

# Using the balanced scorecard in assessing the performance of e-SCM diffusion: A multi-stage perspective

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## ABSTRACT

Electronic supply chain management (e-SCM), a specific form of inter-organizational systems, has generally regarded as one of the major strategies to create competitive advantage. The diffusion of e-SCM among trading partners is critical for its final successful use and accordingly, performance impact. However, the diffusion process is complex and dynamic in nature and involves an evolutionary property across time. Innovation diffusion theory (IDT) is defined for effectively exploring diffusion process with multiple stages. Moreover, prior studies have found inconclusive results of IT-enabled performance due to inadequate measures. The balanced scorecard (BSC) with the extension to SCM, incorporating four performance perspectives, is appropriate for overcoming this problem. Grounding on the IDT and BSC, this study proposes a novel framework for exploring the relationships between a stage-based structure and the BSC. Data are collected from a questionnaire survey. The results indicate that there are significant differences between external diffusion and the two earlier stages, adoption and internal diffusion, on the four BSC perspectives. Furthermore, all of the four perspectives are well realized at external diffusion stage. Implications for managers and scholars are discussed.

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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 the importance that they must compete, as part of a supply chain against other supply chains, to quickly reflect the customers' changing demands. Supply chain management (SCM) is an important discipline that enables business partners to integrate their products/services effectively and to build a long-term relationship eventually [24]. SCM can be extensively defined as effective coordinations on material, product, delivery, payment, and information flows between enterprises and trading partners [68,74]. Therefore, SCM discipline is complex and dynamic while involving various work flows across inter-organizational boundaries. The support of information technology (IT), in particular, the Internet and communication technologies, is therefore imperative for making SCM practice feasible [41,81,82]. Electronic SCM (e-SCM) is defined as the physical implementation of SCM process with a support of IT while also attempting to make a distinction from the concept of SCM.

However, e-SCM, although still considered to be in its earlier stage and with a high reported failure rate, is nonetheless believed to be the key to the final success of SCM process [55]. The issue of e-SCM

diffusion between partners is complex and dynamic in nature and involves an evolutionary property across time. Previous research has discussed a single decision of adoption in the innovation based on relevant theories, such as technology acceptance model (TAM) [7,11], theory of planned behavior (TPB) [76,80], and their many extensions [75,79]. In contrast, innovation diffusion theory (IDT) is a theory to understand the diffusion of innovations across time [65]. According to the IDT, researchers have presented many models concerning information system (IS) innovation. These models were often addressed as a stage-based process, such as initiation, adoption, and implementation stages [21,22,61]. Specifically, some studies have empirically examined the diffusion of inter-organizational systems (IOS), such as electronic data interchange (EDI), supply chain technology, and e-business, using a stage-based analysis [63,64,85]. An example defines a three-stage structure, adoption, internal integration, external integration, in a diffusion of EDI among small organizations [29].

Therefore, a stage-based analysis may further capture the changes of various diffusion stages in e-SCM implementation over time. Next, as e-SCM increasingly becomes popular, it is necessary to systematically examine its performance impact on the organization [56,57]. The stage-based analysis can provide different degrees of performance impacts on different diffusion stages in a dynamic manner [63,64]. However, little research on deploying IOS has discussed the performance impact in a diffusion perspective among partners. Most studies have focused on the perspective of adoption behaviors, such as intention to use or actual use, across different diffusion stages [21,73]. The enabling role of e-SCM diffusion in organizational

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performance has not received sufficient attention. Thus, an understanding of the linkage between e-SCM diffusion and organizational performance is our major goal in this study.

Traditionally, most organizations have evaluated performance based largely on financial accounting methods. These methods are important in assessing whether operational changes are improving the financial health of a company, but insufficient to measure supply chain performance. These measures do not relate to important organizational strategies and non-financial performances, such as customer service and product quality [2,42,65]. In addition, prior studies have found inconclusive results of IT productivity despite massive IT investments, namely IT productivity paradox [14,77]. A major reason may be due to the use of inappropriate measures in assessing IT values and has historically focused on financial ones, such as sales and profits [13]. Therefore, researchers suggested the need using more non-financial measures, such as customer satisfaction and product quality, although there is little agreement on precisely which measures to use [5,13]. This implies that the evaluation of e-SCM should cover both quantitative and qualitative measures in a complementary manner.

