THE EFFECT OF SUPPLY CHAIN INTEGRATION ON INFORMATION SHARING: ENHANCING THE SUPPLY CHAIN PERFORMANCE

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ABSTRACT

This paper addresses the relation of supply chain integration with manufacturing industries. Here, the main objective is to analyze that the supply chain integration is related to manufacturing industries in what all aspects. Supply chain management is mainly contributed to improve the organizational competitiveness in the twenty-first century. As it is involving in all of the activities in industrial organizations, it is said that there is a big relationship between supply chain management and manufacturing industries. Supply chain management is meant to define the quality of the products and thereby the customer satisfaction in manufacturing industry. Therefore this paper concentrates on providing guidelines and references for manufacturing engineers who are interested in supply chain integration.

Key words: *SCM, SCI, SCP, customers, information sharing, suppliers, hypothesis*

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01. Introduction

The hyper-competitive global environment organizations began to realize that delivering the best customer value at the lowest cost is not only related to the activities, functions and processes within the organization itself, but to the whole of the supply chain. As customers become more aware of their demands and conscious about their improved choices, faster response time, shorter product cycle time and customized products/services are placed at the very core of dynamic and responsive value chains, aiming to offer added value for the customers. Due to the complex nature of supply chains; having various activities encompassing multiple functions and organizations, supply chain members while acting in a decentralized manner need to move towards the efficiency associated with a unified system and centralized control. Business goals that might be difficult to achieve by individual organizations alone, might be achieved through value-based supply chain relationships. Hence, collaborative behavior and activities in SCM gained considerable importance in recent decades as an essential pre-condition of staying competitive and enhancing performance which in turn intensifies the efforts for building enhanced value based relationships through the supply chain network.

The accelerating trend of new manufacturing paradigms forcing supply chains to be agile, adaptable and aligned to meet the needs of cooperative, mutually beneficial supply chain partnerships in the value networks, lead firms to refocus on forming tighter and deeper relationships. Firms are compelled to coordinate their internal processes and activities with their boundary spanning partners to achieve improved firm performance. Thus, SCM seeks to enhance competitive advantage, through mutually beneficial integrated relationships among supply chain members and arranging resources, perspectives and objectives of different supply chain partners according to a common set of objectives, and value propositions to deliver the highest value to customer. A definition regarding SCM by Lambert and Cooper highlights that "*SCM is the integration of key business processes from end user through original suppliers that provides products, services and information that add value for customers and other stakeholders"* placing integration as the focal concept. Parallel to this argument, SCI to provide maximum value at low cost and high speed to the customer, articulates the degree to which firms strategically collaborate with their supply chain partners and exert unified control over inter and intra-

organization processes to achieve effective and efficient flows of products, services, information, money and decisions. Although literature abounds of researches concentrating on the benefits of SCI such as; the achievement of competitive advantage, improved firm performance, business and operational performances, efficiency in supply chains by increased flexibility in delivery times and responding to customer demands, eliminate the bullwhip effect, and decrease transaction costs, little emphasis is given to the influence of SCI on information sharing.

The article proceeds in the following manner. In the first section, we briefly present the literature comprising supply chain management (SCM), information sharing, supply chain integration(SCI) and supply chain performance (SCP) respectively. We develop related hypotheses concerning the effect of SCI on information sharing and the effect of information sharing on SCM. Next the hypotheses are tested through the data collected from 158 manufacturing firms in Turkey. Finally in the last section the research findings are presented and discussed with managerial implications.

02. Theoretical framework and hypothesis development

Although there is a growing body of literature encapsulating definitions regarding SCM, the concept mainly involves managing a connected series of activities having various origins and it is concerned with planning, coordinating, and controlling movement of materials, parts, finished goods, financial resources, decisions and information from the supplier to the customer. For the achievement of this supplementary management; material, financial, and information flows are managed as decisions are made at strategic, tactical, and operational levels throughout the supply chain. SCM issues span a large spectrum of a firm's activities at these levels. As, customer satisfaction, product variety, demand for premium customer services and competition in global market places increase the complexity of SCM, the explicit or implicit connections that firms create with critical members of their supply chains, for smooth and synergic functioning of entities thus allowing firms to capture the benefits of inter and intra organizational integration and information sharing within the entire chain gain considerable importance. Supply chain management gives rise to the need and advantages of abandoning the organizational boundaries which strictly isolates the actors in the SC and directs organizations to integrate, cooperate and coordinate. The more centralized supply chains are, the more cooperation among the members

