

THE RELATIONSHIPS BETWEEN SUPPLY CHAIN MANAGEMENT INFORMATION SYSTEM (SCM IS) CAPABILITIES WITH SUPPLY CHAIN PERFORMANCE FOR ELECTRONIC FIRMS IN MALAYSIA: A CONCEPTUAL FRAMEWORK

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ABSTRACT

SCM IS (Supply Chain Management Information System) being the enterprise or inter-organizational information system that manages the flow of information between suppliers, and end customers. The need of such system gets justified with the trend of globalization as business spans beyond borders and the need to manage it centrally. In spite of researchers explaining the importance of SCM IS, the capability of such system with an empirical study is yet to be researched to prove its significant, particularly in the Malaysian context. Being a conceptual paper, this paper provides a framework that spots the capabilities that builds up the SCM IS. Also, this paper investigates if the identified capabilities results to better Supply Chain Performance. It is expected that through this framework, such capabilities could be researched as of which capabilities of SCM IS affect supply chain performance the most. The framework is expected to be tested empirically using data from electronic manufacturing firms in Malaysia.

KEY WORDS

SCM IS, Capabilities, Supply Chain Performance, Malaysia

1. Introduction

Information system (IS) in supply chain management (SCM) has gained its importance recently due to its ability to reduce costs and increasing responsiveness in the supply chain (Mc Laren et al, 2004; Chopra & Meindl, 2001; Dagenais & Gaustchi, 2002; Lee, 2000; Ndubisi & Jantan, 2003). A more evident fact is based on financial excerpts of Proctor and Gamble, in which, the company gained USD325 million savings annually through the usage of SCM system (P&G, 2001). During the past decades, information systems has enabled many organizations such as Dell and Hewlett Packard, to successfully operate solid collaborative supply networks

(Scott, 1993). Thus, organizations increasingly find that they must rely on effective supply chains systems to successfully compete in the global market and networked economy.

With regards to SCM, many researchers have given a lot of definitions on SCM. Among the popular one would be by Lambert et al (1998) in Global Supply Chain Forum mentioned that SCM is the integration of key business processes from end user through original suppliers to add value and services to customer and stakeholders. The other definition that could be also stated here would be by Hanfield and Nicholas (1999) that SCM is the integration of activities, through improved supply chain relationship to achieve sustainable advantage. It is widely accepted in the literature that SCM is important for material and information flows relating to the transformation of the materials into value added products, and the delivery of the finished products through appropriate channels to customers and markets so as to maximize customer value and satisfaction. However, the introduction of information system by a firm for SCM could lead to better efficiency and effectiveness (Goldhar & Lei 1991; Sullivan 1985). For example, the members of the chain can share the database for supply that enable the company to identify optimal inventory levels, reduce warehouse space, and increase inventory turnover (Kaeli 1990). As John Gossman, vice-president of materials management at AlliedSignal recently noted: "competition is no longer company to company, but supply chain to supply chain." His statement emphasizes the strategic benefits of supply chain management. As a consequence, Bowersox and Daugherty (1995) claimed that the benefit of such supply chain management can be attained through electronic linkage among various supply chain activities utilizing information systems. There are huge evidences in the literature on the benefits of different systems that developed for supply chain management.

1.1 Research Background

Traditionally, companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal capabilities even though the internal capabilities are known to impact local firm performance. This is consistent with the resource-based theory (Corner & Prahalad, 1996), in which, they argue that a firm's internal resources and capabilities represent the foundation for the development of creating value. Tracey et al (2005) suggest that those companies have organized functionally, actually generating barriers to the creation of value. This means that top management must identify and acknowledge all the underlying capabilities to create the value, even if customers are aware or not being interested (Bechtel & Jayaram, 1997). A research by Sharma et al, (2006), revealed that 210 SMEs in India understand and acknowledge the importance of IS in their day-to-day operations in the present dynamic and heterogeneous business environment and need to be exploited in the formal and professional manner to drive maximum business gains. For them, the ability to deliver innovative solutions on a sustainable basis requires strategic internal capabilities optimized for business growth.

