery (Chou *et al.*, 2004). EDI allows supply chain partners to exchange documents in standardized EDI messages without human intervention. However, the data exchanged must be in agreed standardized format (Chong and Ooi, 2008a).

The hindrances for EDI however, were due to its high cost, difficulties in implementation and the slow evolution of EDI standards. More importantly, EDI only allows for batch processing of data instead of real time data. Due to its high cost and implementation issues, EDI was not widely adopted among the small and medium organizations.

Since, 1990s, the emergence of Internet technologies has solved most of the issues faced by EDI. With the Internet, the cost of communications is lower and the standard used by Internet technologies such as Extensible Markup language (XML) means companies no longer face the problem of connecting to each other. Companies were able to apply e-commerce to improve collaborations in the supply chain. With e-commerce, business-to-business (B2B) became a standard e-commerce model that was applied by supply chain participants. In 2000, Gartner group came up with the term c-commerce. C-commerce is defined as a set of electronically-enabled collaborative interactions between supply chain participants and leverages on internet tools to create and maintain an interactive business community of employees, trading partners, suppliers and customers (Chong *et al.*, 2009). The difference between c-commerce and e-commerce is that c-commerce covers the exchange of information and ideas between supply chain participants and allows them to collaborate in the design, development, building and management of products through their life cycle. More importantly, the supply chain information flows automatically within the multi-channel distribution network (Chong *et al.*, 2009).

Although e-commerce and c-commerce are available for organizations to implement in their SCM, these tools are still not being widely adopted (Tech2Mkt, 2006). C-commerce tools such as RosettaNet standards remain low in adoption (Chong and Ooi, 2008a). Many organizations are still using face-to-face, phones, fax and EDI instead of collaborative systems. Although organizations are still not willing to adopt many of these technologies available, with the emergence of Web 2.0, comparatively, organizations need to spend lesser efforts and investment in adopting Web 2.0 to as their communication tool to improve their SCM (Bowersox *et al.*, 2000). The next two sections provide an overview of Web 2.0 and their potentials to be applied in SCM.

**Web 2.0 technologies overview:** There have been various debates on the definitions of Web 2.0. It is difficult to provide a single line of definition due to the various characteristics of Web 2.0.

Essentially Web 2.0 is used to describe web applications that have characteristics such as user-centered design, crowd sourcing, using web as a platform, collaboration, power decentralization, dynamic Content, Software as Service (SaaS) and rich user experience (Sharma, 2008). O'Reilly (2005) stated that in order to differentiate between Web 2.0 and Web 1.0, he listed down 7 principles of Web 2.0 as the gauge. They are: The Web as platform, Harnessing collective intelligence, Data is the next 'Intel inside', End of the software release cycle, Lightweight programming models, Software above the level of single device and Rich user experiences. Some of the successful examples of popular Web 2.0 applications include blogs, wikis, social networking websites and RSS. This was confirmed by Anderson (2007) describing in detail some of the key Web 2.0 services and applications such as Blogs, Wikis, Tagging and Social Bookmarking, Multimedia Sharing, Podcasting and RSS. He also described the key concepts of Web 2.0 such as individual production and user generated content, harnessing the power of crowd, data on an epic scale, architecture of participation, network effects and openness. For more comprehensive descriptions of Web 2.0 principles and descriptions (Sharma, 2008; O'Reilly, 2005; Anderson, 2007). For this review, we will discuss how Web 2.0 can be applied to SCM based on some of the characteristics of Web 2.0.

#### **APPLICATIONS OF WEB 2.0 TECHNOLOGIES IN SCM**

**SaaS and cloud computing:** It is unavoidable that supply chain management involves the collaborations of supply chain participants. One challenge with the current global business environment is the fact that not many Small and Medium Enterprises (SME) are willing to or capable to invest large amount of money into a SCM system that matches the capability of their larger supply chain partners (Chong, 2006).

SaaS provides a good opportunity for SME to leverage on SCM systems without incurring high cost. With SaaS, software is deployed over the Internet based on the demand of the customers. Therefore customers are only paying for what is needed. The challenge with SCM applications such as RosettaNet standards for example, is the need to have co-adoption among the supply chain participants. With SaaS, SME are now able to make use of advanced SCM applications, or better still, only pay for the features that they need to use.

With cloud computing gaining prevalence, SMEs are also able to use more powerful applications while keeping their budget to the minimum. One of the limitations of existing IT technologies such as EDI or B2B is the cost of servers. If organizations choose to host their own server, the cost includes maintaining the server as well as having its own IT staff to be in charge of the server. Even if the organization chooses to host the applications on an external server, the cost is also needed and the organizations will need to pay for the resources on the server in order to use the SCM applications that are part of system residing among the supply chain partners. Through cloud computing, SMEs can use SCM applications while avoid paying for hardware and software and they only pay for what they have used. SMEs are able to use the SCM applications through the Internet and the services provided are scalable depending on their needs. The SCM partners can all use their applications through cloud computing and share the infrastructure and costs. Larger organizations will also be able to link up with their smaller supply chain partners through SCM applications due to availability of Web 2.0.

