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The effect of supply chain integration on information sharing: Enhancing the supply chain performance

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Abstract

Prior research on supply chain management (SCM) suggests that information sharing has become a major driver of competitive advantage. In the context of increasingly globalized and competitive economy where organizations are part of an environment characterized by networks of inter- and intra-organizational relationships, an important prerequisite of information sharing emerges as supply chain integration (SCI). Little attention has; however, been paid to the effect of SCI on information sharing. This study focuses on the influence of SCI on information sharing and supply chain performance (SCP) and the role of information sharing in shaping SCP. Hence, the main purpose of this study is to evince the influence of supply chain integration (SCI) on information sharing and SCP. Furthermore, improved supply chain supply chain coordination, quality of products and services, reduced supply chain costs and the achievement of competitive advantage is directly related to effective information sharing. Thus, information sharing has become an important issue canalizing this study to further investigate the impact of information sharing on SCP. The conceptual model comprises of 3 research hypotheses with 3 main constructs; SCI, information sharing and SCP. Yet we categorize the constructs as; integration with customers, integration with suppliers, and the inter-organizational integration as the levels of SCI; the four types of information sharing namely; information sharing with customers, information sharing with suppliers, inter-functional information sharing, and intra-organizational information sharing; and the 4 constructs of SCP which are expenses of costs, asset utilization, supply chain reliability, and supply chain flexibility and responsiveness. The constructs are measured by well-supported measures in the literature. The hypotheses are tested via an empirical study in which data are collected from 158 manufacturing firms in Turkey mainly Marmara Region, that are among the top 500 Turkish manufacturing firms of 2010 listed by Istanbul Chamber of Commerce.   The results suggest that the role played by SCI is critical in information sharing process as it reinforces connectedness, coordination and collaboration among SC members. Moreover the findings of the study provide useful insights on how organizations should benefit from information sharing so as to improve their SCP.

Keywords: Supply Chain Integration; Information Sharing; Supply Chain Performance; Supply Networks

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1. Introduction

In today's 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 [1]. 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 [2]. Due to the complex nature of supply chains; having various activities encompassing multiple functions and organizations [3], supply chain members while acting in a decentralized manner need to move towards the efficiency associated with a unified system and centralized control [4]. 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.

There is a growing consensus in the literature regarding the advantages, information sharing provides for the supply chain partners [5, 1, 6, 7, 8, 9, 10]. Researchers suggest that closer information-based linkages become a prevalent way of effectively managing supply chains which seek improved performance through effective use of resources and capabilities [11]. Through the establishment of both internal and external linkages aligned compatibly with system-wide objectives [9], organizations shift from arm's length to an integrated continuum of possible relationships [2], thus creating a seamlessly coordinated supply chain that is a potential source of competitive advantage [1]. Benefits of information sharing in supply chain networks are a growing area of interest among researchers and practitioners from varied disciplines [3]. Information sharing significantly contributes in reducing supply chain costs [12, 11], improving partner relationships [1], increasing material flow [13], enabling faster delivery [10], improving order fulfillment rate thus contributing to customer satisfaction [14], enhancing channel coordination[15], and facilitating the achievement of competitive advantage [16]. Many researchers agree that information sharing is a key driver of effective and efficient supply chain by speeding up the information flow, shortening the response time to customer needs, providing enhanced coordination and collaboration and sharing the risks as well as the benefits [14]. Moreover, resource-based view concentrates on specific relational resources exchanged through the supply chain networks which are important in enhancing information sharing as well as the improved SCP [17]. However, although recent studies have focused on the benefits associated with information sharing for organizations in the SC context [18, 19, 20, 15, 10], very few studies investigated the specific impact of information sharing on SCP. Moreover, despite the fact that researchers concentrate on the actors enhancing information sharing within SC networks [17], limited attention has been paid to the role of SCI as an antecedent of information sharing.

The accelerating trend of new manufacturing paradigms forcing supply chains to be agile [21], adaptable and aligned to meet the needs of cooperative, mutually beneficial supply chain partnerships in the value networks [22], 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 [23]. Thus, SCM seeks to enhance competitive advantage [24], 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 [25, 26]. A definition regarding SCM by Lambert and Cooper [27, p.66] 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 [22]. However, although literature abounds of researches concentrating on the benefits of SCI such as; the achievement of competitive advantage [28], improved firm performance [24], business and operational performances [22], efficiency in supply chains by increased flexibility in delivery times and responding to customer demands [29], eliminate the bullwhip effect [30], and decrease transaction costs [31], little emphasis is given to the influence of SCI on information sharing [32]. Yet, this research argues that SCI, converges the interests, objectives and opportunistic behavior of supply chain partners and allows effective information sharing within the relational network.