leading to shared benefits, lower costs, and faster responses would be. Efficient transition of consignments is possible through the information flow between the parties of supply chain networks. Yet, increasing the level of integration and information sharing in supply chains is crucial for increased sensitivity towards customer needs hence greater value offered, fast and real-time access to internal and external information, and outperforming competitors with faster response times.

02.01. Supply chain integration and information sharing

SCI has gained considerable attention with changing manufacturing and supply strategies and increased globalization. The theoretical foundation of SCI traces back to Porter's value chain model, emphasizing the value creating linkages among the members of the chain. Contemporarily the grown popularity of SCI during the last decade, revealed that linking all supply chain members and aligning partner's objectives to approach a shared system of values is crucial for firms to deliver superior value to the customers.

Effective linkage of various supply chain activities including the internal functions of an organization with the external rations of suppliers, customers and other SC members is critical in ensuring correct supply chain relationships and facilitates the coordination of information flows from supplier to manufacturer and customer, as well as the backward flow from customer to manufacturer and supplier. Correct supply chain relationships based on strategic collaboration with supply chain partners as a result of SCI, leverage the flow of timely, accurate and quality formation. Although the definitions in the literature regarding SCI encompass the complementarities between integration and information sharing, in the means that SCI supports effective and efficient flow of information, a few studies have up to date focused on the leveraging power of SCI on information as compelled to improve SCP.

Thus SCI is said to enable increased specialization allowing the flow of appropriate information in cases of need. It is thus hypothesized that:

H1. *Supply chain integration positively influences information sharing*

02.02. Supply chain integration and supply chain performance

The need for supply chains to be involved in collaborative relationships, uniting to form a single virtual organization in terms of global approach with the objective of maximizing profit and reducing total operating costs echoes in various industries reminding firms to directing all parties to combine their resources and collaborate . Previous studies have come to a consensus that SCI improves firm performance, and competitive advantage, lowers transaction costs, enhances flexibility, reduce inventories, eliminates bullwhip effect improves delivery quality and shortens cycle times. There is minimal effort to identify the relationship between SCI and SCP. Empirical studies present that firms need to have correct supply chain relationships in order to deliver the benefits associated with SCI into SCP. For this reason, this study explicitly investigates the influence of collaborative and cooperative, trust based relationships enabled through the SCI, to achieve higher SCP.

Particularly, SCI in three levels including integration with suppliers, integration with customers and intra-organizational integration, allows firms to achieve increased SCP, through enabling a centralized approach of management across the extended value network consisting of various parties. Through centralization of operations, management and strategic decisions, the unified control of processes and actors undertakes the role of maximizing utilization of assets both internally and externally. Therefore, SCI leverages SCP through the transparency captured n the flow of goods and information from the origin of sourcing of raw materials till the end user, conveying increased flexibility, reduced lead time, improved inventory, and reliable delivery. Moreover, higher levels of information technologies (IT) involved in the communication, and transaction of supply chain members that are geographically distributed, strengthens secure, and reliable supply chain activities, facilitating coordination among supply chain partners. Strong IT infrastructure enabled through SCI provides timely, accurate and reliable information allowing a convenient and low cost communication with lower information uncertainty. SCI improves SCP through the transfer of real-time, reliable, accurate information both across supply chain partners externally and within the functions of individual organization. Parallel to the above discussion the following hypothesis is developed:

H2. *Supply chain integration positively influences supply chain performance*.

