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THE EFFECT OF SUPPLY CHAIN COLLABORATION ON SUPPLY CHAIN PERFORMANCE

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ABSTRACT

Purpose- The purpose of this study is to to analyze the relationship between Supply Chain Collaboration (SCC) and Supply Chain Performance (SCP).

Methodology- A conceptual model with theoretical basis is developed as a causal model that can be operationalized using Statistical Package for the Social Science (SPSS). Positive relationships between SCC and SCP is hypothesized and tested with regression analyses.

Findings- SCC has significant and positive relation with SCP, which means SCC may help to increase organization's SCP related with ultimate customer.

Conclusion- The appetite for meeting and exceeding customers' demands, achieving high customer satisfaction drives organizations from competition to collaboration. SCC is becoming more important than ever to achieve better performance in supply chain between partners. According to study results, SCC has positive effect on SCP. Organizations may increase the SCP by having SCC between supply chain partners.

Keywords: Supply chain collaboration, supply chain performance. JEL Codes: M11, L14, L20

1. INTRODUCTION

At the end of the 1980s, a new Japanese-inspired trading relation entered the world trade with companies such as Wal-Mart and Proctor & Gamble. The previous "arm's-length" relations were replaced by "durable arm's-length" relations and strategic partnerships (Dyer et al., 1998). Strategic partnership was characterized by a high degree of information exchange. This strategic thinking was aiming to create more streamlined business processes through an open exchange of information, which, in turn, would lead to large cost reductions. The changes in the supply chain relationships can be extended from the simple exchange of basic information to a more elaborate level of experience sharing, risks and profits. To become competitive and stable in the changing environment, many manufacturers and service providers collaborated with their strategic suppliers to upgrade traditional supply and materials management functions and integrate them as part of corporate strategy.

Successful supply chain management requires a long-term orientation with the sharing of risks and rewards balanced over time between partners (Cooper and Ellram, 1993). Collaboration between supply chain partners has been referred to as the driving force behind effective supply chain management (Cooper and Ellram, 1993; Min et al., 2005). Min et al. (2005) noted that supply chain collaboration could positively impact operational effectiveness and efficiency as well as profitability.

Supply chain collaboration (SCC) can be defined as two or more independent firms jointly working to align their supply chain processes as to create value to end consumers and stakeholders with greater success than acting alone (Simatupang et al., 2004). The fundamental rationale behind collaboration is that a single company cannot successfully compete by itself because customers are more demanding; competition is escalating. Therefore, many firms seek to coordinate cross-firm activities and work reciprocally over time to produce superior performance (Anderson and Narus, 1990).

SCC can deliver many benefits to all partners, for example, reducing risk and cost and increasing productivity, performance and profit (Cao and Zhang, 2011). Knowledge sharing in a supply chain which is part of SCC shortens the lead time, reduces input costs, and improves product quality (Kotabe et al., 2003).

The structure of the rest of the paper is as follows; part 2 consists of literature review and hypothesis, in part 3 methodology is explained, part 4 covers discussions and findings according to analyses and part five concludes the study.

2. LITERATURE REVIEW AND HYPOTHESIS

2.1. Defining Supply Chain Management (SCM)

The term "supply chain management" was first used in its popular sense by Oliver and Weber (1982) and then replicated by Houlihan (1985, and 1988) in a series of articles to describe the management of materials flows across organizational borders. Since then, many researchers have investigated the concept of supply chain management, establishing its theoretical and operational bases as we know them today. The influence of supply chain thought on organizational strategy has also been significant, reflecting, as Christopher (1992), Macbeth and Ferguson (1994), and other authors have succinctly claimed, "that today … competition takes place between supply chains rather than between individual companies." (Giannakis and Croom, 2004).

Supply Chain Management 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" (Lambert and Cooper, 2000). The main objective of SCM is to obtain customer value and satisfaction to achieve competitive advantage and profitability for the individual companies in the supply chain, and the supply chain as a whole.