Amid in this research agenda three partial gaps have been explored: First previous works have almost exclusively focused on the co-alignment between SCI and information sharing as compelled to deliver supply chain performance and competitive advantage. Although a robust SCI-coordination [33] and SCI-firm performance [24] relationship appears to be plausible in the literature, a little empirical evidence has so far been offered to support the specific relationship between SCI and information sharing. In doing so this study investigates the three levels of SCI including; integration with customers, integration with suppliers and intra-organizational integration. Second, while the relationship between information sharing and firm performance has been inspected [34, 35], the role of information sharing for the enhancement of supply chain performance is found to be ignored. Third, the paper investigates the multidimensional and contingent gradual effect of SCI on supply chain performance through the conjunctive role of 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. The data collection and method of analysis are explained in detail. Finally in the last section the research findings are presented and discussed with managerial implications.

2. 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 [36, 1]. 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 [37]. As, customer satisfaction, product variety, demand for premium customer services and competition in global market places [15] increase the complexity of SCM, the explicit or implicit connections that firms create with critical members of their supply chains [1], 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 [9] 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 [38]. The more centralized supply chains are, the more cooperation among the members leading to shared benefits, lower costs, and faster responses would be [4]. Efficient

transition of consignments is possible through the information flow between the parties of supply chain networks [39]. 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 [32].

2.1. Supply Chain Integration and Information Sharing

SCI, has gained considerable attention with changing manufacturing and supply strategies and increased globalization [21]. The theoretical foundation of SCI traces back to Porter's [40] value chain model, emphasizing the value creating linkages among the members of the chain [33]. Yet, contemporarily the grown popularity of SCI during the last decade [21], revealed that linking all supply chain members and aligning partner's objectives [9] 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 operations of suppliers, customers and other SC members [24], 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 [21]. Correct supply chain relationships based on strategic collaboration with supply chain partners [26] as a result of SCI, leverage the flow of timely, accurate and quality information[14]. However, 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 [22], a few studies have up to date focused on the leveraging power of SCI on information as compelled to improve SCP.

Particularly, SCI enhances the degree of partnership with external supply chain members, thus structuring the firm-level strategies, processes and practices into collaborative, synchronized and aligned activities to achieve inter-organizational information sharing [14]. The dynamic environment formed through the collaborative relationships between suppliers and buyers, alleviates the necessary technological and managerial resources, to be implemented and utilized by multiple supply chain partners as competitive capabilities, instead of bearing the cost of internalizing these resources in-house [24]. SCI hence, directs all relevant parties towards an expanded resource base, to combine core elements from heterogeneous sources of information into a common platform and achieve the sharing of information [26]. There is a consensus in the literature that the elevated level of close relationships with supply chain partners, leads to increased visibility of suppliers' operational activities, thus allowing transparency and a platform through which the information can be communicated between the actors [1]. The argument above implies that SCI may play a role as an infrastructure for the intensification of information sharing between supply chain members.

Next, SCI improves information sharing through engendering the trust based relationships [24]. The deepening trust-based relationships among the parties, increase the contract duration among the supply chain partners, encourages efficient conflict resolution, promotes customer responsiveness, flexibility and consequently the flow of information through stimulating sense of belonging and willingness to share [26]. Trust is the extent to which a firm believes that its partner with whom exchange takes place, is honest and/or benevolent and is considered to be a salient buffer of long-term stability and success of inter-organizational relationships [22]. The development of long-term secure relationships with key value network members, which are vital to the functioning of the supply chain through their power to assert decisions, solutions, and direct policies, is based on the confidence level of the relationships [2]. Customers have the ability to influence decisions of a manufacturer, accordingly the manufacturer seeks trust-based association with a customer because as the level of trust increases the willingness of the parties to share physical, financial and information based resources is promoted [31]. Respectively, SCI enhances

the involvement of customers to the supply chain activities through and increases the effort of supply chain partners regarding the flow of information.

