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Exploring the Use and Benefits of Web 2.0 for Supply Chain Management

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Abstract

In today's dynamic environment, managing supply chain processes has been challenging. Various information and communication technologies (ICT) have been adopted for supply chain management (SCM) in the last few decades. The adoption of technologies for SCM, nevertheless, has been difficult and complex because different parties are involved. Recently, with the emergence and popularity of web 2.0 as social technology, innovative companies have started to explore and adopt web 2.0 as an alternative method for supply chain integration. Web 2.0 has many features that are useful for dynamic communication across the globe, which facilitates integration among supply chain parties. However, currently, web 2.0 has not been widely used to support SCM practices. Building upon the existing studies, in this paper, we assess how web 2.0 can be used for supporting SCM practices and highlight the values offered. A number of implications for managing supply chain with web 2.0 are also discussed.

Keywords

Web 2.0, supply chain management, business-to-business integration, technology adoption

INTRODUCTION

Supply chain management (SCM) is concerned with planning and coordinating the movement of products, services, finance and/or information from the point of origin to the point of consumption in order to create customer value (Stadtler, 2004). In recent years, companies are facing a competitive and dynamic business environment due to globalisation and heightened customer expectations. To maintain competitive advantage, companies should achieve enhanced communication, coordination of activities, cooperation, and collaboration across supply chain participants.

Due to the complexity of managing supply chain operations, organisations have adopted information and communication technologies (ICT) (Simchi-Levi et al., 2008). Nevertheless, because ICT-enabled SCM initiatives are inter-organisational in nature, their adoption has been difficult (Kurnia and Johnston, 2000). Various supply chain parties often have different and conflicting objectives which make it difficult to engage in close partnership to adopt certain technologies and initiatives (Arshinder et al., 2008, Simchi-Levi et al., 2008). The emergence of the Internet has played an important role in supporting supply chain integration and information sharing among supply chain members and has overcome some adoption barriers (Ghiassi and Spera, 2003, Giménez and Lourenço, 2008, Graham and Hardaker, 2000, Lancioni et al., 2000, Lankford, 2004).

With recent development of the Internet technology, new generation software on the web which is known web 2.0 has been introduced. Web 2.0 has many attractive features that can further help organisations to better manage their supply chains in today's dynamic business environment (Ooi et al. 2011). There have been several studies investigating the potential use of web 2.0 for supply chain operations focusing on different aspects. For example, Goh et al. (2007) and He et al. (2007) assess how web 2.0 concepts and technologies may create potential benefits through dynamic B2B integration. In addition, Tingling et al. (2011) explore how web 2.0 products and services (e.g. smartphones) can support efficient supply chain operations by following supply chain reference (SCOR) framework, while Ooi et al. (2011) briefly demonstrate how web 2.0 can be applied to SCM. However, Goh et al. (2007) and He et al. (2007) only focus on specific and limited SCM practices, while Ooi et al. (2011) and Tingling et al. (2011) do not adequately describe how web 2.0 can support the overall SCM practices. As a result, there are still uncertainties related to which specific web 2.0 tools are relevant for supporting each of SCM practices.

Building upon the previous studies, this paper explores how various web 2.0 concepts and tools support SCM practices and identifies the values that web 2.0 offers through a literature analysis and synthesis. The research questions addressed in this conceptual discussion are:

1. *How can web 2.0 be used to support supply chain management practices?*
2. *What values are offered by web 2.0 in supporting supply chain management practices?*

For the purpose of this study, we first review the literature on the concepts and tools of web 2.0 as well as web 2.0 features and their potential benefits for SCM. We then synthesize the potential use and benefits of web 2.0 on each of the SCM practices based on the existing studies. As a framework, we use Mentzer et al (2001)'s categorization of SCM key practices. The search for relevant literature was carried out using several databases including ScienceDirect, Emerald, ProQuest, EBSCO, IEEE, Elsevier and Google scholar. Typical keywords used in the search include web 2.0, supply chain management, web 2.0 and business-to-business integration. In addition, recent journals (2007 and beyond) including IT/IS-related and SCM-related journals (e.g. Information Systems Journal, Journal of Business Logistics, Journal of E-business, Journal of Supply Chain Management) were examined carefully to identify any relevant articles to the topic of this paper.