Many researchers have recognized supply chain systems as a new organization form, using terms such as Electronic Data Interchange (EDI), Electronic Marketplace or Enterprise Resource Planning (ERP) and Materials Requirement Planning (MRP). A variety of systems has been designed and implemented for different supply chain activities and strategic purposes. Some of the most commonly implemented systems are used to support the operations of planning, scheduling and distributing the materials. Regardless of their intended function, it is generally believed that these systems aid significantly in decision making related to the planning, assessment, and control of supply chain activities (Bowersox and Daugherty 1995). In general, such systems can be defined as "a group of enterprise or inter-organizational systems, each with their capabilities, which collaborate in ever-changing constellations to serve one or more partners in order to achieve some business goal specific to that collaboration" (Akkermans, 2001). However, firms face a complex and risky decisions analyzing and selecting an appropriate the supply chain systems solution or ensuring that their implemented systems are aligned with their business strategies (Reddy and Reddy 2001). Therefore, the main scope of this study is the supply chain management information system or known as SCM IS.

1.2 Research Problem

Increasingly competition is forcing organizations to be creative in their strategic efforts as businesses are learning

to improve the way customers are served. Many organizations, therefore, seek competitive capabilities that would enable firms to exceed customers' perceptions, so that they can enhance market and financial performance (Hayes & Pisaro, 1994). Effective SCM systems allow rich information exchange, quick and reliable data availability, and easy access to business partners (Mukhopadhyay et al, 1995). However, realizing the potential benefits of systems requires the capabilities by organizations (da Silveira et al, 2006). Choudary (1997) also emphasizes that although SCM systems provide the communication benefits, they may differ in their capabilities to provide superior integration and brokerage ability.

Mc Laren et al, (2004) states that the SCM IS is about the integration of the SCM systems and there has not been any empirical research looking on its' capabilities, which this study would try to accommodate. The research problem for this study, therefore, is lack of theory to help decide which SCM IS capabilities are most important for a specific firm. Studies to date have tended to focus on system itself, and its outcomes, rather than the capabilities of the systems that are used to gather, manage, and control them. There is a need for research that establishes linkages between the firm SCM IS capabilities and performance. This study, therefore, is expected to be important to the practical as it reduces risk in SCM IS by providing tools for planning and analysis. Furthermore, the study is also expected to contribute to the theory by investigating the alignment of SCM IS capabilities and performance and builds theory for understanding supply chain systems success with operationalizable constructs.

The purpose of this paper is to provide a conceptual framework for the identification of what are the capabilities of SCM IS and what are the relationships between the capabilities of SCM IS with the supply chain performance. The paper begins with clarifying the concept of supply chain management information system (SCM IS) and clarifies its capabilities. In section 2.1, the paper presents detailed literature reviews of SCM IS. In the section 2.2, it outlines the discussions on SCM IS capabilities as related to operational flexibility, operational efficiency, internal and external analysis of organization. Section 2.3 explores the dimensions for supply chain performance such as supply chain total assets, supply chain total costs, responsiveness and reliability through the SCOR model. Section 2.4 outlines the theoretical foundation for the study. In section 3.0 the paper proposes a conceptual framework for SCM IS, generated hypothesis and the research design. The final section presents the conclusions and insights from the study.

2. Literature Review

2.1 A Concept on Supply Chain Management Information System (SCM IS)

Recent advances in inter-enterprise software and communication technologies, along with a growing use of strategic partnering and outsourcing relationships, has resulted in a confusing assortment of alternative information systems approaches for supporting collaborative SCM. In recent years, SCM in general and information systems in particular, have gained interest among researchers. Thus SCM systems allow organizations to progress beyond mere operational level information exchange and optimization and can transform a business and its partner's into more competitive organizations (Mc Laren et al, 2002). As mentioned earlier, there are huge studies on the SCM systems but more focused on the individual studies which have explored on the adoption, importance and benefits of different systems in supply chain such as Electronic Data Interchange (EDI) (Lee *et al.* 1999; Mukhopadhyay *et al.* 1995), Electronic Marketplace (Dagenais and Gautschi 2002; Kaplan and Sawhney 2000), or Enterprise Resource Planning (ERP) (Green 2001) systems. Figure 1 show the alternative systems used in the organizations in regards with supply chain management and how they related with the type of relationship, degree of inter-organizational and the unique of the processes (Mc Laren et al, 2002).