02.03. Information sharing and supply chain performance

Information sharing has become an important feature among organizations as the value creating factors are shifting from physical and financial assets towards intangible assets. Since SCM emphasizes effective and efficient flows of both physical and non-physical assets both directions starting from the main supply source of raw materials towards the consumption of the product or use of the service by the end-customer, the alignment of information -a "two way shared" asset which does not diminish as it is used, which instead gets depth as it is used and shared- in a common value network, constitutes the key characteristic of integrated supply chains. Many studies show that information sharing among supply chain partners and within the organization have significant impact on the effectiveness of supply chains. Information sharing allows firms to make better decisions on ordering, capacity allocations, production and material planning, through increased visibility of demand, supply and inventory. Many studies indicate information sharing as a key ingredient in achieving seamless SC and mentions the benefits associated with it. Knowledge based view concentrates on the extent of knowledge exchange which facilitates supply chain outcomes and performance. Among the information sharing outcomes; increased coordination, reduced uncertainty faster material flow, higher order fulfillment and shorter order cycle times, reduced inventory costs, increased customer satisfaction with fast and reliable delivery and contribution to overall cost and service level performance take the lead. Concurrently, the benefits associated with information sharing also include; increased operational effectiveness, reduced bullwhip effect, enhanced coordination of physical movements, better conflict resolution and decision making; improved responsiveness and planning. Literature generally focuses on the extent of the information shared including the content, frequency, granularity and up-to-lateness of information shared; when, what, with who and where the information is shared; or the information quality, content, supply chain dynamism and delivery performance the affect of information sharing on performance.

Furthermore information sharing is a critical driver for firms to increase their knowledge base and consequently, allot the possible benefits of maximizing profits throughout the collective system. Firms' growing awareness of the benefits associated with knowledge accumulation as a result of collaborative knowledge sharing, tend to band together and value their inter-relationships. Hence, the customers' and suppliers' willingness to build and maintain long term positive relationships with their supply chain partners increases. Increased knowledge base and

benefits exploited resulting as a consequence of information sharing, encourages firms to become committed and exert effort on behalf of the relationship. The presence of commitment in a relationship, serves to eliminate partners' acts which might adversely affect overall supply chain performance. Moreover, information sharing facilitates for supply chain partners to overcome the fear of information disclosure and the loss of power over competitors, since there is increased transparency and beneficial relationships. According to this theoretical framework we propose the following hypothesis:

H3. *Information sharing positively influences supply chain performance***.**

This presents a framework displaying the relationship between supply chain integration (SCI) and information sharing, the influence of SCI on supply chain performance (SCP), and the effect information sharing has on SCP. The research herein, empirically tests the linkages of the three dimensions of SCI, namely, integration with suppliers, integration with customers, and intra-organizational integration, with the four dimensions of information sharing represented as; information sharing with suppliers, information sharing with customers, inter-functional information sharing, and intra-organizational information sharing. Basing the argument on the lack of explicit research regarding the relationship between SCI and SCP, this research investigates the relationship in consideration. Furthermore, the influence of information sharing on SCP is also examined based on the above arguments and supported through the survey methodology this research utilizes.

