Application of Inter-firm Information Systems in Supply Chain Management

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Abstract

The objective of this study was to identify the drivers to use inter-firm information systems (IS) in Supply Chain Management (SCM). For conducting this study, required primary data were collected from 10 business organizations in order to achieve the objectives of this study. It was found that proposed three categories such as transaction processing, supply chain planning and collaboration, and order tracking and delivery coordination represent well the different types of inter-firm IS uses in SCM. It was also found that the drivers behind these different categories of inter-firm IS use differ from organization to organization; different purposes for which inter-firm IS can be used in the management of supply chains are demonstrated. It also contributed to the extant knowledge on the factors that drive business organizations to use IS in specific ways in their SCM activities.

Keywords: *Chain, Inter-firm, Information, Management, Systems, Supply.*

Introduction

Every organization is struggling in order to survive in today's competitive marketplace. Traditional supply chain working is not going to help an organization to cope up with market demands and customers. Information systems (IS) revolution changed the face of supply chain which was used to be few years back. Information systems (IS) provides an organization to have a smart and robust supply chain [1].

The use of information system (IS) is considered a prerequisite for the effective control of today's complex supply chains [2]. Business organizations are increasingly seen as parts of supply chains, delivering goods and services to the final customer [3]. The existing literature on supply chain management (SCM) is extensive [4].The utilization of information systems (IS), in turn, is considered an imperative requirement for managing these networks, and has been associated with significant improvements in supply chain efficiency [5].

Although the importance of IS for efficient SCM is widely acknowledged, empirical research assessing how business organizations actually use IS for SCM purposes is limited. Majority of the prior study has focused either on modeling the benefits of inter-firm information technologies and information sharing, or on assessing the impact of specific technologies on supply chain. Consequently, the actual uses of IS in SCM as well as the drivers for using IS in a specific way still remain unclear. Owing to these limitations in the previous literature, this study seeks answers to the following research questions by employing business organization study data from 10 Bangladeshi business organizations.

In this paper, SCM refers to the flow of information among various stakeholders. Further, when discussing the use of IS in SCM, researchers refer to the use of inter-firm information systems, also referred to as inter-organizational systems in the literature, that are used for sharing and/or processing information across organizational boundaries. The paper is structured as follows.

First, relevant literature on the use of IS in SCM is reviewed. Second, the research design is presented, followed by the presentation of the analysis and key findings of the study. Finally, in the last two sections, the main results of the study are summarized and discussed, and concluding remarks are presented.

Literature Review

In supply chain management, ICT has especially been recognized as an enabler for information sharing which companies in the supply chain can use for eliminating the so called bullwhip-effect [6]. The prior research that acknowledges the possibilities offered by IS for the management of operations between organizations is abundant. For example, researchers have included over a hundred journal articles in their recent literature survey addressing the use of IS in supply chain integration and management [7]. Next, a concise literature review discussing the main contributions and shortcomings of three research approaches – analytical and modeling research, empirical studies, and classification frameworks – in relation to the topic of this paper is provided. Researchers have found that the sharing of information in supply chains typically increases the performance of the supply chain by increasing availability and reducing inventory related costs [8, 9],[10],[11].

The advantages of sharing information have been proposed to depend on the predictability of demand. Researchers anticipate that sharing information can have a significantly positive value in situations with unknown demand, for example, the early sales of new products or promotion situations [12]. Another study also has proposed information sharing to be less beneficial in situations where demand is predictable, and where past demand can be used to form a reasonably accurate demand forecasts [3]. Moreover, a researcher have proposed that the benefits of IS use are more due to the positive effects of IS on transaction processing efficiency, potentially leading to shorter lead times and smaller batch sizes, than to sharing of inventory and information of an organization [13]. Besides, the supply of actual demand information forward in the supply chain provides greater benefits than lead time reductions [14].

As compared to the research focusing on specific technologies or application areas, research on the use and benefits of IS in SCM without the focus on specific technology is fewer in number. The research on the benefits of the use of IS in SCM includes a number of surveys investigating the impact of IS on supply chain integration, customer integration and service [15], supply chain time performance [15], financial performance, or a combination of these [16].