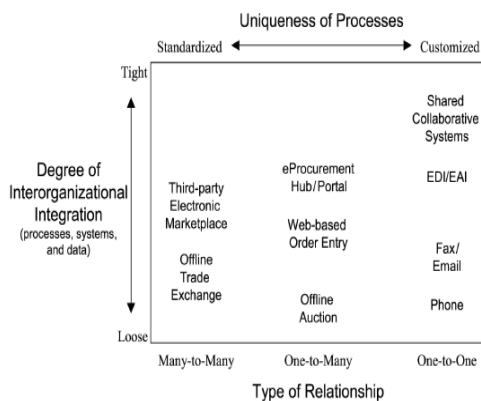


Figure 1: Alternative Systems for SCM
Adapted from Mc Laren et al, (2002)

Ready and Ready (2001) stressed that many firms are facing with complex and risky decisions in analyzing and selecting an appropriate the supply chain systems solution. However, the main scope of this study is to investigate the supply chain management information system (SCM IS). According to Mc Laren et al (2004), Supply Chain Management Information Systems (SCM IS) play an increasingly critical role in the ability of firms

to reduce costs and increase the responsiveness of their supply chain. This supported by other researchers such as Chopra and Meindl (2001); Dagenais and Gautschi (2002) and Lee (2000). Mc Laren et al (2004), therefore, have defined SCM IS as information systems (IS) that used to coordinate information between internal and external customers, suppliers, distributors, and other partners in a supply chain. In other words, SCM IS is the inter-organizational systems that coordinate the flow of information between buyers, suppliers, distributors and other partners in a supply chain”.

As Mc Laren et al (2004), states that SCM IS could be inter-organizational system, the relationship between IS and SCM being explained explicitly by Shah et al (2002). They claimed that the “practices and initiatives of supply chain requires information intensively, thus the support of information’s systems capabilities is required to enact SCM and business strategy effectively. This study, therefore, is at intersection of three important disciplines (refer to Figure 2).

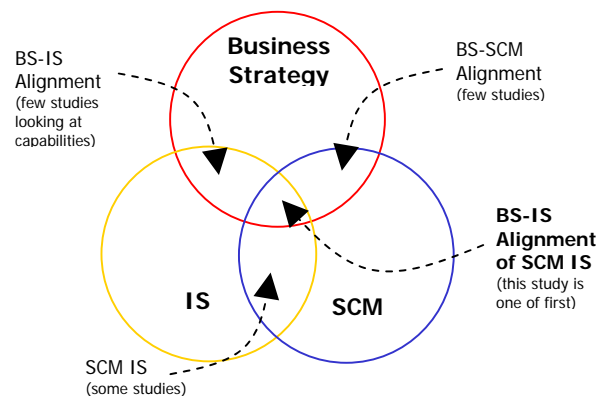


Figure 2: Scope of Study

2.2 SCM IS Capabilities

To clarify the concept of SCM IS capabilities, the paper first need to clarify the concept of organizational capabilities and information systems capabilities. These capabilities need to be discussed as they formed the capabilities for SCM IS.

An organizational capability is the ability of an organization to achieve its goals by leveraging its various resources (Ulrich and Lake 1990). In other words, capability represents the identity of a firm as perceived by both its employees and its customers. It is a firm ability to perform better than competitors using a distinctive and difficult to replicate set of business attributes. According to Novartis (1994), it is critical for the organizations to have the organizational capabilities in 4 areas: - external

focus, innovation, people and performance. External Focus is mainly on customers, markets, competitors, and technologies. It means that organizations must actively search for new opportunities, are immediately aware of threats, and rapidly apply and implement new technologies and ideas. Innovation is the driving force in organizations. It enables them to create new, cutting-edge products, processes, and technologies. Organizations also must treat each other with respect, support each others efforts, and work at delivering superior results. By fostering teamwork and collaboration, organizations can enhance learning throughout the organization. Based on ambitious targets and aim at the highest performance standards, some organizations strive to achieve world-class results. They have to thrive on competitive challenge, measure the results and benchmark the performance in terms of that of major competitors.

