

An Investigation on the Research Topics in Relation to Information Systems in Supply Chain Management

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Abstract This study is designed to investigate the trend of information systems (IS) research in relation to supply chain management (SCM). The purpose of this research is to predict how IS research is likely to evolve in the near future and to suggest to which direction it should be further conducted. We attempted to investigate the previous research topics about information systems in the fields of SCM on the basis of 96 journal articles published between the year of 2006 and 2010 including the database of ScienceDirect. The most frequently appeared keywords in the titles and abstracts were searched by two different categories: “business, management and account” and “decision science”. As a result we found that the most popular research topics appeared in the articles were “impacts of IS on the performance of SC and enterprise” “framework and model of IS in SCM”. We also suggested the future research implications of the current research trend or preference. This study academically and practically contributes to deepening our understanding of the on-going issues discussed on the current IS papers in the field of SCM by suggesting the future direction of studies.

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1 Introduction

Supply chain is defined as a network of relationship between organizations such as suppliers and customers (Kelle and Akbulut 2005), and the main goal of supply chain management is the management of the interconnection of organizations which relate to each other through upstream and downstream linkages between the different processes that produce value in the form of products and services to the ultimate consumer [1]. As the stakeholders of SC are located all over the world by globalization, it is more required to integrate the activities and process both intra and internal organization [2]. This means that without implementation and integration of ISs for information sharing it is impossible to achieve the benefits of SCM. Accordingly, there were few literature studies on information technology and system in the field of logistics, supply chain management, and some industries [1–4]. The purpose of this research is to predict how IS research is likely to evolve and to suggest to which direction it should be further conducted. Previous research was mainly focused on the comprehensive studies of information technology and systems justification; however, in this paper we attempted to explore the extensive studies of information system in supply chain management.

This study is designed to investigate the trend of ISs research in relation to SCM. The remainder of this paper is organized as follows. In [Sect. 2](#), we discuss IS in SCM with literature review. The methodology of research is explained in [Sect. 3](#). The results of investigation on the previous research are being discussed in [Sect. 4](#). In the last section, the limitation and conclusion of this paper are presented.

2 Literature Review

While Menzer et al. (2010) viewed supply chain (SC) as a set of three or more organizations directly involved in the upstream and downstream flows of products, services, finances and/or information from a source to a customer [5], Kelle and Akbulut (2005) interpreted it as a network of relationship between organizations such as suppliers and customers. For a more detailed explanation they pointed out that SCM is the management of the interconnection of organizations that relate to each other through upstream and downstream linkages between the different processes that produce value in the form of products and services to the ultimate consumer [1].

Ginnarsson and Jonsson (2005) showed that increased collaboration among the partners of a supply chain contributed to improve the performance of SC. In order

to achieve significant performances in SCM [6] suggested the integration of business processes and information flows of SC partners cannot be overlooked. The benefits associated with the integration of supply chain system involve increasing competitive advantage, decreasing operational costs, and improving collaboration and coordination among the partners of supply chain. However, without information system (IS) and information technology (IT), it is unlikely to achieve the benefits of SCM since the stakeholders of SC are located all over the world. Thus, it is required to integrate the activities and process both intra and internal organization [2] to increase efficiency in SCM. This means that implementation and integration of ISs for information sharing has played a key role in promoting business competitiveness.

Without IT/IS that support SCM relatively poor services or high cost products in terms of quality would be provided to customers. Many attempts have been made to reduce manufacturing costs such as the costs of managing resources and controlling inventories. IS used within organizations for SCM can be categorized into four types: (1) transaction processing system (TPS), (2) management information system (MIS), (3) decision support system (DSS), and (4) artificial intelligence and expert system (AI/ES) (Oz 2008).

It has been known that the most fundamental system is TPS that handles the large volume of business transactions that occur daily within an organization, and MIS is operated on the basis of the information from a TPS that supports management decision making. This system yields to a variety of reports such as scheduled reports and demand reports. DSS is information and planning system, which organizationally collects people, procedures, databases, and devices used to support problem-specific decision making. DSS differs from MIS in the support given to users toward the decision emphasis, the development and approach, and system components, speed, and output. Another system considered to support management decision making is the expert system (ES) [7].

