



Examining the diffusion of electronic supply chain management with external antecedents and firm performance: A multi-stage analysis

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ARTICLE INFO

Article history:

Received 14 August 2009
 Received in revised form 8 February 2010
 Accepted 18 July 2010
 Available online 23 July 2010

Keywords:

e-SCM diffusion
 Innovation diffusion theory
 External antecedents
 Organizational performance

ABSTRACT

In modern business, competition is no longer between organizations, but among supply chains. Supply chain management (SCM) is the major weapon for firm's competition. e-SCM implementation is the key to the success in SCM practice. Innovation diffusion theory (IDT) with multi-stage analysis provides insight into the complicated process. Several key external antecedents affect the rate of e-SCM diffusion, in particular, technological and collaborative structures. Little research on IOS has discussed the performance impacts from the diffusion perspective among trading partners. Studies on IT performance have been traditionally focused on financial performance and inconclusive in their results. This study thus considers both financial and non-financial performances in a complementary manner. Grounding on IDT and relevant theories, this study proposes a novel research model for the relationships among external antecedents, stage-based e-SCM diffusion, and firm performance. Empirical findings have concluded the relative effects of external antecedents on diffusion stages and in turn, firm performance.

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1. Introduction

Business organizations face a more complex and competitive environment than ever before in the Internet era. Many organizations are gradually considering that they must compete, as part of a supply chain against other supply chains, to quickly reflect customers' changing demands. Supply chain management (SCM) is an important concept and discipline which enables business partners to integrate products and services effectively and to build long-term relationships. SCM can be extensively defined as effective coordination on material, product, delivery, payment, and information flows between enterprises and trading partners [60,63]. Effective flow management across inter-organizational boundaries is the major focus of SCM concept. Information technology (IT), such as Internet and communication technology, is therefore an important tool to make the deployment feasible. For example, supply chain partners need to share production information to rapidly and accurately respond to inventory demand.

For these reasons, SCM has been widely recognized as a significant area for IT investments to support its processes. Electronic SCM (e-SCM) is therefore defined as the physical implementation of SCM process with the support of IT while also making a distinction from the general management concept of SCM. However, e-SCM, although still considered to be in its early stages and with a high reported failure rate, is nonetheless believed to be the key to the final success of

SCM process [48]. Due to this trend, IT innovation issue is at the core of modern SCM research. Nevertheless, most studies have been focused on a single decision view of adoption/acceptance based on relevant theories such as the technology acceptance model (TAM), theory of planned behavior (TPB) and their extensions [2,19]. In contrast, innovation diffusion theory (IDT) is a theory to understand the diffusion of innovations across time [59]. Based on IDT, researchers have presented models specifically concerning information system (IS) innovation. These models were often addressed as stage-based processes, such as the three stages of initiation, adoption, and implementation [27,79]. Furthermore, some studies have empirically investigated the diffusion of Inter-Organizational Systems (IOS), such as Electronic Data Interchange (EDI) and e-business, using stage-based analyses. [30,53,56,57,78].

Moreover, because this diffusion process is dynamic and complex in nature, analyzing this process requires an understanding of the fundamental of evolutionary change across time. According to innovation researchers, a variety of contextual factors, originally defined in IDT, may affect an organization's decision to diffuse new technologies. Five major contextual factors have been defined: innovation (new technology), individual, task, organizational, and environmental factors [35]. In general, these five factors can be further classified as technological and non-technological structures. The non-technological structures consist of four factors: individual, task, organizational, and environmental factors. The technological structure is defined to include one factor, innovation. e-SCM diffusion basically involves both internal diffusion among functional units within an organization and external diffusion across a large number of

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inter-organizational trading partners. This study was mainly focused on examining the aspect of the external diffusion of e-SCM across trading partners. Technological and environmental factors were therefore the major concerns in this study [55,57]. Individual, task, and organizational factors, however, were mainly defined for intra-organizational diffusion and would not be considered in this study. Much research has also differentiated between intra-organizational and inter-organizational factors in assessing their different impact on IOS diffusion [47,51,56,57].

Furthermore, e-SCM diffusion has been considered to be an open collaborative system among trading partners, and the literature has greatly emphasized particular collaborative relationships rather than the general IS innovation environment [34,56,57,60,61]. Collaborative relationships between participants concern the degree of communication, trust, and interdependence which they enjoy, and which results in more stable transactions and in a reduced level of uncertainty and risk in the market [34,65]. Accordingly, collaborative relationships are defined as consisting of a composition of relevant relationship attributes. We define it as the collaborative structure. Next, in IOS research, attributes of supply chain technologies are often defined in terms of innovation characteristics, as defined in Rogers [59]. We define it as the technological structure. More specifically, technological structure includes three attributes: relative advantage, complexity, and ability to provide security; and collaborative structure comprises four attributes: peer pressure, transaction climate, environmental uncertainty, and supplier interdependence. In addition, a comprehensive literature review was initially carried out to theoretically define the stage-based structure to include three stages, adoption, implementation, and assimilation. This diffusion structure will be further confirmed by an empirical data for the latter analysis. These three components will be described in detail in the next section.