IS capabilities are organizational capabilities which are enabled by IS. Similarly, SCM IS capabilities are organizational capabilities enabled by SCM IS. Over the years, research on the evaluation of IS has increased in abstraction from matching IS capabilities with functional requirements (Lucas 1981), to desired architecture (Allen and Boynton 1991), to competitive strategies (Henderson *et al.* 1996). Although strategic alignment has received considerable attention in recent studies of overall IS strategy (Kearns and Lederer 2001; Reich and Benbasat 2000; Sabherwal and Chan 2001), models have not yet been developed to a sufficiently detailed level to examine the organizational capabilities enabled by specific types of IS, such as SCM IS. In this study, SCM IS capabilities are indicated by level of support for:

- Operational Efficiency
- Operational Flexibility
- Long-term Planning
- Short-term Planning
- Internal Analysis
- External Analysis
- Internal Process Coordination
- External Process Coordination

2.3 Supply Chain Performance

The so-called “Supply Chain Operation Reference” or “SCOR” model is acknowledged as an adopted elementary framework in this study because of its well-documented attributes. In addition, this process reference model was also integrated with the well-known concepts of: • Business Process Reengineering • Benchmarking • Best Practice. Hence, from a range of frameworks, the SCOR model is viewed as a powerful tool to evaluate the performance of supply chain (Supply Chain Council, 2000). The Supply Chain Council (2000) has suggested

that in order to achieve a competitive advantage, five performance attributes of the supply chain had to be assessed and improved. They were:-

- Supply chain delivery and reliability
- Responsiveness
- Flexibility
- Cost
- Assets management efficiency

2.4 Theoretical Foundation

This study sought to examine potential outcomes of firms' SCM IS capabilities. Of particular interest is whether investment in SCM IS capabilities leads to tangible benefits for the firm. Thus a resource-based perspective is used to guide this study. Resource-based theory has long been used to explain differential performance between firms. The fundamental thesis of resource-based theory is that firms possess heterogeneous resource endowments, which in combination with unique firm environmental settings, lead to differentiable performance within a given marketplace.

3. Methodology

3.1 Research Framework

Refer to Figure 3 in Appendix.

3.2 Hypothesis

As a result of SCM IS capabilities, resource-based theory propose that overall supply chain performance advantages should result (Barney 1991). Thus, the following capability-performance relationship is hypothesized:

H1: SCM IS capabilities will be positively associated with supply chain performance.

3.3 Research Design

The proposed framework will be tested using data from the electronics sector in Malaysia. This sector is selected because it is expected to have relatively higher levels of SCM IS implementation compared to other sectors. Therefore, it is important to find out what the SCM IS capabilities are and how these capabilities influence the supply chain performance. As mentioned earlier, the results of the study are expected to be of value to researchers in enhancing knowledge and theory of strategy selection and implementation of SCM IS. Research design applied in this study is shown in Figure 4.

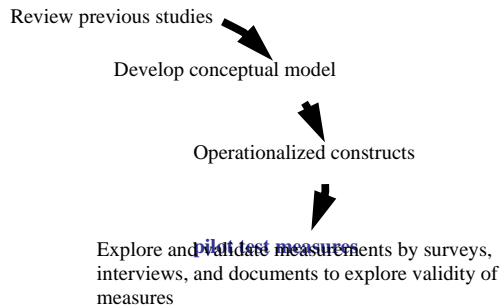


Figure 4: Research Design

This study is intended to assess the relationships between SCM IS capabilities and desirable performance outcomes. Specifically, the analysis is center on the relationships between the four types of SCM IS capabilities and supply chain performance. The study will adapt survey instruments from previous studies and will administer the instruments to seven senior informants on three manufacturers to analyze validity and plausibility of instruments. The instruments for SCM IS Capabilities are adapted from Sabherwal and Chan, 2001; Zviran, 1990; Venkatraman and Ramanujam, 1987; Bensaou, 1997; Raymond, 1985; Miller and Doyle, 1987. The study will use the multi-dimensional scale on Operational Efficiency, Operational Flexibility, Long-term Planning, Short-term Planning, Internal Analysis, External Analysis, Internal Process Coordination, and External Process Coordination. For supply chain performance, the study adopted the Supply Chain Performance Indicators (Supply-Chain Council, 2001)

4. Conclusion

SCM IS being the enterprise or inter-organizational information system that manages the flow of information between suppliers, and end customers. The need of such system gets justified with the trend of globalization as business spans beyond borders and the need to manage it centrally. In spite of researchers explaining the importance of SCM IS, the capability of such system with an empirical study is yet to be researched to prove it's significant, particularly in the Malaysian context. Being a conceptual paper, this paper provides a framework that spots the capabilities that builds up the SCM IS. Also, this paper investigates if the identified capabilities results to better Supply Chain Performance. It is expected that through this framework, such capabilities could be researched as of which capabilities of SCM IS affect supply chain performance the most. The framework is