2.2. Supply Chain Collaboration (SCC)

There has been a dramatic paradigm shift in strategic management because of the developments in the last quarter of the 20th century. A widespread phenomenon of this era has been the increase in inter-firm collaborations. Firms engage in these collaborations with their suppliers, channel partners, customers, and even with their competitors (Turk and Ybarra, 2011). According to Alavudeen and Venkateshwaran (2008), collaboration requires effective team work. Team members must trust and respect one another. There must be open communication and a willingness to accept input from others. There are often conflicting goals in product development. Therefor decision-making must be based on a collaborative approach (Figure 1).



Figure 1: Level of Cooperativeness (Alavudeen and Venkateshwaran, 2008)

SCC is two or more autonomous firms that form long-term relationships and work closely to plan and execute supply chain operations toward common goals, thereby achieving more benefits than acting independently. Supply Chain Collaboration (SCC) has many benefits for the supply chain partners in the supply chain network. Researchers and academicians have conducted plenty of researches that support the advantages of the SCC (Ralston, 2014).

Firms enter into inter-firm collaborative arrangements in order to share risks and rewards between partners. The objective in collaboration is to secure higher performance than would be achieved by operating as individual firm (Lambert et al., 1999). Another reason that firms are looking outside their organizational boundaries for opportunities to collaborate with supply chain partners to ensure efficiency and responsiveness of supply chain, so as to leverage the resources and knowledge of their suppliers and customers (Cao and Zhang, 2011). Crook et al. (2008) suggested that when independent firms collaborate and share knowledge with others, they can achieve the advantages beyond what could be achieved in arm's length exchange.

Reducing uncertainty via transparency of information flow is a major objective in external supply chain collaboration. Unpredictable or non-transparent demand patterns have been found to cause artificial demand amplification in a range of settings (also referred to as the 'bullwhip' or 'whiplash effect'). This leads to poor service levels, high inventories and frequent stock-outs (Holweg et.al., 2005). The necessary condition for supply chain collaboration is that the supply chain partners are able to expand the total gain due to synergy (Simatupang and Sridharan, 2005). The supply chain partners will gain financial benefits by increasing responsiveness, especially for innovative products (Fisher, 1997).

2.3. Supply chain performance (SCP)

Even managers of the organizations are ultimately held accountable for the performance of their own organizations, the success of their organizations also depends heavily upon the success of the supply chain in which the organization participates as a partner. Success in this supply chain is mostly defined as customer satisfaction. Today's managers must consider whole supply chain as path to reach ultimate customer satisfaction and both manage efficiently and effectively at the organizational level and also at the supply chain level. New supply chain approach proposes that effective SCM depends on the ability to develop long-term, strategic relationships with supply chain partners. Such effective SCM maximizes value to the ultimate customers of the supply chain in terms of both satisfactions with the product and/or services and a relatively low total cost of the product and/or service.

In literature, it has been argued that a well-connected business process improves SCM performance through lowering cost, shortening delivery time, providing appropriate feedback, maintaining low inventory levels, and improving reliability (Davis, 1993; Krajewski et al., 2005; Mason-Jones and Towill, 1997). SCP has been used very commonly as an output of an organization in studies. Many scholars contend that both customer and supplier firms seek collaborative relationships with each other as a way of improving performance (Duffy and Fearne, 2004; Sheu et al., 2006). Supplier firms can obtain high sales and earn great returns from resources invested in maintaining long-term relationships with their customers (Kalwani and Narayandas, 1995). Stank et al. (2001) suggest that both internal and external collaboration are necessary to ensure performance. Supply chain collaboration facilitates the cooperation of participating members along the supply chain to improve performance (Bowersox, 1990).