The Balanced Scorecard (BSC) was initially developed by Kaplan and Norton [31]. The BSC proposes a balanced approach between financial and non-financial measures and specifically looks at a business from four perspectives: finance, customer, internal process, and learning and growth [32,33]. It has been widely applied in assessing organization-based performance in an internal basis in different industries. However, there are few studies in discussing its potential applications to evaluate SCM performance in an external basis [5,53]. One study suggested that the BSC can be extended to include inter-organizational process perspective in supply chain context [53]. That is, internal process has been generally redefined as business process for including both internal and external processes. Grounding on the IDT and BSC, this study thus proposes a new research model for using the extension-based BSC to assess the performance of e-SCM from a multi-stage diffusion perspective. Specifically, a three-stage structure, adoption, internal diffusion, and external diffusion, is defined based on a comprehensive literature review in e-SCM diffusion. In addition, many studies on the issue of adopting supply chain systems have suggested a moderating effect of some organizational characteristics, such as industry type and firm size, on the realization of firm performance [27,62,72]. We thus specified industry type and firm size as two moderating variables.

## 2. Literature review and hypotheses development

Based on the above discussion, Fig. 1 provides a pictorial depiction of this research framework. The following paragraphs discuss the theoretical foundation of this framework and development of hypotheses.

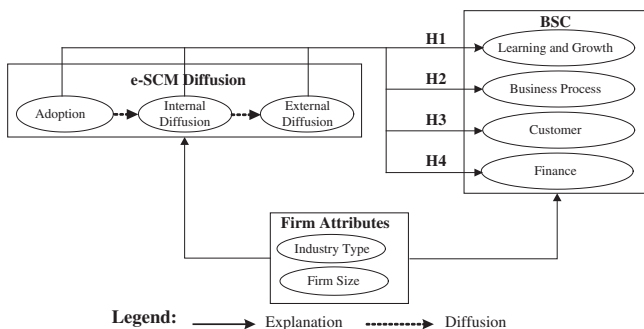


Fig. 1. Research framework.

### 2.1. SCM and e-SCM

In the contemporary business, SCM is one of the major strategies to enhance organizational efficiency and effectiveness, and ultimately achieve competitive advantages [24,78]. Moreover, the development of business-to-business (B2B) commerce has spotlighted the role of SCM in the modern digital economy [30]. The definition of SCM is developed and used by The Global Supply Chain Forum (GSCF) as "... the integration of key business processes from end users through original suppliers that provide products, services, and information that thus add values for customers and other stakeholders" [40]. The mechanism, in essence, widely covers the activities of integration in an intra-organizational basis and collaboration across inter-organizational boundary [59,71,73]. The ultimate goal of SCM is to build strategic relationships with customers, suppliers, and other business partners [50,54].

In general, there are three components flowing through the supply chain: goods, payments, and information [60]. The movement of the three components needs large amount of information exchange and generally requires frequent communication and collaboration among trading partners. Recently, a growth in information and communication technologies (ICT) such as the Internet-based technologies enhances the capabilities to integrate the supply chain [24,72]. Without the support of ICT, the objective of SCM will not be effectively accomplished [55,62]. Traditionally, inter-organizational systems (IOS) provide an electronic linkage infrastructure to facilitate the movement of the three components in the supply chain with the support of EDI [43,71]. Similarly, electronic SCM (e-SCM) is a specific form of inter-organizational systems with the support of the Internet and e-commerce technologies. More recently, the concept of virtual enterprise (VE) for integrating trading partners through the Internet-based is an important approach to carry out strategic relationship [24].

### 2.2. IDT and e-SCM diffusion

Effective diffusion of IS innovation is the critical force in determining final success of IS implementation [22,65]. In fact, this process is complex and dynamic in nature, which may vary with distinct sets of characteristics across time and involves different loci of organizational impact [61]. To better understand IS implementation problems and how they can be solved, a multiple-stage rather than a single-stage analysis would provide deep insight for understanding this process [21]. While the IDT is mainly defined for exploring how diffusion of innovation with multiple stages is guided and affected by changes in related variables over time, a stage-based process is originally proposed to include two stages: adoption and implementation [66,67]. The adoption stage further defines sub-stages of knowledge acquisition, persuasion and learning, and decision, leading to the actual adoption decision. The implementation stage further comprises activities of preparation of changes to task structure, task process, and technology necessary for innovation deployment.

While IS innovation has increasingly become an important resource in a firm, the IDT has been widely applied for effectively understanding its diffusion. Kwon and Zmud [39] first generally discussed a six-stage model for IS innovation diffusion, founded on Lewin's three-stage change model [44], including initiation, adoption, adaptation, acceptance, routinization, and infusion. Afterwards, various stage-based models have been proposed for different IS innovations. A four-stage model, comprehension, adoption, implementation, and assimilation, was developed to explore a firm's involvement in IT innovation diffusion [74]. There are a number of three-stage structures presented for the diffusion of IS innovation. A model with the stages of initiation, adoption, and implementation was proposed to understand the use of telecommunications technologies in business organizations [22]. Additional model with the stages of earliness of adoption,

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