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References

- [1] Akkermans, H. (2001). Intelligent E-Business: From Technology to Value. *IEEE Intelligent Systems*, 16(4), 8-11
- [2] Bowersox, Donald J., David J. Closs, and M. Bixby Cooper (2002), *Supply Chain Logistics Management*, New York, NY: McGraw Hill/Irwin.
- [3] Bowersox, Donald J., David J. Closs, and Theodore P. Stank (1999), *21st Century Logistics: Making Supply Chain Integration a Reality*, Oak Brook, IL: Council of Logistics Management.
- [4] Bowersox, Donald J., Patricia J. Daugherty, Cornelia L. Droge, Dale S. Rogers, and Daniel L. Wardlow (1989), *Leading Edge Logistics: Competitive Positioning for the 1990s*, Oak Brook, IL: Council of Logistics Management.
- [5] Broadbent, M., and Weill, P. (1993) "Improving Business and Information Strategy Alignment: Learning from the Banking Industry," *IBM Systems Journal* (32:1), 1993, pp. 162-179.
- [6] Chopra, S and Meindl, P., (2003), "Supply Chain Management", Prentice Hall.
- [7] Conner, Kathleen R. (1991), "A Historical Comparison of Resource-Based Theory and Five Schools of Thought within Industrial Organization Economics: Do We Have a New Theory of the Firm?" *Journal of Management*, Vol. 17, No. 1, pp. 121-154.
- [8] Conner, Kathleen R. and C.K. Prahalad (1996), "A Resource-Based Theory of the Firm: Knowledge Versus Opportunism," *Organization Science*, Vol. 7, No. 5, pp. 477-501.
- [9] Copacino, William C. (1998), "The IT-Enabled Supply Chain: Key to Future Success," *Logistics Management and Distribution Report*, Vol. 37, No. 4, pp. 36.
- [10] Choudary, V. (1997), "Strategic Choices in the Development of Interorganizational Information System", *Information System Research*, 8:1, 1997.
- [11] Da Silveira, G., D. Borenstein, & F.S. Fogliatto (2001). *Mass Customization: Literature Review and Research Directions*. *International Journal of Production Economics* 72, 1-13
- [12] Dagenais T, Gautschi D (2002) *Net Markets: Driving Success in the B2B Networked Economy*, McGraw-Hill Ryerson Ltd., Toronto, ON *Effect. Management Science*, 43(4), 546-558
- [13] Goldhar, Joel D. and David Lei (1991), "The Shape of Twenty-First Century Global Manufacturing," *The Journal of Business Strategy*, Vol. 12, No. 2, pp. 37-41.
- [14] Handfield, R. and Nichols, Jr. E. (1999), *Introduction to Supply Chain Management*, Prentice Hall, New Jersey.