The paper is structured as follow. Section 2 provides a literature review and synthesis of the key web 2.0 concepts and features and summarises the expected benefits for SCM offered by each feature. Section 3 explores the potential use and values of web 2.0 for each of the SCM practices. Section 4 summarises the key findings, outlines the limitations of our study and concludes the paper.

WEB 2.0 AND ITS VALUES FOR SUPPLY CHAIN MANAGEMENT

With the emergence of web 2.0, there have been new concepts emerged and a number of tools used to support social interactions. There are four web 2.0 key concepts identified from the literature. Firstly, the concept of web-as-a-platform was introduced since it is possible to build web-based software applications that run on the web platform regardless user's actual computer's operating system such as Windows, Mac, or Linux OS (Ooi et al., 2011, Mathaba et al., 2011). Secondly, the Service-as-a-Software (SaaS) concept enables on-demand access to web-based software applications maintained centrally by a service provider (Hsu, 2011). Thirdly, with concept of Rich Internet Application (RIA), web 2.0 provides richer, more responsive and interactive user experience than a desktop application by using a thick client configuration (He et al., 2007). Consequently, RIAs offer advantages such as better interaction between users and system, a possibility of on/offline applications use, a balance between client and server, and increased effectiveness of network connection (Goh et al., 2007). Finally, the Collective Intelligence concept signifies the generation of intelligence based on knowledge from many connected people (Goh et al., 2007). These various concepts are reflected in various web 2.0 applications including Really Simple Syndication (RSS), mashup, blog, wiki, micro-blog, social networking site, content community, podcast, and tagging and social bookmarking (Murugesan, 2007).

Managing supply chain activities and the adoption of various technologies to improve SCM have been always challenging due to some issues including the complexity involved in agreeing on the standards, lack of cooperation, high investments and lack of critical mass (Tingling et al., 2011). With the web 2.0 concepts and tools, there are some features of web 2.0 technologies that are attractive and relevant for SCM. Therefore, a number of organisations have started exploiting web 2.0 for managing some aspects of their supply chain activities (Tingling et al., 2011, Mathaba et al., 2011). Figure 1 summarises a number of key features of web 2.0 and possible benefits for SCM that each feature may offer as identified from the literature.