The relations connected to SCP may differ but the result wanted to have from a successful supply chain not, it is high level of supply chain performance at the end of the day. As SCM activities become more complex, it becomes more critical to be able to measure the various aspects of supply chain operations. There are a lot of metrics that can be used by managers to evaluate supply chain operations. These measures are mostly industry specific and different measures should be used to evaluate organizational performance based on the nature of the organization. Performance measures play an important role in success by evaluating performance and benchmarking the results against similar organizations (Camp, 1989; Stewart, 1995). Measures can be generally categorized into quality, financial, time, product flexibility, overall performance, and innovation. Metrics of supply chain are important as they distinguish between the performing and non-performing entities versus the traditional system as a whole. SCM operating system must try to meet the broad competitive and strategic objectives of quality, speed, dependability, flexibility and cost (Slack et al., 1995; Gunasekaran et al., 2001; De Toni and Tonchia, 2001).

2.4. Research Hypothesis

There are numerous studies in literature regarding to SCC and performance relationship (Flynn et al., 2010). Previous studies suggested that collaboration benefits include cost reduction, risk sharing, access to financial capital, complementary assets, improved capacity for rapid learning, and knowledge transfer (Park et al., 2004). Simatupang and Sridharan's (2005) collaboration index which developed in their study is positively associated with operational performance. Close collaboration enables the supply chain partners to improve their ability to fulfill customer needs by flexible offerings

(Simatupang and Sridharan, 2005). SCC can deliver many benefits to all partners, for example, reducing risk and cost and increasing productivity and profit (Cao and Zhang, 2011). According to Ramanathan and Gunasekaran (2014) study, collaborative alliances help to improve SCP. In this study, supply chain performance is received as performance outcome of focal firm. Therefore, this study develops the following hypothesis;

H 1: In a supply chain relationship, Supply chain collaboration (SCC) has a significant positive effect on supply chain performance (SCP). The higher level of SCC, the better in terms of SCP.

3. DATA AND METHODOLOGY

3.1 Source of Data

Unit of Analysis of the study is organizations which are in supply chain. The organization in the supply chain is focal point which has connection with suppliers and customers, population selected according to this criteria, focal firm should be able to see both side of the supply chain. The population is primarily selected from the organizations which are in ISO 500 -1, ISO 500 - 2 (First 1000 industrial firm list announced annually by Istanbul Chamber of Industry in Turkey on the year 2014). The list is composed of industrial enterprises' annual production based sales figures, as the major criterion of sorting and ranking. Beside the organizations in the first 1000 list, the organizations in different Supply Chain associations like LODER, TEDAR, TUSAYDER, KALDER are considered as source of data. Some of the organizations in these associations are already in First 1000 industrial firms list. Totally, around 1500 organizations were contacted to remain within the budget and time restrictions of the study.

3.2. Data Collection Method

After establishing the population, the data collection method was constructed. Since the survey attempts to measure supply chain collaboration and supply chain performance, supply chain managers and purchasing managers who are in touch with suppliers frequently are considered as the most appropriate respondents to provide sufficient data for the research purposes.

A special emphasis is given to the selection of respondents among the executives of those leading industrial enterprises, holding the responsibility for managing the flow of inter organizational supply chain activities. They are in prestigious positions in Turkey's leading industrial enterprises and very much capable of providing high quality data when responding to questionnaires within their area of expertise.

After reaching correct respondents' e-mails, online questionnaires were sent to directly to respondents' personal business e-mail addresses instead of sending to info mails of organizations. In e-mails, the purpose of the research was explained and online entry was requested to attached link of the questionnaire. A deadline was included to e-mail and at the deadline another reminder e-mail was sent to respondents. The survey was conducted over a 6-month period during the spring and summer of 2016.

3.3. The Design and Content of the Questionnaire

The intention of the questionnaire is to measure supply chain collaboration on the specific supply chain relationship between major supplier and focal firm and supply chain performance at final customer side as a result of this relationship. This study employs Likert scale, which is accepted as the most frequently used variation of the summated rating scale. In Likert scales, responses over a number of items tapping a particular concept or variable are then summated for every respondent (Sekaran, 2003). The respondents which are considered as focal firm in the supply chain, are asked to agree or disagree with each statement and a 6-point numerical score is assigned to each response, in anticipation to reflect the degree of agreement to the statements in the questionnaire. Six measurement items were used with responses ranging from (1- Totally Disagree, 2- Very slightly agree, 3- Slightly agree, 4- Pretty agree, 5- Very much agree, 6 Totally agree).