Moreover, SCI provides a firm with the opportunity to focus on its core competencies and particular area of expertise and attempting an alignment with other supply chain members having varied resources, technological knowledge and expertise [24]. SCI, by its very nature, refers to the adoption and use of collaborative and coordinating structures, processes, technologies and practices among supply chain partners for building and maintaining a seamless conduit for the precise and timely flow of information, materials and finished goods [41]. This type of alignment constitutes an alternative to the acquisition of lacking resources, reduces the transaction cost, cost of negotiating and writing contractual agreements, thus allowing companies to reap the benefits of utilizing common resources and capabilities [14]. The parties can understand each other's business better and assist each other through flows of right information at the right time, in the achievement of higher supply chain performance. In turn, the arm's length relationships transform into a network of shared benefits where each member is involved in complementing the other's deficiency through implicit sharing of its own competences and expertise. A seamless/hidden map of information flow can be generated by the involvement of various parties of different expertise and competences enabled through the connectedness which SCI promotes [17, 42]. 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.

2.2. 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 [11] echoes in various industries reminding firms to directing all parties to combine their resources and collaborate [26]. Previous studies have come to a consensus that SCI improves firm performance [24], and competitive advantage [33], lowers transaction costs [31], enhances flexibility [29], reduce inventories, eliminates bullwhip effect [30] improves delivery quality and shortens cycle times [21]. However, there is minimal effort to identify the relationship between SCI and SCP. Yet, empirical studies present that firms need to have correct supply chain relationships in order to deliver the benefits associated with SCI into SCP [43]. 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 accross the extended value network consisting of various parties [33]. 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 [22]. 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 [43]. 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 [42]. Strong IT infrastructure enabled through SCI, provides timely, accurate and reliable information allowing a convenient and low cost communication with lower information uncertainty [33]. Hence, 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.

2.3. 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 [10] . Many studies show that information sharing among supply chain partners and within the organization have significant impact on the effectiveness of supply chains [17, 44, 14, 20]. Information sharing allows firms to make better decisions on ordering, capacity allocations, production and material planning [17], through increased visibility of demand, supply and inventory [11]. 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 [45]. Among the information sharing outcomes; increased coordination [46, 47], reduced uncertainty [14, 10] faster material flow, higher order fulfillment and shorter order cycle times [48], reduced inventory costs [49], increased customer satisfaction with fast and reliable delivery [50] and contribution to overall cost and service level performance [14] take the lead. Concurrently, the benefits associated with information sharing also include; increased operational effectiveness [1], reduced bullwhip effect [30], enhanced coordination of physical movements [3, 15], better conflict resolution and decision making [14]; improved responsiveness and planning [9]. Literature generally focuses on the extent of the information shared including the content, frequency, granularity and up-to-dateness of information shared [44]; when, what, with who and where the information is shared [14]; or the information quality, content, supply chain dynamism and delivery performance [10] the affect of information sharing on performance.

However, despite the fact that researches in SCM literature attempt to explore the consequent advantages of information sharing, few studies concentrate on the influence of information sharing on supply chain performance, supported through the integrative inter and intra-organizational relationships. Some studies, implicitly suggest information sharing as a predicting factor of increased supply chain performance through its role as the driver of competitiveness and supply chain effectiveness [32] but few studies explicitly examines the impact of information sharing on SCP. Thus, this study aims to fill this gap by examining the relationship between information sharing and SCP.

In particular, information sharing among supply chain partners, has a leveraging power on SCP, by eliminating the potential variability of the information exchanged thus facilitating achievement of a standardized information sharing platform [9]. The decreased variability in information shared regarding all types of supply chain activity, relieves firms from corrective (e.g. rush orders and over time) and preventive (e.g. safety stocks and extra capacity) actions which serve to compensate poor information exchange between the partners [51]. SCP, is typically associated with parameters reflecting, costs, resource utilization and customer service [52, 51]. Information shared ranges from organization's forecasts to planning data and to product and process information [2]. Through the sharing of information between supply chain partners, parties may have access to operational activities of their customers and suppliers such as point of sales (POS) data, customer level of inventory, and process visibility [1]. Thus,

parties attaining timely and accurate information, gain the power of adequately planning their strategies and delegating their functions for the higher flexibility and responsiveness [51]. This in turn, creates superior customer value for the firm's long term survival and success within the supply chain context [17].