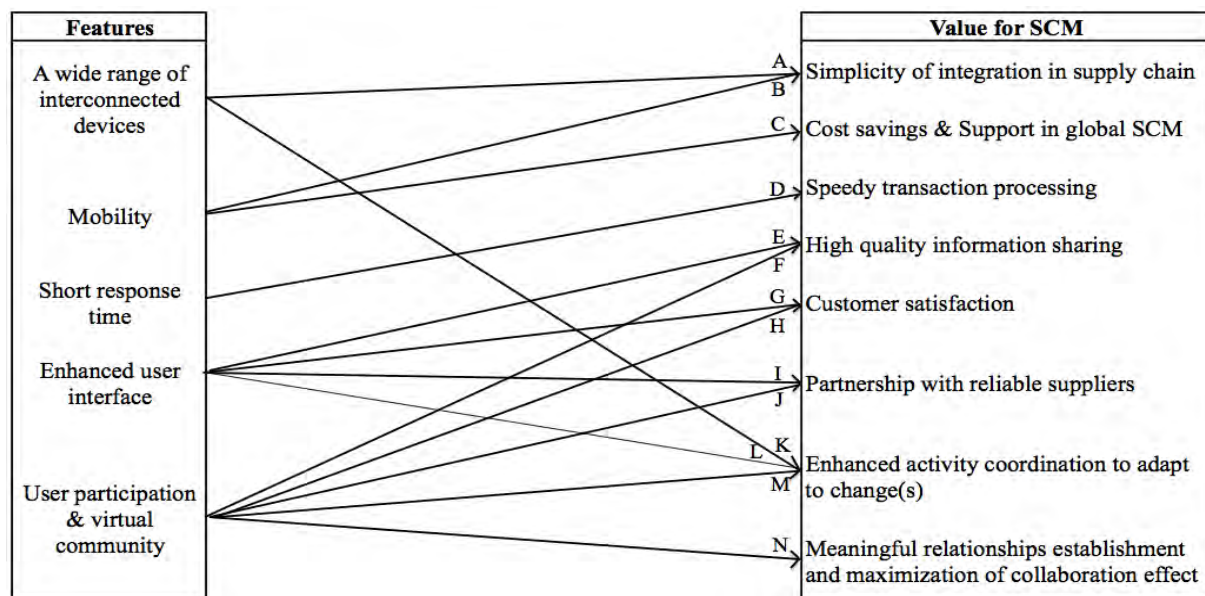


Figure 1: The Possible Web 2.0 Benefits for SCM

Firstly, a number of studies (Ooi et al., 2011, Mathaba et al., 2011, Liu and Liu, 2009) indicate that with a wide range of interconnected devices, web 2.0 applications reduce complexities in supply chain integration (arrow A in Figure 1) and enhance the level of information exchange to coordinate activities among supply chain members (arrow K). The second feature, mobility, improves business environment by facilitating connectivity anytime and anywhere at lower cost among trading partners (Sankar and Bouchard, 2009). The benefits of mobility are captured in arrows B and C in Figure 1. Real-time business with mobility may increase not only employee productivity but also sales. In addition, He and Chen (2008) argue that short response time enabled by web 2.0 speeds up transaction process between supply chain partners (arrow D) while enhanced user interface of web 2.0 applications enables organisations to accomplish various business activities more easily such as sharing information, searching for information regarding potential partner or customer requirements, and improve coordination of activities (Liu and Liu, 2009, Kaplan and Haenlein, 2011). These are represented by arrows E, G, I and L (Barlow, 2011). Moreover, a high level of participation (e.g. supply chain parties, past/potential partners, etc.) in various virtual communities supports customer relationship management (CRM), training, innovation, communication and collaboration (Chui et al., 2009, Andriole, 2010), as depicted by arrows F, H, J, M and N.

The existing studies, however, do not demonstrate how web 2.0 concepts and tools can be specifically applied in SCM practices to achieve the identified benefits. Therefore, in this study, we postulate how web 2.0 can be used to support each of the SCM practices in order to achieve the expected benefits, by focusing on the key concepts and specific tools that are relevant for each practice.

THE POTENTIAL USE OF WEB 2.0 FOR SCM

The underlying philosophy of SCM is to seek synchronisation and convergence point of intra and inter-company capabilities, aiming at improving competitiveness of not only the company itself but also the supply chain as a whole (Li et al., 2004, Mentzer et al., 2001). We use Mentzer et al (2001)'s classification of SCM key practices as a framework for this study since their work is well recognized in the SCM literature with over 1717 Google Scholar citations by July 2013. For each of the key SCM practices listed in Table 1, we analyse and synthesise how it can be supported by web 2.0. We then identify potential benefits of using web 2.0 tools for each SCM practice based on the relevant features and summarise them in Table 2.

Table 1. Possible use of web 2.0 for SCM practices

SCM practices	Web 2.0 concepts	Web 2.0 tools	Potential Use	References
Supplier relationship management	Collective intelligence	SNS	Offers various and useful information about suppliers at no cost	Burrus (2010)
		Wiki	Facilitates business relationship by effectively transferring information regarding the contract management	Ooi et al. (2011)
		Content community	Allows to rate the performance for the vendors in a real-time	Lancioni et al. (2000)
	RIA	RSS ^b	Provides market research information to buyers efficiently	Barlow (2011)
Integrated Behavior	Collective intelligence	Content community	Enhances training efficiency via social media website such as YouTube	Burrus (2010), Barlow (2011)
		Wiki	Provides a education system created by experts in one place	Burrus (2010)
		Tagging	Supports employees' cooperative ties with other supply chain members	Liu and Liu (2009)
	Web as a platform	Podcast	Provides training with less cost and effort and higher effect	Liu and Liu (2009)
		Mashup	Offers new performance metrics to monitor the performance of the focal company itself and their suppliers	Goh et al. (2007)
RIA	RSS	Enables news to be pushed automatically to specific parties	Ooi et al. (2011)	
Information sharing	RIA	Mashup	Enables supply chain visibility through mixing and integrating various sources of data from supply chain members easily	Koris et al. (2008)
		RSS	Enables information for order and inventory management to be pushed to supply chain partner automatically	Goh et al. (2007)
	Collective intelligence	Micro blog	Facilitates discussions to solve unexpected matters by spreading short message quickly and widely among supply chain members	Burrus (2010)
Collaboration	Collective intelligence	SNS	Improves internal networking and collaboration among supply chain members, and disseminates news and knowledge easily	Burrus (2010), Ooi et al. (2011)