The questionnaire consists of 2 variables, Supply Chain Collaboration (SCC) and Supply Chain Performance (SCP) (Table 3.1). SCC items were drawn from Cao et.al, 2010 study which is one of the most comprehensive measurement tool for SCC in literature. Respondents were asked to indicate their level of agreement in regards to collaboration elements between their firm and supply chain partner. SCC variable consists of 7 factors; Information Sharing (IS) 5 questions, Goal Congruence (GC) 5 questions, Decision Synchronization (DS) 5 questions, Incentive alignment (IA) 5 questions, Resource Sharing (RS) 5 questions, Collaborative Communication (CC) 5 questions, Joint Knowledge Creation (JKC) 5 questions. These 7 factors were measured with 35 questions totally.

Since SCP measurement items were covering intention of our study, the items were drawn from Green et al., (2008) study which includes 11 questions, covering performance of final products, speed of deliveries, volume or capacity flexibility and

production costs. With this variable, on the side of final customer, it was intended to measure the performance of the supply chain established with most important supplier.

Table 1: Variables and Sub Items

SUPPLY CHAIN COLLABORATION (SCC)	SUPPLY CHAIN PERFORMANCE (SCP)
Information Sharing (IS)	performance of final products
Goal Congruence (GC)	speed of deliveries
Decision Synchronization (DS)	volume or capacity flexibility
Incentive Alignment (IA)	production costs
Resource Sharing (RS)	
Collaborative Communication (CC)	
Joint Knowledge Creation (JKC)	

Beside 46 items asked with Likert scale method, 14 demographic questions (the number of employee, age of the organization, annual gross sales, implementation of SCM, implementation of SCC, average quantity of suppliers etc.) were asked to understand the organization and respondents' position and 5 relational questions (the relation between supply chain partner; organization's position in the partnership, power and dependence relation of partners, partnership duration, percentage of this supplier in all purchases in this supply chain, material purchased from this supplier) were asked to understand relationship between focal firm and major supplier. To receive full version of questionnaire you may contact with correspondent author.

4. FINDINGS AND DISCUSSIONS

4.1. Factor and Reliability Analysis

For each variable in the model, exploratory factor analysis was used to identify the not directly observable factors based on the questionnaire. The goal was to identify a smaller set of factors to represent the relationships among the variables parsimoniously (i.e., to explain the observed correlation with fewer factors). The Bartlett Test of Sphericity (to test the null hypothesis that the correlation matrix is an identity matrix) and the Kaiser-Meyer-Olkin measure of sampling adequacy (small value of KMO indicates factor analysis is inappropriate) were used to validate the use of factor analysis.

During data collection period, 213 responses were received via online questionnaire collection method. After checking the data one response was deleted because of the standard deviation test (all answers were same). Totally 212 responses were used for statistical tests. By using SPSS version 20, SPSS Data Reduction Factor Analysis program was used to evaluate the measurement items. As a result;

Supply Chain Collaboration (SCC) variable; questionnaire was designed originally for seven factors. After making factor analysis on SPSS Data Reduction Factor Analysis program, first run showed us 4 factors. Factor 1, labeled as SCCISGC consists of 12 questions which cover Information Sharing (IS) and Goal Congruence (GC) factors. Factor 2, labeled as SCCDSJKCIA consists of 10 questions which cover Decision Synchronization (DS), Joint Knowledge Creation (JKC) and Incentive Alignment (IA) factors. Factor 3, labeled as SCCRS consists of 3 questions which belong Resource Sharing (RS) factor. Factor 4, labeled as SCCCC consists of 3 questions which belong Collaborative Communication (CC).

