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Demand chain management: Relationships between external antecedents, web-based integration and service innovation performance

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ABSTRACT

This paper presents an investigation of the relationships between the factors that drive the adoption of integrated, web-based demand chain management (DCM), as well as the relationship between web-based DCM integration and service innovation performance. Data was collected from 256 companies in the health care industry. The results show that collaborative structure (e.g. competitive pressure, trust, information sharing and environmental uncertainty) and technological structure (e.g. security) have a positive and significant influence on an organization's decision to adopt web-based DCM integration. However, collaborative structure has the greatest influence by far on an organization's adoption of web-based DCM integration. The findings also show strong evidence that web-based DCM integration improves service innovation performance. We also found that web-based DCM implementation has a greater impact on service innovation performance than in organizations that only implement web-based supply or demand integration strategies. This research has important implications for organizations interested in improving their service innovation performance, as well as improving web-based DCM integration. For example, to improve the success of web-based DCM adoption, organizations should focus on improving their collaborative structure with suppliers and customers first, before considering their technological structure. Security is also a key issue that needs to be addressed by organizations to ensure the successful adoption of web-based DCM.

1. Introduction

Organizations today operate in an extremely competitive business environment driven by the emphasis on time and quality based competition, market uncertainties, and globalisation. In respond to the competitive environment, many organizations started to have multi-sites production networks in order to reduce costs (Chong et al., 2011). Due to the multi-sites productions, integration in supply chains becomes important for organizations. As Frohlich (2002) stated, one of the most admired organizations are those that have a tightly integrated, collaborative supply chain. Although the concept of supply chain integration has long existed, it is only due to the recent emergence of web technologies which ensure that supply chain integration can be achieved easily and practically (Baker, 2003). Prior to the emergence of web technologies, organizations relied heavily on technology such as Electronic Data Interchange (EDI) to integrate their supply chain (Tai et al., 2010). However, EDI has several limitations such as the lack of consistent standard (e.g. Europe and Japan used a different EDI standard), high costs, and only transmitting data in batches. The Internet has solved many of the EDI implementation problems faced by organizations. The integrations between an organization and its upstream suppliers and downstream customers is known as e-supply chain integration (Akyuz and Rehan, 2009).

E-supply chain integration enable organizations to share real time information seamlessly, improve productivity, increase efficiency, improve the ability of the supply-chain to deliver faster and better products/services, improve the balance between supply and demand, and reduce the cost through better coordination and information sharing, and reduce the risks of bullwhip effects (Koh et al., 2007; Frohlich and Westbrook, 2002; Lee et al., 2004). Despite the reported benefits of e-supply chain integrations (Tai et al., 2010), there remained some important questions that are unanswered in practice in terms of successfully implementing e-supply chain integrations (Caniato et al., 2009). Researches on e-technologies from the operations management (OM) perspective is so far scant as well (Cullen and Taylor, 2009; Chong and Bai,

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2014). Furthermore, the performance outcome of implementing e-supply chain integrations, in particularly whether firms can have better innovation performances as a result of better supply chain remained understudy.

This paper has two aims: first, to examine the antecedents that drive the adoption of e-supply chain integration and, second, to analyse the relationship between e-supply chain integration adoption and service innovation performance. However, unlike previous studies on general e-supply chain integration, this study examined e-supply chain integration by focusing on web-based demand chain management DCM). DCM and supply chain management (SCM) are very similar in concepts, and are interchangeable except from different perspectives. With DCM, the emphasis is on the needs of the marketplace and designing the chain in order to satisfy those needs, as opposed to starting with the supplier/manufacturer and working forwards in an SC (Lun et al., 2013; Esper et al., 2010; Hilletofth, 2011). DCM is also closely related to the perspectives from market orientation which focuses on "marketing intelligence generation, market information dissemination, and market responsiveness" (Lun et al., 2013, pp. 486).