		Blog	Enables a diversity of collaboration between individuals / teams, allows the expression of freedom of supply chain members at an acceptable level, and accumulates personal knowledge / opinion that can be accessed easily	Chen (2009)
		Wiki	Enables collaboration in making useful information / knowledge among a group of members	Goh et al. (2007)
		Content community	Enables all supply chain partners to offer opinions regarding any business development plan of a company	Ooi et al. (2011)
		Tagging and Social bookmarking	Helps up-to-date market information on the web collaboratively	Burrus (2010), Razmerita et al. (2009)
Risk / Benefit sharing	SaaS	-	Lowers initial cost of technology implementation, enables sharing of infrastructure and other costs among supply chain partners, and offer flexible and scalable SCM applications	Ooi et al. (2011), He et al. (2007)
Processes integration	Web as a platform	-	Enhances level of integration and collaboration among upstream and downstream participants, and overcomes compatibility issue across different business partners	Ooi et al. (2011)
	SaaS	-	Accessible to SaaS-based SCM applications on the same platform	Goh et al. (2007)
Customer relationship management	RIA	Micro-blog	Offers a fast way to solve customer issues	Burrus (2010), Case and King (2011)
	Collective intelligence	SNS	Helps increase companies awareness, advertise products/services, get customer feedbacks, and build a customer loyalty	Social networking (2009)
		Content community	Enables showcase the products / services, and facilitates friendly and personalised customer training	Barlow (2011), Liu and Liu (2009)
		Blog	Facilitates marketing of products/services, and enables sharing opinions about products / services	Miller et al. (2010), Liu and Liu (2009)

^a Social Networking Sites, ^b Really Simple Syndication

Table 2. Web 2.0 tools, features and benefits for SCM

SCM practices	Web 2.0 tools	Features	Benefits
SRM	SNS, Wiki, Content community, RSS	Enhanced user interface, User participation & virtual community	Partnership with reliable suppliers
Integrated behavior	Content community, Wiki, Tagging, Podcast, Mashup, RSS	A wide range of interconnected devices, Enhanced user interface, User participation & virtual community	Enhanced activity coordination to adapt to change(s)
Information sharing	Mashup, RSS, Micro-blog	Short response time, Enhanced user interface, User participation & virtual community	Speedy transaction processing, High quality information sharing
Collaboration	SNS, Blog, Wiki, Content community, Tagging and Social bookmarking	User participation & virtual community	Meaningful relationships establishment and maximization of collaboration effect
Risk / reward sharing	-	Mobility	Cost savings and support in global SCM
Processes integration	-	A wide range of interconnected devices, Mobility	Simplicity of integration in supply chain
CRM	Micro-blog, SNS, Content community, Blog	Enhanced user interface, User participation & virtual community	Customer satisfaction

Supplier Relationship Management

Supplier relationship management (SRM) refers to the process for building and managing relationships with suppliers (Johnson and Mena, 2008). One key activity is the selection of right partners (Li et al., 2004, Eltayeb et al., 2011). Another activity is the formation of strategic alliance with supply chain partners (Li et al., 2004, Eltayeb et al., 2011). The Internet has been used as a rich source of potential suppliers. Buyers could have a broader supplier base accessible through a computer connected to the internet (Tucker and Jones, 2000) and intelligent software on the web helped finding suppliers matched with quantitative selection criteria such as low cost and short delivery lead time as demanded by buyers. However, there is still a limitation in searching suppliers against qualitative criteria such as trustworthiness (Fasanghari, 2008). To support this practice, social networking site, RSS and content community can be used, addressing the concepts of RIA and collective

intelligence. Wiki and content community can be used to facilitate building strategic partnership based on the collective intelligence concept. For each explanation of the possible use of web 2.0 tool described below, we indicate the relevant web 2.0 concepts in square brackets.

Social networking sites: Suppliers' Facebook is a useful source of information in selecting partners because organisations may find information such as the level of communication with their customers, corporate culture, opinions of employees, the number of comments, and so on via Facebook [Collective Intelligence], which can be used for assessing the reliability of suppliers. According to Burrus (2010), more than 35 million registered members spanning over 170 companies are actively networked with each other via LinkedIn. From B2B perspective, LinkedIn can be an effective tool for B2B marketers. Marketing charts study shows that the largest number of survey respondents, which corresponds to 65 %, have used LinkedIn for acquiring buyers as of 2012.