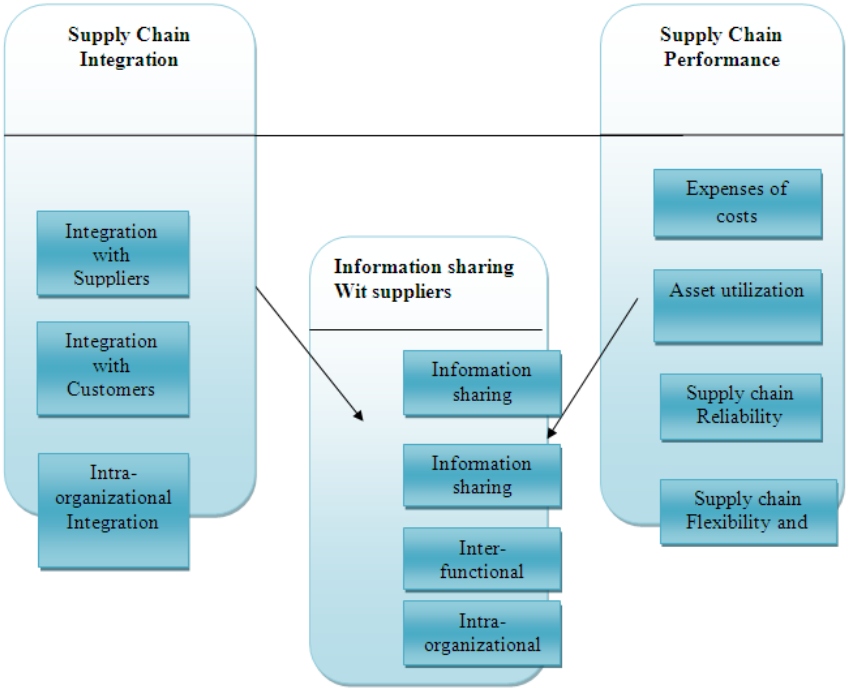

Figure 2.1. Conceptual model

03. Method

This study has been conducted to reveal and investigate the factors affecting supply chain performance (SCP). Particularly the impact of supply chain integration (SCI) and information sharing on SCP is empirically tested. Moreover, based on the arguments supporting the linkage between SCI and information sharing, the explicit relationship between the two constructs is examined. The methodology initially involves the establishment of the construct's domain through a literature review followed by the identification of a pool of items to measure the constructs forming the research model. This pool of items is used to develop an initial survey and was subject to a pilot study for measurement purification prior to the finalization of the questionnaire and the implementation of the main study.

03.01. Sampling

The data used to test the hypotheses are drawn from a varied spectrum of Turkey's industries. The Sample frame of the study consisted of a range of industries including; telecommunications, computer an electronics, communication, software, manufacturing and machinery, chemical, service technologies, food, and material industries. The organizations taking part in the survey have both national and international, operational domains. The initial sample consisted of 500 medium and large sized firms in total, residing in the Marmara Region of Turkey which is the most industrial region. The firms were selected and contacted through the database of Istanbul Chamber of Commerce. The screening criterion was established on the basis that these firms which have been selected are parts of a wide range of foreign and domestic industries both in public and private sectors. Also these firms are organized and managed based on the Western management style, e.g., they operate in accordance with ISO quality standards. The use of key informants as sources of data is standard practice in strategic management research. The presumption that "individual views on issues will constitute a function of their organizational roles" directed the survey of the study to be done with individuals who occupy strategic positions in their organizations who would be more knowledgeable about the strategic relationships between the inter organizational structures.

For the purpose of eliminating flexibility in the survey technique which would breed inconsistency and to provide a common understanding of the questions for each respondent the parallel-translation method is used. Question items adopted from the literature were first translated into Turkish by one person and then retranslated into English by a second person to make sure that the meanings of question items were correctly transformed from English to Turkish. The two translators then jointly reconciled all differences. The suitability of the survey form prepared in Turkish was then subject to a pilot study with 30 respondents working in the industry. Regarding the warnings and suggestions analyzed through these results the survey was transmitted to more extensive masses. The general managers of the firms were contacted by telephone as a pre-notification of the survey and were announced about the imminent arrival of the survey as well as the aim of the study. Hence this involved the assurance of confidentiality and the anonymity of the responses. The assurance of anonymity and confidentiality regarding any data of their company or specifically products to be undisclosed and the premise that a report of the results and implications will be sent to the respondents in case they request aimed at

increasing the motivation of informants to cooperate without fear of potential reprisals. Of the 500 contacted, 193 agreed to answer the survey. Yet, of the 193 returns, 35 were deleted due to incomplete and inconsistent information, leaving 158 usable returns for analysis. Correspondingly, a response rate of 31, 6% is obtained.

03.02. Measures

The methodology consistently entails the adoption of a survey research method. A survey was conducted to validate the proposed relationships ascribed in the hypotheses and to develop a reliable discussion coextending with the findings attained. To test the hypotheses, well verified measures of multistep scales adopted from previous studies were used. All the measurement constructs were estimated through respondents' perceptual evaluation on a seven-point Linker scale, which was anchored by the end points of "strongly disagree" to "strongly agree".