- [15] Hayes R H & Pisano G P (1994) Beyond World-Class: The New Manufacturing Strategy. Harvard Business Review 72(1): 77-86
- [16] Kaeli, James K. (1990), "A Company-Wide Perspective to Identify, Evaluate, and Rank the Potential for CIM," Industrial Engineering, Vol. 22, No. 7, pp. 23-26.
- [17] Kaplan, S. and Sawhney, M., 2000, "E-hubs: The New B2B Marketplaces", Harvard Business Review, May- June, 97-103.
- [18] Karahannas MV, Jones M (1999) Interorganizational Systems and Trust in Strategic Alliances, Proceedings of the Twentieth International Conference on Information Systems, Charlotte, NC, December 13-15, pp 346-357
- [19] Lambert, D. M., M.C. Cooper , and J.D. Pagh (1998). Supply Chain Management: Implementation Issues and Research Opportunities. The International Journal of Logistics Management, 9(2), 1-19.
- [20] Lee HL (2000) Creating Value through Supply Chain Integration, Supply Chain Management Review
- [21] Lee, Choonwoo, Kyungmook Lee, and Johannes M. Pennings (2001), "Internal Capabilities, External Networks, and Performance: A Study on Technology-Based Ventures," Strategic Management Journal, Vol. 22, No. 6, pp. 615-640.
- [22] Lee, H.L., V. Padmanabhan , and S. Whang (1997). Information Distortion in Supply Chain: The Bullwhip
- [23] McLaren, T. S., Head, M. M., and Yuan, Y. (2002) "Supply Chain Collaboration Alternatives: Understanding the Expected Costs and Benefits," Internet Research: Electronic Networking, Applications and Policy (12:4), 2002, pp. 348-364.
- [24] McLaren, T. S., Head, M. M., and Yuan, Y. (2003). "Measuring the Strategic Fit of Supply Chain Coordination Systems", Quarterly Journal of Electronic Commerce 2003.
- [25] McLaren, T. S., Head, M. M., and Yuan, Y. (2004), "Supply chain management information systems capabilities. An exploratory study of electronics manufacturers" Information Systems and E-Business Management Volume 2, Numbers 2-3 / July, 2004
- [26] Moncrieff B, Stonich M (2001) Supply-Chain Maturity Model and Performance Assessment, <http://www.supply-chain.org> <http://www.supply-chain.org>
- [27] Mukhopadhyay T, Kekre S, Kalathur S (1995) Business Value of Information Technology: A Study of Electronic Data Interchange, MIS Quarterly 19(2): 137-156
- [28] Ndubisi, N. O and Jantan, M. (2003). "Evaluating IS usage in Malaysian small and medium-sized firms using the technology acceptance model", Logistics Information Management, Dec 2003 Volume: 16 Issue: 6 Page: 440 - 450
- [29] O'Leary DE (2000) Supply Chain Processes and Relationships for Electronic Commerce. In: Strader T, Whinston A (eds), Handbook on Electronic Commerce, Springer-Verlag Berlin, Heidelberg, Germany
- [30] P & G (2001), www.sap.com/services/pdf/CS_Procter_Gamble.pdf
- [31] Parr A, Shanks G, Darke P (1999) Identification of Necessary Factors for Successful Implementation of ERP Systems. In: Ngwenyama OL Inrona LD, Myers MD, DeCross JI (eds), New Information Technologies in Organizational Process, Kluwer Academic Publishers, Boston, MA pp 99-119
- [32] Peterson K (1999) Supply Collaboration is a Reality - But Proceed with Caution, Achieving Supply Chain Excellence Through Technology, Montgomery Research, San Francisco, CA.
- [33] Reddy R (2001) Chasing Windmills: The Paradox of Efficiency and Agility in Supply Chain Management Technology, <http://www.iemagazine.com>
- [34] Reddy R, Reddy S (2001) Supply Chains to Virtual Integration, McGraw-Hill, New York, NY Reich BH,
- [34] Reich, B.H., and Benbasat, I. (1996) "Measuring the Linkage between Business and Information Technology Objectives," MIS Quarterly (20:1), 1996, pp. 55-81.
- [36] Reich, B.H., and Benbasat, I. (2000). "Factors that Influence the Social Dimension of Alignment between Business and Information Technology Objectives," MIS Quarterly (24:1), 2000, pp. 81-113.
- [37] Scott (1993), in http://en.wikipedia.org/wiki/Supply_chain_management
- [38] Tracey, M. & Lim, J. S & Vonderembse, M A. (2005), "The impact of supply-chain management capabilities on business performance". Supply Chain Management: An International Journal Jul 2005 Volume: 10 Issue: 3 Page: 179 - 191

APPENDIX A.

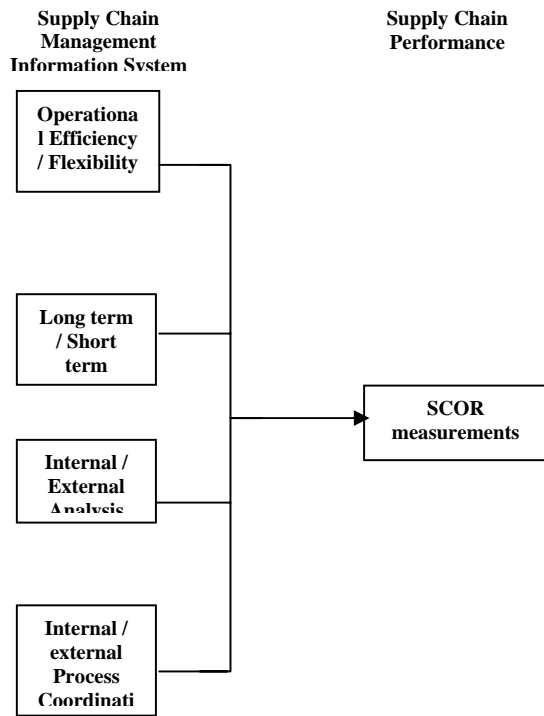


Figure 3: Research Framework