RSS: The new content updated on the relevant websites can be delivered to buyers automatically through RSS subscription [RIA]. This is helpful for market search (Barlow, 2011) because RSS provides buyers with more efficient way to check new updates on several websites at a same time.

Content community: Based on contracts negotiated with the vendors, companies can rate the performance of its vendors in real time on the web (Lancioni et al., 2000). Companies can also make use the information about the potential supplier's performance that are rated or reviewed by buyers on the web [Collective Intelligence].

Wiki: The wiki website allows relevant supply chain partners to create and share information related to their deal management (e.g. contract term or policy) in one place [Collective Intelligence] (Ooi et al., 2011).

The above web 2.0 tools reflect two features of web 2.0 namely enhanced user interface and user participation in virtual communities. These features bring positive effects on searching reliable potential partner rapidly. With enhanced user interface offered by content community websites or RSS, information needed to assess the reliability level of the potential partners can be pushed to the companies automatically in web 2.0 era. In addition, co-creation of contract-related documents across supply chain partners can be facilitated by active online participation of the members on collaborative website like wiki.

Integrated Behavior

Integrated behaviour means coordinated efforts across the supply chain partners. Coordination indicates working together complementarily for a shared or a common purpose and goal (Moharana et al., 2012). Mentzer et al. (2001) suggest integrated behavior between the partners should be expanded to understand ever-changing end-customer needs efficiently and respond to market change quickly. In addition, the importance of flexibility and agility in developing and executing strategies in supply chain is greater for long-term sustainability under uncertainty. To achieve integrated behaviour, trading partners need to have common understanding of the ultimate goal in SCM and share information efficiently for coordination of activities. To enable constant update of information and efficient information sharing to support this practice, content community, podcast, wiki, tagging, mashup and RSS can be used with the concept of collective intelligence, web as a platform and RIA, as discussed below.

Content community: Supply chain partners can establish a YouTube or SlideShare channel in order to share videos or pictures of best practice across the supply chain (Barlow, 2011, Burrus, 2010) as part of their effort to improve their own supply chain operations [Collective Intelligence].

Wiki: Supply chain partners (especially retailers and suppliers) can collaboratively create a wiki site in order to educate and train internal and external employees (Burrus, 2010). The education information offered by multiple experts is highly possible to be informative and supportive [Collective Intelligence].

Tagging: Organisation tagging tool enables search engine to correctly identify the required individuals regardless their position and location. Further, this tool can be helpful to develop employees' social networking which promotes close cooperative ties with other parties (Liu and Liu, 2009). Consequently, it enables quicker and better joint problem solving [Collective Intelligence].

Podcast: Podcast allows members to record directly their experiences in a form of audio or video content and broadcast them through the Internet [Web-as-a-platform]. Thus, members can save time and effort in creating training documents. Through RSS subscription, the system will send the updated content automatically to the participants, and the participants just need to download the necessary files and can access them on their mobile devices at anytime and anywhere. Consequently, it improves learning effect, which can indirectly lead to enhanced processes and integrated behavior in fulfilling consumers' demand (Liu and Liu, 2009).

Mashup: As mashup facilitates the ease of combining and transforming various performance measurements internally and externally from business partners, new performance monitoring metrics can be created easily according to specific situations and displayed for monitoring purpose [Web-as-a-platform] (Goh et al., 2007)

RSS: Through RSS, supply chain partners can gather different web sources automatically at one place [RIA]. It ensures that supply chain partners have the latest news (Ooi et al., 2011).

The relevant web 2.0 features demonstrated above include a wide range of interconnected devices, enhanced user interface and user participation in virtual communities. These features not only facilitate training, but also help maintain the consistent coordination among members in volatile business environment. More specifically, a wide range of interconnected devices facilitate accessing and creating information such as training material and business strategies on wiki or content-sharing websites and distributing such information to the relevant members in a real time. With enhanced user interface, supply chain members can be alerted automatically through RSS subscription. Furthermore, supply chain members can deliver their knowledge or experience easily to the relevant website.