3 Methodology

3.1 Article Sampling

Literature review was conducted to capture a snapshot of the current academic research of information system in SCM field. 96 Journal articles were sourced from the ScienceDirect database which has been known as one of the major scientific databases offering journal articles and book chapters. In this research, we only sorted keywords from the topics and abstracts of the journal articles. According to the 2011 journal citation data, ScienceDirect includes many of top journals in the field of SCM such as Journal of Operations Management, Omega International Journal of Management Science, European Journal of Operational Research, and Decision Support System. The search terms that were found in the intersection of

“information system” and “supply chain management” within abstracts, titles and keywords (as of September 2012) in all journals of ScienceDirect. In order to increase accuracy, the fields of disciplines that are subjected to this search are limited to Business, Management and Accounting and Decision Science. The time horizon in this research is limited to 5 years between 2006 and 2010 in that A. Gunasekaran and E.W.T. Nagai conducted a similar analysis for the past 15 years between 1991 and 2005.

3.2 Descriptive Features of the Whole Literature

In the past decade between 2001 and 2010 the quantity of research dealt with the information system in supply chain management has steadily increased (Fig. 1). Compared to the earlier half of the last decade with its later half, the number of published journal articles in the later half was one and half ratio (Figs. 1 and 2). The types of journals dealt with these topics also became more various toward the year of the 2010, and the list of journal is described in Table 1.

4 Analysis, Results and Implications

Li et al. [8] compared the research trend of the two groups of researchers whose research topics were about IS and management. They described that IS researchers are more likely to focus on the information flow while management researchers tended to focus on the materials and finances. For example, in the aspect of inter-organizational information sharing IS researchers analyzed the benefits of EDI or the level of information sharing. On the other hand, management researchers studied the topics regarding the decrease in the bullwhip effect due to information sharing or the decision making of inventory level with information sharing (Table 2).

Fig. 1 Journal articles by years (2001–2010)

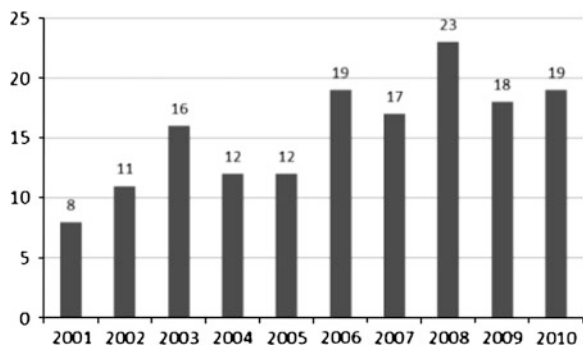


Fig. 2 Journal articles by years (2006–2010)

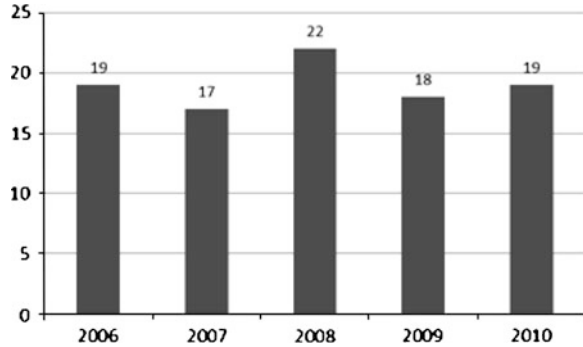


Table 1 Theresources of articles—journal

Journal	Number	Percentage	Cumulative percentage
International journal of production economics	19	20	21
European journal of operational research	19	20	41
Decision support systems	9	9	50
Computers in industry	8	8	58
Expert systems with applications	8	8	67
Computers & industrial engineering	6	6	73
Journal of operations management	5	5	78
Omega	5	5	83
International journal of information management	3	3	86
International journal of project management	2	2	89
Others	11	11	100
Total	95	100	–

Table 2 Previous research by category

Category	Reference
<i>SCM (Management, business and account)</i>	
Impact of IS on SC performance	[9, 10, 17, 18, 21, 22, 23, 25, 26, 27, 29, 30, 31]
The function of IS in SCM	[11, 12, 13, 19, 28]
Application of IS in SCM	[16, 23; Persona et al. (2007); 14, 20]
<i>Information system (decision science)</i>	
Framework and model of IS in SCM	[35, 40, 43, Wang et al. (2010), 33, 36, 37, 39, Zhang et al. 55, 56, Uçkun et al. 38, 48, Kwon et al. (2007)]
Application	[48, 52, Kurata and Yue (2008), 47]
Infrastructure	RFID: Lin [43, 44, Wang et al. (2010), 45, 50] Web: Repoussis et al. [54]
Technique	Optimization: Shukla et al. [34, 49], Policy: Lee and Wu [46, 37], Datamining: Thomassey [41, 32]