Finally, the ultimate goal of IT innovation diffusion is to increase firm performance. Previous studies have investigated the impact of IT investments on firm performance in general and have been inconclusive: namely the IT productivity paradox [11,21,22]. More specifically, little research on IOS has discussed the performance impacts from the diffusion perspective among trading partners [56,57]. Grounding on these ideas, this research also examines the important linkage between e-SCM diffusion and firm performance. Historically, studies have focused on financial measures of firm performance, and one major reason for the IT productivity paradox may be that inappropriate measuring methods have been used. This study therefore considers both financial and non-financial measures in a complementary manner [7,8,19]. In addition, many studies on the issue of organizational innovation have suggested a control effect of some organizational characteristics, such as industry type and firm size, on the realization of firm performance [5,59,67,71]. We thus specified industry type and firm size as two control variables. In summary, this study proposes a novel research model to explore the

relationships among external antecedents, stage-based e-SCM diffusion, and firm performance. More specifically, it discusses two questions: (1) the impact of the two external structures on various diffusion stages diffusion and (2) the effect of various diffusion stages on financial and non-financial performances.

2. Literature review and hypotheses development

Based on the above discussion, the specific relationship structure we identified is summarized in Fig. 1. The followings discuss the theoretical foundations and development of hypotheses.

2.1. External structures and e-SCM diffusion

2.1.1. IDT and external structures

IS innovation may be broadly defined as innovation in the organizational application of IT [68]. IDT is defined as “the process by which an innovation is communicated through certain channels over time among the members of a social system” [59]. While the theory has been originally applied to a wide range of organizational innovations, much research has been undertaken to explore IS innovation diffusion in particular. Furthermore, the diffusion of IS innovation has indicated a critical role in determining the final success of its usage [26,28]. Basically, two types of research approaches were used to investigate the diffusion of IS innovation: factor research and stage research [54,59]. Factor research generally employs cross-sectional research designs and is used for identifying variables that are related to particular implementation outcomes. Stage research generally uses longitudinal or repeated measures to explore how the diffusion process with multiple stages is guided and affected by changes in related variables over time.

While much innovation research with IDT was mainly based on intra-organizational context, little research has been focused on inter-organizational context, for example, e-SCM diffusion. A brief review of relevant literature for the major antecedents of inter-organizational diffusion is presented as below. First, several studies for examining the adoption of various supply chain tools have reported many factors that affect their adoption and use. These factors are divided into those related to IT attributes and those related to maintaining the relationships that are important in managing supply chain linkage [56,60,61]. Next, other studies have examined the diffusion of web technologies or EDI with the impacts of internal and external drivers and further, the realization of SCM performance [55,57]. Their results revealed that IT attributes and supplier interdependences are the major factors in affecting this diffusion. In summary, the above studies have clearly indicated a similar argument that the success of diffusing inter-organizational systems is mainly dependent on two key external factors: IT attributes and collaborative relationships. In this study, we named IT attributes and collaborative relationships as the technological and collaborative structures, respectively, for the purpose of

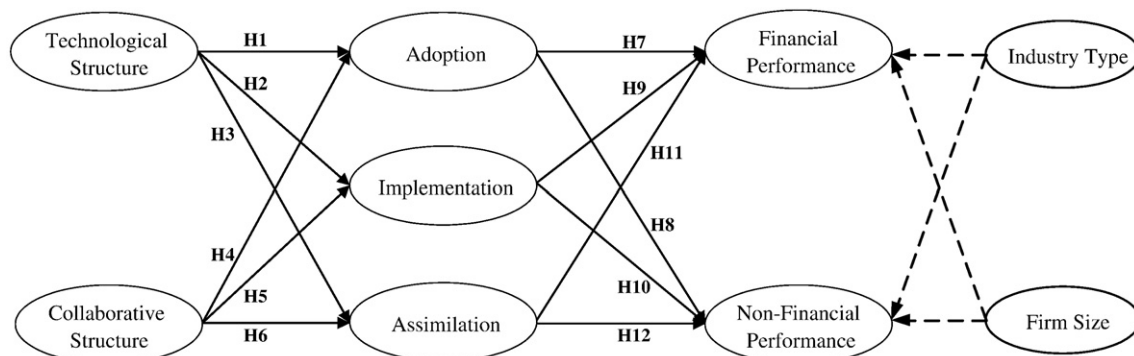


Fig. 1. Theoretical framework.

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