Information Sharing

Related to integrated behaviour, information sharing among supply chain partners is an important practice to reduce uncertainty, especially for planning and monitoring processes in SCM (Mentzer et al., 2001). Yu et al. (2001) suggest that getting information about other supply chain participants helps reduce uncertainties. To support this practice, mashup, micro-blog and RSS have been identified as tools that can support information sharing practice with the concept of web as a platform, RIA and collective intelligence.

Mashup: To support order/inventory tracking activity and to streamline the process of manufacture/delivery, supply chain partners can set up a mashed up application that combines Google maps API and listings of supply chain participants. By enabling any changes in inventory level and/or sales volume of the participants to be shared in the same domain, each role in supply chain can adjust their replenishment plan to meet customers' demands while keeping a relatively low stock level, which saves cost of inventory management. Transport cost can also be reduced as suppliers can determine transport routes via Google map (Koris et al., 2008). Likewise, SCM operational activities-related information can be shared in a rich form and in real time [RIA].

RSS: Companies can get the required information from specific supply chain partners timely through subscribing RSS feed [RIA] (Goh et al., 2007).

Micro-blog: Micro-blog such as Twitter can provide the fastest way of spreading pressing issues (e.g. unexpected situation or sudden change) to a large number of supply chain members [Collective Intelligence] (Burrus, 2010).

In terms of web 2.0 features, short response time, enhanced user interface and user participation in virtual communities facilitate speedy transaction processing and high quality information sharing. GPS-enabled SCM applications help products to be delivered in a fast and safe way. With enhanced user interface, new SCM applications can be created easily with shorter time and lower effort by bringing data from more than one source into one interface. This provides flexibility and ease of customization (Goh et al., 2007). In addition, any supply chain member can provide emergency information (e.g. unexpected accident) directly on micro-blogging websites. Furthermore, information can be shared with other members at high speed on online social network.

Collaboration

Collaboration refers to joint implementation and operational efforts to produce mutual benefits across the supply chain members. Building close and wide relationships across supply chain is an important factor for collaboration, which can create new business value and opportunities. Web 1.0 page enabled only one-way communication rather than multi-directional communication necessary to establish new and worthwhile relationships among members and to maximize collaboration effect. Social networking sites, blog, wiki, content community and tagging and social bookmarking have been identified to be useful for supporting the collaboration practice with the concept of collective intelligence.

Social networking sites: Through SNS, supply chain members can be linked with each other easily across the departments and companies in SCM (Burrus, 2010). Members can share their opinions via social networking channel regardless of time and place. Social networking tool can create a new culture, which supports sharing opinion or announcements between members easily [Collective intelligence] (Ooi et al., 2011).

Blog: Collaboration across departments and companies can be facilitated when supply chain members can share knowledge and express opinion conveniently using their own blogs [Collective intelligence] (Chen, 2009). A variety of collaboration vertically and horizontally within a company or across companies plays a key role to discover brilliant and fresh ideas for mutual business development with less R&D cost.

Wiki: The collected suppliers' and customers' views on a product/service in a wiki page would be informative for product/service development and innovation [Collective intelligence] (Goh et al., 2007). In addition, the wiki technology that allows tracking of changes made to the page(s) can be used to effectively manage in-progress project information within a business and across businesses.

Content community: All supply chain partners can participate in voting on new product lines or product development ideas on the web [Collective intelligence]. This collaborative work would lead to a higher level of end-customer satisfaction and help forecast initial demand (Ooi et al., 2011).

Tagging and social bookmarking: Via tagging and social bookmarking tools, supply chain members can collect, classify and share web search results (Razmerita et al., 2009). This would be useful for amassing business intelligence and market information in a collective way which also facilitate collaboration among different parties [Collective intelligence] (Barlow, 2011)

In terms of the web 2.0 features, user participation in virtual communities not only supports better communication among members, but also enhances online collaboration. All supply chain members can be connected and communicated with one another through social networking sites and blog.

Risk and Reward Sharing

Improving supply chain performance through partnerships requires a fair distribution of risks and benefits (Ha et al., 2011, Mentzer et al., 2001). Ha et al (2011) found the mutual sharing of risks and benefits allows the suppliers to participate more actively in their purchasing, marketing, and product/service development processes. One of the limitations of former technologies such as EDI or other B2B platforms is the high cost of server, including hosting and maintenance fees (Ooi et al., 2011). The lack of staff skills and resources to build infrastructure, maintain data flow, and manage data quality is a significant barrier. Unequal distribution of benefits, costs and risks is one of the significant issues that impedes supply chain parties to cooperate (Kurnia and Johnnton, 2000).