Researchers examine the role of IS and organizational integration in supply chain integration and propose an IS integration path from low, through medium, to high integration [12]. On the other hand, researchers have focused on the ways business organizations use IS in SCM and classify the use of IS in SCM to transaction execution and information sharing [7].

To conclude, based on literature review, there is a lack of empirical research on drivers to use inter-firm information systems (IS) in Supply Chain Management (SCM). Furthermore, there is a limited knowledge on the factors that drive the business organizations to use IS in specific

ways in their SCM efforts. For the purposes of examining the use of IS in SCM, two prior constructs were developed:

➢ The types of inter-firm IS use in SCM; and
➢ The drivers for using inter-firm IS in SCM.

Types of inter-firm IS use in SCM

The first construct, types of inter-firm IS use in SCM, refers to the purposes for which business organizations employ inter-firm IS. More specifically, three different types of inter-firm IS use for SCM are proposed: transaction processing, supply chain planning and collaboration, and order tracking and delivery coordination. This categorization, while not explicitly proposed in the prior research, is based on the types of inter-firm IS use identified from the prior literature.
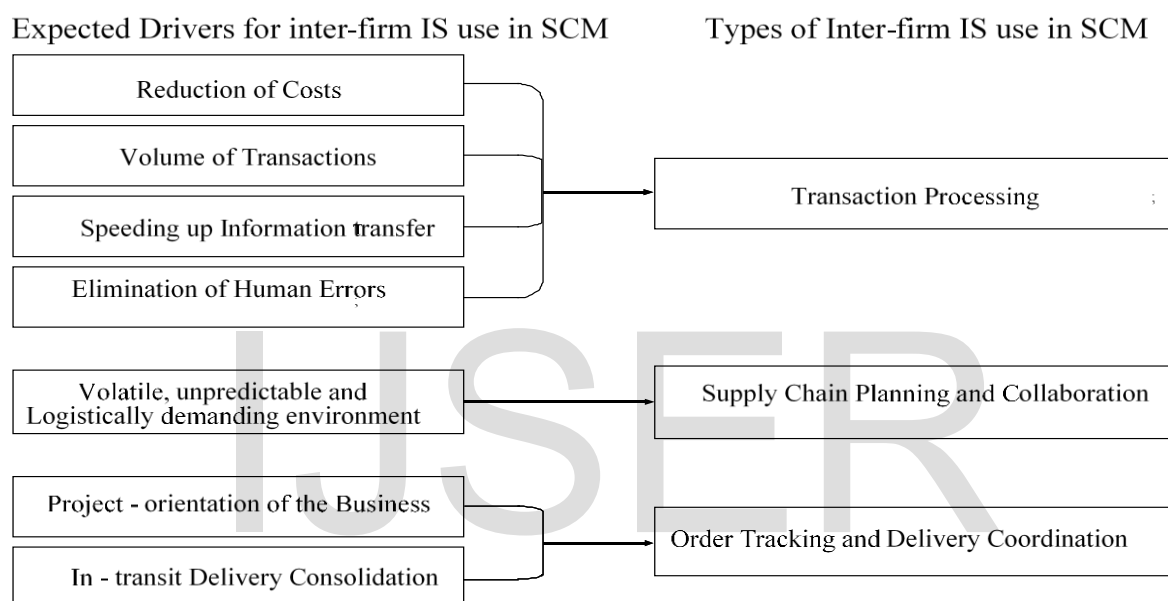
Source: Alftan, Kaipia, Loikkanen, & Spens[17], Sudhindra, Ganesh, & Arshinder [18]

Transaction processing stands for the use of IS for increasing the efficiency of repetitive information exchanges between supply chain partners. In this type of IS use the exchanged information is typically related to such tasks as order processing, billing, delivery verification, generating and sending dispatch lists, and producing order quotes. Supply chain planning and collaboration represents the use of IS for sharing planning-related information such as inventory information, production capacity information, demand forecasts and other demand information, for increasing the effectiveness of the supply chain. Finally, order tracking and delivery coordination, third drivers of IS, is defined as the monitoring of individual orders which may consist of final products, with the aim of coordinating their delivery or conveying timely information of their desired location.

Drivers for inter-firm IS use in SCM

The second construct, drivers for using inter-firm IS in SCM, refers here to the reasons for using inter-firm IS in a certain manner for the purposes of SCM. Based on the literature review, the following drivers for the use of inter-firm IS in transaction processing were expected to be

found from the study: improvement of information quality by eliminating human errors, reduction of the costs of operational processes, and speeding up the transfer of information between organizations.