**Collaborations:** One of the main objectives of SCM is to have a collaborative supply chain among the supply chain participants. Although technologies such as B2B and e-commerce allow

organizations to collaborate, the adoption of B2B and c-commerce among supply chain partners remain low. With Web 2.0 tools, organizations are able to use some of the common tools and technologies their employees are familiar with to collaborate. One of the tools which can be used by companies is social networking tools. In a big supply chain environment, people from departments such as Research and Development (R and D), marketing, logistics and so forth might need to collaborate and communicate with each other. Through the use of social networking tools, employees as well as external supply chain partners can be linked together easily. Updates and announcements can be disseminated to supply chain partners as fast just push the button.

Some of the supply chain practices, organizations missions and visions, product information, organization profiles can also be shared by the supply chain partners through the use of Wiki technologies. Using the same concept as Wikipedia, organizations are able to set up their own Wiki website. The websites allow supply chain partners to share information with their counterparts and information can also be updated by the supply chain partners. This will create a knowledge repository which can be used by the supply chain partners. This is important as it is important for knowledge to be transferred and disseminated to individuals, teams and companies (Cheah *et al.*, 2009).

**Web as platform:** One of the challenges with collaboration in supply chain is the compatibility of different applications and platforms. It is important for organizations to achieve both upstream as well as downstream integration. As the supply chain in today's businesses expand across local business environment, it is possible that organizations are unable to integrate their existing applications to their supply chain partners' platforms due to compatibility issues. With Web 2.0's characteristic of using Web as a platform, users will not need to download any applications. This resolves the issues of compatibility as well as reducing cost.

However, some might argue that B2B and c-commerce also allow applications to use the web as a platform. However, one of the main differences with Web 2.0 is the development in Ajax-Asynchronous JavaScript + XML. With Ajax, only little information is passed between the server once the webpage has been loaded (Anderson, 2007). Therefore, the website can be dynamically reloaded in real-time. Examples of applications which use Web 2.0 as a platform include Google Docs, Google Spreadsheet and Google Calendar. These applications allow for greater collaborations among the supply chain partners.

**Crowd sourcing:** One of the important strengths of Web 2.0 is the ability to make use of the contribution from the web users. This is what commonly termed as crowd sourcing. Examples of crowd sourcing include Flickr, Digg and YouTube whereby the contents are contributed by the users. As Sharma (2008) stated, the Internet users' contributions will lead the website to higher relevance. One of the SCM practices is customer relationships (Tan, 2001). An efficient SCM needs to integrate their suppliers to their customers in order to achieve financial and growth objectives (Tan, 2001). Therefore, there exists an opportunities for organizations to improve their customer relationships through the use of Web 2.0 service. Organizations can use concept similar to Digg whereby users vote for the news which they find most important and relevant. The same concept can be applied by organizations whereby suppliers and customers are able to vote on products or future products based on design and ideas. By doing this, organizations are able to produce products that satisfy the end customer. This is important as customer relevancy is one of the important strategic commitments of many larger organizations (Bowersox *et al.*, 2000). By involving customers

as well as suppliers through crowd sourcing, the organizations are able to improve their SCM by building a close relationship with the customers as well as suppliers. This information volunteered by customers and suppliers not only help the product design, but will also help to forecast the demand of a product before it is being launched.

**Power decentralizations:** One limitation with EDI is that data are only sent in batches. Many existing application need to be administered and are not automated (Sharma, 2008). However, with Web 2.0, it allows for a self-service by the various users instead of being dependent on administrator. One Web 2.0 tool of power decentralization characteristic that will improve SCM is RSS. Through RSS, organizations can subscribe to a feed from their suppliers or customers.

For example, whenever there is a new product or changes in price, the information from the supplier will be fed into their supply chain partners systems automatically. Similarly, when there is a delay in product delivery, the information can also be fed automatically into the supply chain partners systems.

In the some of the B2B websites, it is common that news and information that are important to a particular industry or products is updated regularly for users consumption. However, if the usual regular updates are depending on the administrator of the website and these information can be outdated if they are not refreshed by the administrator. Through Web 2.0 technologies, aggregation services where information from different web sources are gathered automatically and published and gathered at one place. For example, news and updates are gathered through RSS feed aggregators and email to supply chain participants automatically to ensure they have the latest news and information that will affect their SCM.

## **CONCLUSION AND FUTURE WORK**

The web technology has moved from the traditional Web 1.0 to Web 2.0. With this new development, there present new some opportunities for Web 2.0 service to be applied to SCM. This study provides an overview of how Web 2.0 technologies can be applied to SCM. The characteristics of Web 2.0 is presented and examples are given on how these characteristics can be applied to improve SCM when compared to existing SCM IT technologies such as B2B and c-commerce which are based on Web 1.0 technology.

With the availability of Web 2.0, there are some future research opportunities that can be considered by researchers. Firstly, developers can design and develop SCM based on Web 2.0 services mentioned to come up with a more affordable and collaborative SCM IT system. Secondly, given the adoption issues involved in existing SCM tools such as EDI, B2B and c-commerce, future studies can investigate what are the antecedents that can allow the successful adoption of Web 2.0 technologies in SCM. Lastly, future studies can also look at other potential applications of Web 2.0 to SCM which are not discussed in this study.

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