The issues addressed in this paper are critical and have several important contributions for a number of reasons. First, although DCM promises many benefits in theory, in practice it can be hard to achieve due to a lack of coordination along the chain (Frohlich and Westbrook, 2002). To solve the problem, the organization can integrate suppliers and customers via the web to facilitate the implementation of DCM, which is referred to as web-based DCM integration. On one hand, given that the primary focus of DCM is on the customers, organizations will be able to develop new products and services that better cater to customer needs. On the other hand, web-based DCM integration as a tool also brings challenges from various viewpoints, such as technological (e.g. relative advantage and security perceptions), organizational (e.g. technical and financial resources) and environmental (e.g. competitive pressure) perspectives (also known as the TOE model) (Chan et al., 2012). Although the TOE model and other adoption models, such as the diffusion of innovation model (Rogers, 1995), have been applied to examine technology adoptions, they have not been used to examine web-based DCM integration adoption. Given that the implementation of web-based DCM integration offers many advantages to firms, it remains an unanswered question as to why this tool is not adopted as often as it should be. In other words, what are the factors influencing the adoption of web-based DCM integration? Moreover, from a theoretical view, this study extends previous technology adoption models through including inter-organizational relationships such as trust and information sharing. This is important, as our findings show that these factors play a more prominent role in affecting organizations' adoption of web-based DCM.

Second, understanding the relationship between the adoption of web-based DCM integration and service innovation performance is important for both theoretical and practical reasons. Theoretically, this research can enrich the existing DCM literature by addressing a previously unexplored research area, namely whether adopting web-based DCM integration improves the service innovation performance of the organization. For practitioners, this research helps managers and decision makers to formulate strategies to motivate the adoption of web-based DCM integration in their organizations. Furthermore, as one of the key motivations for implementing DCM is to improve service performance, a positive relationship between web-based DCM integration and service innovation performance will further justify to practitioners why the adoption of web-based DCM integration should be an important business strategy in their organizations.

Third, we have selected the health care industry to examine the hypotheses for three reasons: (i) unlike other industries, the health care industry demands zero fault in the product design and operations process. Hence, customer needs must be accurately transferred into product design and delivery to make products error free. It is a typical demand-driven SC (i.e. a DC); (ii) the health care industry is a leading industry in adopting the most advanced technology and techniques first. Innovation performance is one of the key measurements; (iii) the health care industry is important to the national economy and to people's livelihoods. The development of this industry is a barometer indicating governmental performance, which gives research into the area special meaning.

The rest of this paper proceeds as follows. In the next section, the literature review and the development of the hypotheses are presented. This is followed by the methodology and results. Discussions of the results and their implications are then presented.

2. Literature review and hypotheses development

2.1. E-supply chain integration via web-based DCM

Problems due to poorly coordinated and non-integrated supply chain have been well documented in past literatures (Chong et al., 2009c). A poorly integrated supply chain will result in the Bullwhip Effect, whereby the orders to the suppliers have larger variance then the buyers' sales, and this demand distortion propagates upstream in an amplified form (Lee et al., 2004). Due to the instability in planning which is magnified backwards up to the supply chain (Lee et al., 2004), it becomes vital to control error amplified from the downstream customers to the upstream suppliers. One way to reduce the Bullwhip Effect is to balance the supply and demand across the supply chain, and this requires an integrated flow of data between the suppliers and buyers (Frohlich, 2002; Chan and Chan, 2009).

The integration of data flow can be achieved by implementing appropriate supply chain information systems (Chong et al., 2009a–2009c). However, the Internet is not the first electronic link. Prior to the Internet, firms seek to integrate their supply chain through Electronic Data Interchange (EDI) on Value Added Network (VAN). However, there are some limitations of EDI on VAN such as processing information in batches, slow evolution in standard, expensive, and difficulties in implementation (Geunes et al., 2002; Chong and Ooi, 2008). Recent developments in internet technologies have facilitated the integration between customers and suppliers. One e-supply chain integration model which has gained the attention of researchers is web-based DCM (Frohlich and Westbrook, 2002). DCM has similar concept and is interchangeable with the definition of SCM. However, the emphasis of web-based DCM is demand-driven supply chains, and is introduced to capture deeper synergies between SCM and marketing by starting with the needs of customers and designing the chain in order to satisfy these needs (Agrawal, 2012).

Given the lack of research on web-based DCM integration, the focus of the present research is on the adoption of web-based DCM integration, rather than on general DCM implementation. Frohlich and Westbrook (2002) empirically validated four web-based SC integration models, namely: those that have little or no web-based integration, those with a high level of demand integration, those with a high level of SC integration and those with a high level of web-based integration, coordinating the whole DC from the customers backwards to the suppliers. This last model is web-based DCM integration (Frohlich and Westbrook, 2002). Previous studies have shown that DCM integration can deliver the highest level of operational performance to organizations (Rexhausen et al., 2012). However, there is still limited research to help advance the discipline in terms of what drives the adoption of web-based