The concept of SaaS therefore can support the risk and reward sharing practice. We do not identify any existing web 2.0 tools that are particularly relevant to facilitate this practice. Specific applications must be developed based on the concept of SaaS which can facilitate cost, benefit and risk sharing among supply chain partners. With SaaS, supply chain partners can use their application through the Internet using a browser while only paying for the volume of services or fixed fee instead of software license because service provider support and maintain it, giving partners 24/7 access from any device anywhere. Furthermore, the cost of hardware, software and IT staff can be significantly reduced or eliminated, and thus the partners can share infrastructure and other related costs. Moreover, SaaS-based applications support supply chain partners with better flexibility, scalability and accessibility (He et al., 2007). It helps provide integrated and enhanced services to end-customers.

Mobility, which is a key web 2.0 feature, facilitates global SCM with lower cost and less resources and better coordination and collaboration among supply chain partners for mutual benefits. Web 2.0 applications, which run as SaaS, promotes global SCM by allowing members to easily access to the applications from any web browser.

Processes Integration

Seamless integration of supply chain activities and processes from the point-of-origin to the point-of-consumption is necessary for improving the overall supply chain performance (Simchi-Levi et al., 2008, Schnetzler and Schönsleben, 2007). However, process integration has always been difficult, particularly in the context of SCM. The heterogeneous software applications and platforms often affect the complexity of integration within the supply chain. In web 1.0 era, some organisations cannot integrate their existing applications with their supply chain partners due to the compatibility issue (Ooi et al., 2011). The concepts of web as a platform and SaaS support the processes integration practice. No existing web 2.0 tool is particularly relevant. With 'Web as a platform' concept, the complexity of processes integration between organisations can be reduced as the SCM applications are accessible through any PC with Internet connection. SaaS enables organisations to use supply chain applications offline. Data will then be synchronized with the server when the connection is re-established. As many organisations move toward globalisation, the feature of 'offline SaaS' supports the idea of mobile offices (Goh et al., 2007).

In terms of web 2.0 features, a wide range of interconnected devices and mobility facilitate seamless and dynamic integration of supply chain management processes with several benefits including effective inventory control, improved delivery performance, reduced lead-time, speed of decision making and transactions, and so forth. By using web as a platform, a large number of interconnected devices support enhanced processes integration especially for supply chain organisations moving toward globalisation in dynamically changing business environment. Furthermore, data synchronization among multiple systems in SCM is feasible in web 2.0 era. This enables seamless integration among supply chain partners.

Customer Relationship Management

Customer relationship management (CRM) refers to integrated approach to managing and developing relationships with customers (Johnson and Mena, 2008). Traditionally, companies have conducted one-way

communication with customers through mass media (e.g. e-mail) to advertise products. It has a limitation to develop products that customers want. Micro-blog, social networking sites, content community and blog can support CRM practice with concepts of RIA and collective intelligence.

Micro-blog: Twitter's real-time communication can be used as an obvious method to solve customer problems immediately (Burrus, 2010, Case and King, 2011). Companies can also use Twitter in order to promote perishable products/services rapidly and widely.

Social networking sites: Social networking site helps gather customers' feedbacks on advertised products, build customer loyalty, and improve marketing (Anonymous, 2009). Supply chain partners can use Facebook to introduce their products or services. Social networking site like Facebook allows existing and future customers to put comments and generate their own content around the products or companies [Collective Intelligence]. In addition, customers can click a 'Like' button on companies' Facebook page, which creates a direct communication between the enterprise and customers (Hopkins, 2012). What customers like can also be seen in all their friends' news feeds.

Content community: Companies can use content community like YouTube to introduce and show their products and services to customers (Barlow, 2011). As an example, Dell provides YouTube channel of their version, called 'StudioDell'. Through the channel, Dell offers customer educational contents about their products/services in an enjoyable and easy-to-understand manner (Liu and Liu, 2009).

Blog: Blogs allow customers to post their queries or issues, and employees and other customers can respond to requests to solve the queries or issues. As a real case, Direct2Dell blog of Dell is used as a marketing and promotional tool. It enables local employees to exchange the required information with their customers in their local language in order to enhance relationship with local customers (Liu and Liu, 2009). Besides, customers can share their opinions on the products/services and possible ways of improving better products/services [Collective Intelligence] (Gerow and Miller, 2010).