SCI is considered in three levels in this study following the study of Kim integration with customers, integration with suppliers and inter-organizational integration. In order to evaluate the integration with suppliers six items are placed in the survey, covering the partnership level, collaboration, participation, and involvement of suppliers throughout the supply chain activities of the firm. For the measurement of integration with customers we utilized seven questions focusing on the, communication level, automation and feedback systems, and network linkages to achieve information flow from and to the customers. Regarding, intra-organizational integration eight questions are asked encapsulating the functional systematic integration level within the organization, the access to real time data among apartments and the scheduling of inter-functional meetings and plans.

We developed a scale of twenty two items categorized in four dimensions adapted from the studies of Size and Eng. The four categories are; information sharing with customers, information sharing with suppliers, inter-functional information sharing and intra-organizational information sharing. The scale consists of five items for the measurement of information sharing with suppliers which include the flow of information regarding demand forecasts, capacity planning, and order processing and manufacturing plans with suppliers. For the measurement of information sharing with customers we asked five questions focusing on the sharing of demand

forecasts, capacity planning, order processing and manufacturing plans with customers. Moreover, based on the study of Eng, we asked seven questions regarding the inter-functional information sharing addressing to what extent functions within the organization share information on new product, and processes developed the possibility of departmental managers in accessing to supply chain information, the alternative strategies for improved coordination among departments. Finally, with regard to intra-organizational information sharing we asked five questions encapsulating the degree of communication efforts and procedures for sharing supply chain experiences and skills across departments.

We derived the scale for measuring the supply chain performance from the research of Liu and asked twenty-six questions. Accordingly SCP is categorized under four dimensions, namely expenses of costs, utilization of assets, supply chain reliability and Responsiveness and flexibility. The scale attempts to assess the delivery reliability, responsiveness, speed, quality, cost and flexibility of the supply chain.

04. Conclusion

In an era of intense global trade, where the most critical challenge is the management of the relationships among physically dispersed yet operationally unified supply chain partners, it is essential for firms to exploit the benefits associated with supply chain integration and information sharing to improve their supply chain performance. The strategic relationships between supply chain partners, ought to be considered as the linkages constituting and sustaining a long-term common unity, the value transferred to customers as well as all the entities in the supply chain would increase, costs would decrease, the participation effort of the parties to multi-party processes would be enhanced, the specialization on the core competences would improve, the quality of products and services offered to the market would thrive and consequently the achievement of sustainable competitive advantage would be facilitated. The goal of this study was to investigate the antecedents of SCP; particularly the significant positive impact of SCI and information sharing has on the SCP, besides explicitly investigating the role of SCI in the

enhancement of information sharing. Towards that goal, multiple approaches from theoretical background of supply chain management were synthesized to propose a research framework and three hypotheses were proposed The results fully support the three hypotheses. It is found that information sharing is positively influenced by SCI, which is the H1. Specifically concentrating on this result, we identify that i-) the feedback flow mechanisms from the customers, ii-) accurate demand forecast data, ii-) efficient inventory planning and distribution models, can be succeeded by the integration with customers. Next, integration with suppliers, i-) strengthens the trust-based relationships, ii-) establishes the long-term contractual agreements, iii-) more coordinated communication channel and transactions are created, and iv-) leverages higher synergy and collaborative business environment thus supporting information sharing. Moreover, the intra-organizational integration leads to the homogeneous transmission of external data received into the organization from any contact point with the supply chain members to various organizational functions or departments, ii-) real time response to the environmental stimuli, iii-) generates an integrative, collective-decision and action based business environment within the organization, iv-) creates a systematic approach to process the information gathered from outside and a division of labor among the organization' employees thus facilitating the flow of information throughout the organization. Hence for the improvement of information sharing with supply chain partners (suppliers and customers, as well as inside the firm itself), our research suggest the following;

- Encouraging inter-organizational integration by collaborative work between the departments which allows the sharing of resources, responsibilities, risks and reward,
- Allowing some incentive mechanism which encourages employees to be involved and committed in the positive relationships with customers and suppliers.
- Recognizing, a customer focused approach where co-creation of value with the participation of customers and suppliers to manufacturing, distribution and even after-sales services.
- Establishing long term, trust-based, transparent and strong relationships

with supply chain partners, because trade is somehow limited, but relationships built on trust are harder to be destroyed.

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