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 [11]. 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 [17]. 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 [14]. 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 [10]. Hence, according to this theoretical framework we propose the following hypothesis:

H3. Information sharing positively influences supply chain performance.

Figure 1. 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. Moreover, 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.
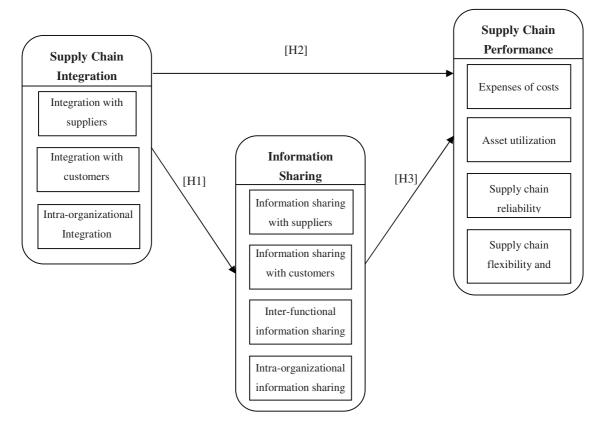
Figure 1. Conceptual Model

3. 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 emprically 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 measurment purification prior to the finalisation of the questionnaire and the implementation of the main study. The data needed for field search has been collected through survey research method, which is described and analysed in more detail in the following sections.

3.1. 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 and 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 [53]. Thus, 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 [53].

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.

3.2. *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 multi-item scales adopted from previous studies were used. All the measurement constructs were estimated through respondents' perceptual evaluation on a seven-point Likert scale, which was anchored by the end points of "strongly disagree" (1) to "strongly agree" (5).

SCI is considered in three levels in this study following the study of Kim [24]; 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 departments, and the scheduling of inter-functional meetings and plans.

Consequently, we developed a scale of twenty two items categorized in four dimensions adapted from the studies of Sezen [32] and Eng [46]. 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, 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 [46], 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.

Finally, we derived the scale for measuring the supply chain performance from the research of Liu [52] and asked twenty-six questions. Accordingly SCP is categorized under four dimensions, namely expenses of costs (8 items), utilization of assets (6 items), supply chain reliability (7 items) and responsiveness and flexibility (5 items). The scale attempts to assess the delivery reliability, responsiveness, speed, quality, cost and flexibility of the supply chain.

3.3. Data Analysis and Results

Since the scales were used with a new sample, the items were subject to exploratory factor analysis in SPSS 19.00. The best fit of data was obtained with a principal component analysis utilizing varimax rotation with Eigenvalues of 1 as a cut of point. In the data reduction procedure, those items having a factor load of lower than 0.50 and those having collinearity with more than one factor, were removed one by one while continuing the factor analysis until reaching the ideal factor table. A total of 15 items are removed, and the results of the factor analysis revealed that the remained items are naturally gathered in eleven factors of which three belong to SCI, four are part of information sharing and the final four constitute SCP. Factor loading values are found out between 0,52 and 0,84, with a total variance explained 80.72%, as shown in Table 1 which present the results of the factor analysis. Furthermore, the Kaiser-Meyer-Olkin test which informs the researchers about the adequacy level of the scales has been found as KMO= 0.60 . Consequently, the presented items of the measurement scale were found to be appropriate to measure the variables given in the model.

Table 1. The Results of the Exploratory Factor Analysis

KMO: 0.60 Total Variance Explained: 80.72%	1. Integration with suppliers	2. Integration with customers	3. Intra-organizational integration	4. Information sharing with suppliers	5. Information sharing with customers	6. Inter-functional information sharing	7. Intra-organizational information sharing	8. Expenses of costs	9. Utilization of assets	10. Supply chain reliability	11. Responsiveness and flexibility
Int. with Sup. 1	.725										
Int. with Sup. 2	.710										
Int. with Sup. 3	.626										
Int. with Sup. 4	.583										