Methodology of the Study

Both qualitative and quantitative data were gathered using personal interviews as well as a questionnaire. The business organizations were selected using the approach of purposive sampling[19]. The required questions for the interviews and the required questionnaire for data collection were designed concurrently so that they together would cover both the IS solutions employed by the business organizations in their SCM practices and the essential business organization and business environment characteristics.

The interviews were semi-structured in nature. The typical composition of participants in the interviews included two to three interviewers and one to three business organization representatives. A total of 17 business organization representatives participated in the 10 interviews conducted.

In order to increase the validity of the research, investigator, source, and method triangulation were used[19]. Multiple respondents were typically present in the interviews in each business organization. Finally, the data collected via the semi-structured interviews were complemented with the use of questionnaires to gather structured quantitative data.

Data Analysis
Table-1: Characteristics of Business Organization

Business Organization	Industry	No. of Employee	Sales Revenue (Monthly Lac BDT)	No. of Customers	No. of Suppliers
A	Manufacturer of Engineering Steels and Steel Products	15	15-17	High	Moderate
B	Producing Bakery Products	27	22-25	Moderate	High
C	Producing Wood Furniture	9	12-14	High	low
D	Manufacturer of Engineering Steels and Steel Products	11	13-15	High	Moderate
E	Producing Wood Furniture	12	14-16	Moderate	Moderate
F	Manufacturer of Engineering Steels and Steel Products	13	14-15	Moderate	High
G	Producing Bakery Products	29	21-22	High	High
H	Producing Wood Furniture	8	9-11	High	Low
I	Producing Bakery Products	24	17-19	Moderate	Moderate
J	Manufacturer of Engineering Steels and Steel Products	17	14-17	High	Moderate

Notes: No. of customers: low= less than 100 customers, moderate=100-300 customers, high=more than 300 customers. No. of supplier: low= less than 5 suppliers, moderate=5-10 suppliers, high=more than 10 suppliers.

Table-02: Transaction Processing with Customers and Suppliers

Business Organization	Transaction Processing with Customers	Transaction Processing with Suppliers	Supply chain planning & collaboration with customers	Supply chain planning & collaboration with suppliers	Order tracking and Delivery coordination with customers and suppliers
A	√	√	√	×	√
B	√	√	√	×	√
C	√	√	√	√	√
D	√	√	√	×	√
E	√	×	√	×	√
F	√	×	√	×	×
G	√	×	√	×	√
H	√	√	√	×	√
I	√	×	√	×	√
J	√	×	×	×	×

After analyzing each of the business organization separately, the business organizations were compared with each other in order to identify potential patterns within and between business organizations utilizing inter-firm IS in a specific manner. Grouping and cross-business organization analysis was performed for the different types of inter-firm IS uses addressing both the customer and supplier sides of a business organization's supply chain.

Most of the business organization business organizations, 10 out of 10 (A, B, C, D, E, F, G, H, I, J), used inter-firm IS to process transactions with their customers. Five of the business organizations (A, B, C, D, H), in turn, used inter-firm IS for transaction processing with their suppliers. Consequently, nine of the business organizations (A, B, C, D, E, F, G, H, I) used inter-firm IS for Supply chain planning & collaboration with customers. Eight of the business organizations (A, B, C, D, E, G, H, I) used Order tracking and Delivery coordination with customers and suppliers. As expected, reduction of costs and manual work, improvement of information quality, speeding up of information transfer, and volume of transactions were found to drive the use of inter-firm IS for improving the process of business organizations. The continuous nature of the business relationship was considered important in these business organizations.