In terms of web 2.0 features, enhanced user interface and user participation in virtual communities facilitate rapid customer requirements identification and enhance marketing effect. Various web 2.0 communication tools such as micro-blog and social networking sites facilitate companies to communicate with numerous customers in various ways with enhanced user interface. Furthermore, active participation of suppliers and customers on the social networking or blog websites allow suppliers to understand customer requirements more accurately and to handle customer complaints or inquiries promptly.

DISCUSSION, IMPLICATIONS AND LIMITATIONS

This study has reviewed and analysed the relevant literature on web 2.0 and SCM to offer an integrated view of how web 2.0 can be used to support SCM and the benefits offered. Based on the concepts, tools and features of web 2.0, we have explored their relevance and specific benefits for each SCM practice. There are various benefits that can be obtained from the use of web 2.0 in SCM. There are a number of key observations that we would like to highlight. Firstly, our study finding indicates that 'collective intelligence' appears to be the most relevant concept of web 2.0 in the context of supply chain management since it is applicable for all SCM practices except for risk/reward sharing and process integration. A number of existing studies (Burrus, 2010, Ooi et al., 2011, Liu and Liu, 2009, Chen, 2009, Goh et al., 2007) have identified the relevance of collective intelligence in supporting supplier relationship management, integrated behavior, information sharing, collaboration and customer relationship management. Due to the social nature of web 2.0 and the fact that many challenges faced by organisations in managing the supply chain activities are related to human aspects such as collaboration, information sharing and trust (Kurnia and Johnston, 2000, Simchi-Levi et al., 2008), organisations may need to devise appropriate strategies to utilize the popular web 2.0 technologies to improve relationships with trading partners for mutual benefits. Although our study does not identify previous studies that show how the concept of collective intelligence supports risk/reward sharing and process integration, we argue that through the positive impacts of web 2.0 on other SCM practices, particularly through a higher level of transparency and partnership across supply chain participants, organisations can work more effectively towards risk/reward sharing and process integration. This concept is not mutually exclusive from the other three concepts since web as a platform, SaaS and RIA enable collective intelligence concept to be achieved.

Our study also indicates that different tools can be useful for particular SCM practices. For example, our literature synthesis shows integrated behavior of SCM can be supported by various web 2.0 tools such as RSS, mashup, wiki, content community, podcast and tagging. Thus, organisations need to carefully select appropriate tools to support some aspects of SCM practices that would fit their organisational culture and requirements since each tool has its own strengths and weaknesses. Although no previous study has identified any existing web 2.0 tools that are relevant for risk/reward sharing and process integration, a number of studies (Goh et al., 2007, He et al., 2007, Ooi et al., 2011) show how the concept of SaaS can support these two practices. With the rapid development of web applications in the last years, we can expect different tools and applications to emerge in

near future that are based on the concept of SaaS that facilitate risk/reward sharing and process integration among trading partners.

Our study has a number of limitations. Firstly, this is a conceptual study and our analysis is only based on the existing literature focusing on the potential use of web 2.0 for managing supply chain. Future studies would be needed to explore the actual use of applying different web 2.0 tools and concepts for specific SCM practices through case studies. Secondly, our literature coverage may not cover all possible existing studies of web 2.0 and SCM, which are still rather fragmented. Also, in this study we have not explored the impact of organisational culture, existing trading relationship and possible other factors on the achievement of benefits of web 2.0 for SCM. Finally, an in-depth exploration of the benefits and challenges of utilizing web 2.0 in SCM which include data security and privacy concerns as experienced by organizations is required to complement the study.

CONCLUSION

In this study, we have explored the potential use and benefits of web 2.0 for supply chain management based on the existing studies. Despite the study limitations, we believe this study offers modest contributions by providing a more holistic view of how web 2.0 concepts, tools and features can be used to support supply chain management practices. Since the use of web 2.0 technologies for managing supply chain is still emerging and there are many opportunities that can be explored by organisations in making use of web 2.0 to support their current supply chain management practices, this study offers a initial guide to identify the potential use and benefits of web 2.0 for SCM and complement the existing studies in this area.

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