Int. with Sup. 5	.573			
Int. with Cust. 1	.716			
Int. with Cust. 2	.702			
Int. with Cust. 3	.676			
Int. with Cust. 4	.649			
Int. with Cust. 5	.631			
Int. with Cust. 6	.530			
Intra-org. int. 1	.771			
Intra-org. int. 2	.760			
Intra-org. int. 3	.681			
Intra-org. int. 4	.629			
Intra-org. int. 5	.590			
Info. Sh. with Sup. 1		.726		
Info. Sh. with Sup. 2		.669		
Info. Sh. with Sup. 3		.663		
Info. Sh. with Sup.4		.651		
Info. Sh. with Cust. 1		.811		
Info. Sh. with Cust. 2		.773		
Info. Sh. with Cust. 3		.748		
Info. Sh. with Cust. 4		.719		
Info. Sh. with Cust. 5		.521		
Inter-Funct. Info. Sh. 1			.730	
Inter-Funct. Info. Sh. 2			.688	
Inter-Funct. Info. Sh. 3			.673	
Inter-Funct. Info. Sh. 4			.671	
Intra-org. Info. Sh. 1			.775	
Intra-org. Info. Sh. 2			.762	
Intra-org. Info. Sh. 3			.604	
Intra-org. Info. Sh. 4			.595	
Intra-org. Info. Sh. 5			.582	
Exp. of costs 1				.828
Exp. of costs 2				.814
Exp. of costs 3				812
Exp. of costs 4				.721
Exp. of costs 5				.702
Exp. of costs 6				.683
Util. of Assets 1				.764
Util. of Assets 2				.704

Util. of Assets 3	.686	
Util. of Assets 4	.652	
Util. of Assets 5	.573	
Util. of Assets 6	.544	
S.C. Reliability 1		.836
S.C. Reliability 2		.727
S.C. Reliability 3		.677
S.C. Reliability 4		.668
S.C. Reliability 5		.666
S.C. Reliability 6		.568
Resp. and Flex. 1		.788
Resp. and Flex. 2		.727
Resp. and Flex. 3		.628

Factors 1, 2 and 3 constitute the dimensions of SCI explicitly; i-) integration with customers, ii-) integration with suppliers, and iii-) inter-organizational integration. Factor 4, 5, 6, and 7 are the four dimensions encapsulated by information sharing namely; i-) information sharing with customers, ii-) information sharing with suppliers, iii-) inter-functional information sharing, and iv-) intra-organizational information sharing. Finally factor 8, 9, 10, and 11 lie within the scope of SCP, named as; i-) expenses of costs, ii-) utilization of assets, iii-) supply chain reliability, and iv-) responsiveness and flexibility. Thus informing us that the variables are adequately reliable being all above 0.70 as suggested by Nunnally (1978).

Next, we calculated means and standard deviations for each variable and created a correlation matrix as shown in Table 2. Moreover, Cronbach`s Alpha values representing reliability of each variable are shown on the diagonal of the table. The means and standard deviations are within the expected ranges. It is also seen as a result of the correlation analysis that all of the constructs each differing from each other as a factor, are significantly related to each other when one-to-one correlations are considered; and the relatively low-to-moderate correlations provide further evidence of discriminant validity. Regarding to the results of the above statistical tests for reliability and validity, it is assumed that the factors of the variables are sufficiently valid and reliable to test hypotheses.

Table 2. Mean, Standard Deviation and Correlation Coefficients

Factors	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1. IwS	3.82	0.63	α=.65										
2. IwC	3.93	0.60	.575**	α=.0.73									
3. IOI	3.95	0.49	.416**	.598**	α=.72								
4. ISS	3.99	0.58	.440**	.603**	.551**	α=.65							
5. ISC	3.80	0. 67	.223**	.408**	.357**	.441**	α=.77						
6. IFIS	3.90	0.57	.355**	.446**	.586**	.638**	.522**	α=.65					
7. IOIS	3.72	0. 65	.482**	.350**	.306**	.359**	.460**	.569**	α=.69				
8. EoC	3.76	0.70	.510**	.354**	.247**	.448**	.262**	.252**	.291**	α=.86			
9. UoA	3.60	0.63	.412**	.228**	.213**	.349**	.192*	.270**	.361**	.599**	α=.74		
10. SCR	3.83	0.59	.642**	.574**	.510**	.566**	.460**	.551**	.521**	.631**	.382**	α=.78	
11. RF	3.87	0.58	.365**	.428**	.411**	.414**	.192*	.387**	.282**	.431**	.289**	.491**	α=.65

*p<0.1; **p<0.05

IwS: Integration with Suppliers, IwC: Integration with Customers, IOI: Intra-organizational Integration, ISS: Information Sharing with Suppliers, ISC: Information Sharing with Customers, IFIS: Inter-functional Information Sharing, IOIS: Intra-organizational information sharing, EoC: Expenses of Costs, UoA: Utilization of assets, SCR: Supply chain reliability, RF: Responsiveness and flexibility.