[9–56]

In this section, we analyzed the characteristics of information system (IS) in supply chain management appeared in information system papers and management papers to explore the research trend formed in accordance with the view point of IS. With the subject category of ScienceDirect, we divided sampling papers into two areas, (1) business, management and accounting and (2) decision science. The former investigated the journals: Omega, Journal of Operations Management, Decision Support Systems, etc. The latter mainly consists of the following journals: Computer in Industry, Computers and industrial Engineering, etc. However, International Journal of Production Economics and European Journal of Operational Research were distributed to the area of business, management and accounting and the area of decision science respectively depending on research subject.

In the fields of business, management and accounting, previous research paid more attention to (1) the impact of IS on the performance of enterprises or SC, (2) the present status of IS implementation and use, and (3) application of IS in a variety industry' SC. On the other hand in the field of decision science, previous research more concentrated on the classification of (1) the framework and modeling of SCM IS, (2) the application of IS in SCM, and (3) the technique of IS.

Su and Yang [9] explored what and how ERP system impacts on the performance of enterprises with structural equation model, and showed the positive relationship between ERP system and the operation, customer relationship and planning and control of enterprises. In addition, Seggie et al. [10] examined the impact of IT on enterprises' brand equity, which is one of intangible performances by adopting IT with structural equation model, and concluded high degree of IT alignment between SC firms positively affects brand equity. When it comes to intra and inter organizational information sharing system, functions and benefits of SCM are introduced and examined in these papers. For example, Fildes et al. [11] examined the use of forecasting support system, which is one of the decision support systems, and identified design features with literature review Holweg and Pil [12].

In contrast to the first research field that is related to the impacts of IS on SC or business performance, the area of decision science explored the impact of technique, information visualization, on ERP system (Parush et al. 2007).

In decision science, the main subject of researches is to develop frameworks and models for optimization system performance. In general, SC is composed with many different enterprises with complex systems so the integration and coordination of heterogeneous IS in internal SCare a major issue to achieve efficient SCM performance. For example, Li and Wang [40] developed the model of coordination for centralized SC and Chatfield et al. [35] worked for the supply chain modeling language so he can provide a generic framework (XML based format) for storing SC structure and managerial information to overcome the difference between heterogeneous systems.

Both business and decision science areas studied the application of IS in a variety of SC like a fashion industry (Kurata and Yue 2008; Lo et al. [39]).The attributes of an industry and its structure of supply chain should be taken into

consideration when adopting IS. Few research was done with regards to the IS application in terms of regions such as China (Ge and Voß [47]), and South East Europe [13].

4.1 Future Research

In this paper, we founded that the function of IS in SCM has been advanced from operational support to decision support function, and the object of information sharing has been enlarged the efficiency of individual enterprise into the efficiency of whole SC. Compared to the previous research [1–4], who studied information system in supply chain management, recent research tends to focus on decision support system instead of operational system. According to Forme et al. (2007) who classified the information sharing of SC into four categories: the downstream and upstream parts of SC and inter and cross of SC, the progress of SCM philosophy and IT leads to the change of research topic from operational system into decision support system.

Secondly, according to Williamson et al. [1] who categorized the phase of inter-organizational system development within SCM based on Shore (2001), recent main topic of research of IS in SCM become more focused on the web for easier integration and coordination of heterogeneous systems within SC. As a result, many research suggested web based SCM IS research such as privacy and security of information in open platform and the standard language as the future research.

5 Conclusion

This paper investigates the previous research topics about information systems in the fields of SCM on the basis of 96 journal articles published between the year of 2006 and 2010 including the database of ScienceDirect. The most popular research topics appeared in the articles were “impacts of IS on the performance of SC and enterprise” “framework and model of IS in SCM”. Also, many research suggested the research of web based SCM IS such as privacy and security of information in open platform and the standard language as the future research.

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