The Expected and Observed Drivers for inter-firm IS Use in SCM
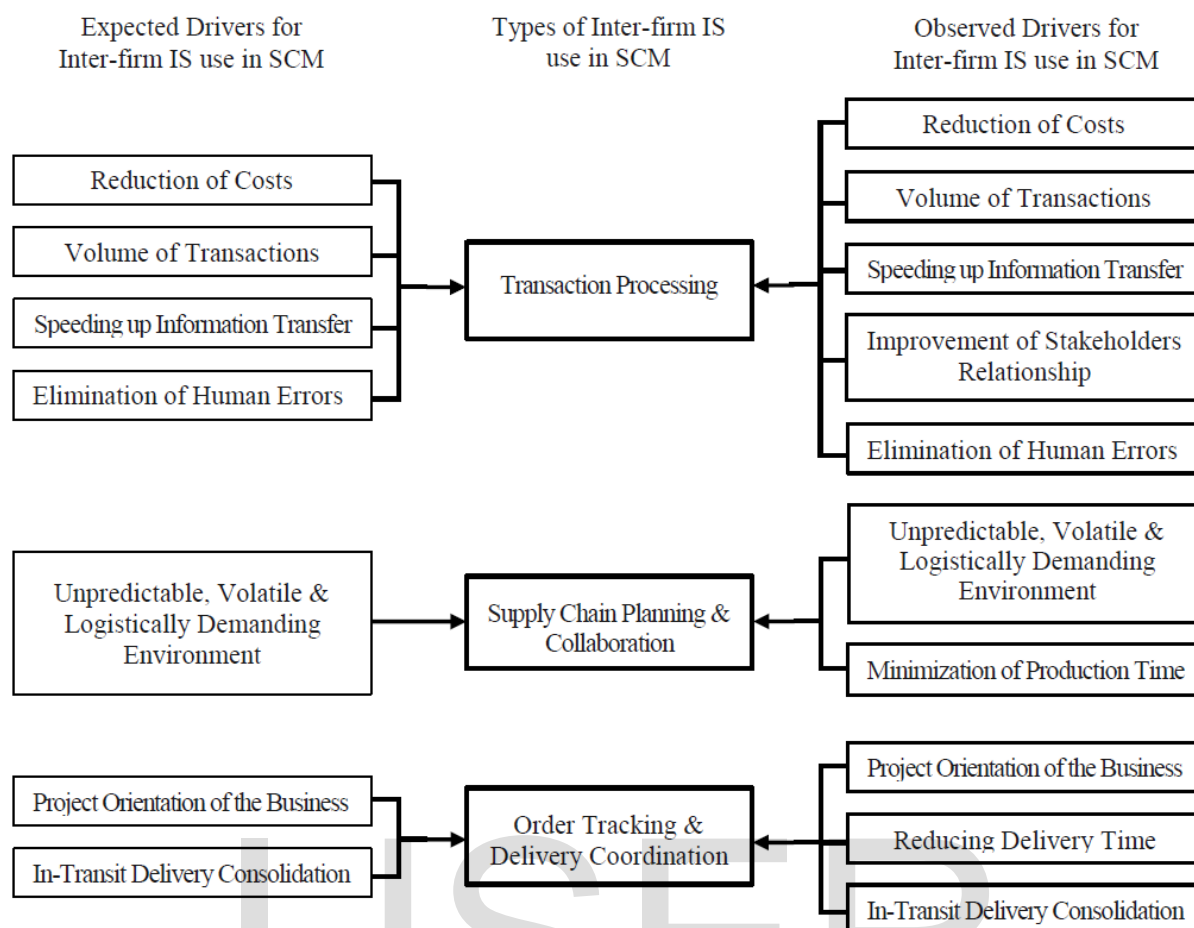
Conclusion

There is a rapid development in the use of information systems (IS) in logistics and supply chain management. This paper try to identify the drivers to use inter-firm information systems (IS) in Supply Chain Management (SCM). It is found that proposed three categories such as transaction processing, supply chain planning and collaboration, and order tracking and delivery coordination represent well the different types of inter-firm IS uses in SCM. It is also found that the drivers behind these different categories of inter-firm IS use differ from organization to organization; different purposes for which inter-firm IS can be used in the management of supply chains are demonstrated. It also contributed to the extant knowledge on the factors that drive business organizations to use IS in specific ways in their SCM activities. Further, like expected, the use of inter-firm IS for transaction processing is found to be driven by reduction of costs and manual work, improvement of information quality, speeding up of information transfer, and high volume of transactions. In addition, improvement of stakeholders relationship is identified among the drivers for this type of inter-firm IS use. Also the presumed relationships between the uses of inter-firm IS for order tracking and delivery coordination and the drivers of project-orientation of the business organizations.

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