The reliability and average variance extracted (AVE) of the second-order factors namely; supply chain integration (SCI), information sharing and supply chain performance (SCP) are represented in Table 3. All values highlight the fact that the second-order factors are above the required value which is suggested in the literature.

Table 3. Reliability Table of Second Order Factor Analysis

Construct	Composite Reliability	AVE	Cronbach Alpha
1. SCI	0.87	0.69	0.77
2. Information Sharing	0.86	0.60	0.77
3. SCP	0.87	0.62	0.76

To statistically analyze the research model and test our hypotheses, we used Partial Least-Squares (PLS)-based Structural Equation Modeling (SEM) technique. In SEM, the measurement model refers to the linkages between the research constructs (latent variables) and their indicators (manifest variables) and the structural model captures the hypothesized causal relationships among the research constructs. PLS is a regression based technique that originates from path analysis, and has emerged as a powerful approach to study causal models involving multiple constructs with multiple indicators. The PLS method has an ability to model latent constructs that are uncontaminated by measurement error under conditions of non-normality and small-to-medium sample sizes, and to handle complex predictive models, which is preferable to techniques such as regression assuming error-free measurement [54]. Further, PLS is the most appropriate SEM approach to use when the aims of the study are predictive applications and/or theory building [55]. As this study introduced a model to examine the impact of SCI on information sharing, and SCP, and the relationship between information sharing and SCP, and the sample size is

relatively small (N = 158 firms), PLS was deemed to be the most suitable approach. PLS was chosen for two reasons. First, this SEM technique supports both formative and reflective relationships between latent constructs and their indicators [41]. A second reason for choosing PLS is that this research I one of the first attempts to assess supply integration as a multi-dimensional construct that is reflected by four first-order dimensions, and is, therefore, in the preliminary stages of theory development and more exploratory in nature. In general, PLS is considered to be more appropriate for testing research models that are relatively new and in a nascent phase [41]. In this respect, we used PLS Graph 3.0 and Bootstrapping resampling method to test the statistical significance of the relationships. The mean of items (composite score) was used for each variable. This procedure entailed generating 100 sub-samples of cases randomly selected, with replacement, from the original data.
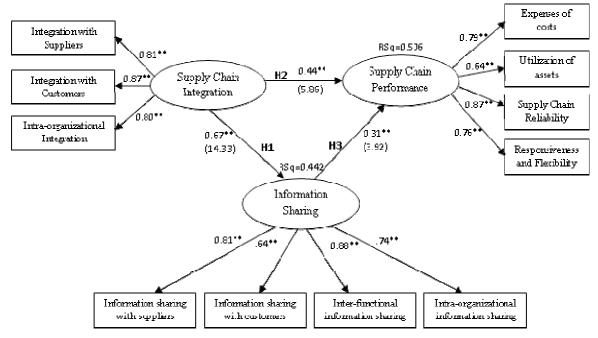
Parallel with our basic premise that SCI, information sharing and SCP are multi- dimensional constructs, we modeled these constructs as second-order factors that are reflected by three (i.e. integration with suppliers, integration with customers, intra-organizational integration), four (information sharing with suppliers, information sharing with customers, inter-functional information sharing, intra-organizational information sharing) and four (expenses of costs, utilization of assets, supply chain reliability, responsiveness and flexibility) first-order factors respectively. In PLS, higher-order factors can be accommodated by using the hierarchical component model, whereby the indicators of the first-order factors are repeated as indicators of the second-order construct. Support for the modeling of higher-order factors is provided by the significant correlations between the second-order factors and their respective first-order constituents [41]. The relevant correlations, for SCI and its first-order factors are 0.81, 0.87, 0.80; the correlations for information sharing and its first-order factors are 0.81, 0.64, 0.88, and 0.74; and for SCP, the correlations with first-order factors 0.79, 0.64, 0.87, 0.66, respectively being all significant at the 0.01 level.

PLS also generates the path coefficients for the relationships modeled among the constructs. The significance of these coefficients was assessed using the bootstrap procedure (with 500 sub-samples) that provided the t-values for each path estimate. Figure 2 presents the results of the PLS analysis on the structural model along with the path estimates (β) and t-values. Support for the study hypotheses, which are labeled on their corresponding paths in Figure 2, could be ascertained by examining the directionality (positive or negative) of the path coefficients and the significance of the t-values.

The results are revealed in Figure 2 which presents the relationship between SCI and information sharing, and the impact of SCI and information sharing on SCP, respectively. As indicated, the results highlight that SCI has a positive influence on information sharing (β=0.67, t= 14.33), supporting H1. PLS, similar to regression analysis produces squared multiple correlations (R^2) for the endogenous constructs in the model. The R^2 values for the two dependent variables –information sharing and SCP– are 0.442, and 0,506 respectively. Vijayasarathy [41] utilizes the R^2 categorization of Cohen [56]according to effect sizes as small; 0.02, medium; 0.13, and large; 0.26. Based on this classification, the effect size of SCI on information sharing and the effect sizes of SCI and information sharing on SCP are large. These results reveal that, SCI explains the 44.2% of the variance in information sharing, hence suggesting that other variables which were not considered in this research may also be associated with information sharing across the supply chain. Regarding the impact of SCI on SCP, the results show that SCI has a positive relation with SCP (β=0.44, t= 5.86), thus H2 was supported. The results also demonstrate that SCP, is also positively influenced by information sharing (β=0.31, t= 3.92), supporting H3. Finally, the results indicate that SCI and information sharing together, explain the 50.6% of variance in SCP.

Hence, it can be seen that all three hypotheses are supported, resulting in a positive triangular relationship between SCI, information sharing and SCP. The, literature has implicitly indicated that

integrative relationships between supply chain members are an important unit of analysis for explaining the flow of information and its patterns [2, 21, 23, 32, 41], as well as improvements on supply chain performance [22, 57, 24] Moreover, the forward and reverse communication of critical and proprietary information between supply chain members is suggested to be an important building block that enables to work as a single entity, better understanding the needs of the customers, sharing risks and benefits, decreasing the costs associated with improper resource allocations, responding to market changes faster hence achieving a more effective supply chain and increased supply chain performance (SCP) [1, 17, 14, 9, 10]. Therein, the results constitute indication towards supporting the suggested relationships.

*p< 0.05, **p< .01

Figure 2. Results of the PLS analysis

4. Discussion and 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 (Figure 1). 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 encourage 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,
- Providing a IT infrastructure which enables the real time diffusion of information within the organization,
- Arranging internal and external meetings which concentrate on the latest situation of supply chain activities and relationships,

Moreover, the empirical testing on the impact if SCI on SCP revealed that SCI has a positive influence on SCP and also information sharing positively impacts SCP, therefore supporting H2 and H3. Particularly the information sharing with supply chain partners and internally within the organization enhances SCP through the i-) ability to recognize the assets in possession to be utilized for various situations or partners in the supply chain context, ii-) the opportunity to learn from outside sources which have totally different knowledge repositories, experiences and capabilities, iii-) the effective utilization of resources by the division of labor among supply chain partners based on the specialization, and iv-) the centralized control over a series of decentralized entities within the supply chain. Hence, our research reveals the following suggestions regarding the improvement of supply chain performance (SCP) through supply chain integration (SCI) and information sharing;

- Taking into account the forecasted demand and accordingly making the manufacturing and distribution plans,
- Provide real time information to and from the customers for determining the effectiveness of stock management,
- Encouraging the trial of new methods and procedures in supply chain processes together with the partners,
- Increasing the communication level from the network channel,
- Supporting the information sharing with suppliers to decrease the level of uncertainty among the environmental context,
- Following a collective, integrative, complementary supply chain structure.

Like any empirical research effort, this study contains a number of methodological strengths and limitations. The breadth of the sample included in this study suggests that the findings are fairly generalizable to many manufacturing industries. However, the findings are limited in some important ways. First, there is not a separation concerning the size of the firms involved in this study; results may differ for SMEs and large sized firms. Second, these results reported here emerge from a local area; results may differ for firms located on different areas that are operating in different cultural, environmental and political conditions. Third, there was not an industrial separation while evaluating data; results may differ for different industries. Despite these limitations this study provides important implications in the context of a developing country from theoretical and practical perspectives.

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