Supply Chain Performance (SCP) variable; Normally this variable was one factor but had sub phrases which were performance of final products, speed of deliveries, volume and capacity flexibility, production costs. In the second run of factor analysis, measurement items divided two factors, PERSPEED (Performance and Speed) and FLEXCOST (Flexibility and Cost). Factor 1 consists of SCP1, SCP2, SCP3, SCP4, SCP5, SCP6, SCP7 measurement items. Factor 2 consists of SCP8, SCP9, SCP10, SCP11 measurement items. In reliability test of Factor 2, SCP8 was eliminated because of the low reliability score, only cost related questions left in Factor 2. For all factors, factor variances, KMO and reliability scores are listed in table 2.

FACTOR	FACTOR VARIANCE	KMO SCORE	RELIABILITY SCORE
SCCISGC	28,927		0,96
SCCDSJKCIA	24,362		0,936
SCCRS	9,283	0,931	0,895
SCCCC	7,922		0,755
SCP PERSPEED	43,904		0,917
SCP COST	30,669	0,895	0,878

Table 2: Factor and Reliability Analysis Results for Research Constructs

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4.2. Regression Analysis

In this study, each SCC factors is separately representing different collaboration styles between organizations. This means organizations may have different types of collaborations between their key suppliers. While one organization may share information as a collaboration tool, may not share resources. SCC measurement construct in this study was adopted from Cao et.al. 2010 study. According to this study, the definition and measures of SCC can help managers to define specific actions to be taken to improve shared supply chain processes that benefit all members. The definition and measurements can serve as a powerful tool for managers to form effective collaborative relationships. They can be used to measure and monitor the level of collaboration with partners and benchmark the performance of a supply chain. To be able to see the different level of collaboration between organizations, regression analyses are conducted separately for each SCC factors.

In order to apply linear regression analysis, some assumptions have to be checked. Correlation analysis is one of these assumptions to check if if there is any high correlation between dependent variables which may cause multicollinearity. If there is high correlation (r>70) between independent variables, there may be multicollinearity. The analysis showed no multicollinearity between variables.

4.2.1 H1 - SCC and SCP Regression

Regression Analyses between SCC and SCP factors were tested separately for each factor. Model Summary tables combined to see all SCC factors in the same table, first analysis was SCC factors and SCP perspeed factor regression (Table 3).

Model Summary ^b						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	,636 ^a	,405	,402	,72101		
2	,395 ^a	,156	,152	,85876		
3	,523 ^a	,273	,270	,79691		
4	,269 ^a	,072	,068	,90025		
a. Predictors: (Constant), 1- SCCISGC, 2- SCCDSJKCIA, 3-SCCRS, 4-SCCCC						
b. Dependent Variable: PERSPEED						

Table 3: H1 Hypothesis Model Summary (SCC – SCP PERSPEED)

Anova tables of these regression tests were all significant, p values 0,000 (< 0.05). F values were; SCCISGC 142,936, SCCDSJKCIA 38,793, SCCRS 78,912, SCCCC 16,389. Coefficient tables were also combined to see all factors in the same table (Table 4). The most powerful effect on SCP perspeed factor was from SCCISGC factor, the beta value was 0,636.

Table 4: H1 Hypothesis Combined Coefficient	s Table (SCC factors – SCP PERSPEED)
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Coefficients ^a								
		Unstanda Coeffic	ardized ients	Standardized Coefficients			Collinearity	/Statistics
Model		В	Std. Error	Beta	t	Sig.	Tolerance	VIF
	(Constant)	1,578	,232		6,798	,000		
	SCCISGC	,645	,054	,636	11,956	,000	1,000	1,000
2	(Constant)	3,212	,183		17,574	,000		
2	SCCDSJKCIA	,334	,054	,395	6,228	,000	1,000	1,000
2	(Constant)	2,596	,198		13,089	,000		
3	SCCRS	,427	,048	,523	8,883	,000	1,000	1,000
	(Constant)	3,401	,228		14,921	,000		
4	SCCCC	,238	,059	,269	4,048	,000	1,000	1,000
a Dependent Variable: DEPSDEED								

a. Dependent Variable: PERSPEED

The second analysis to test hypothesis was SCC factors and SCP cost factor regression (Table 5).

Model Summary ^b						
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate		
1	,633 ^a	,401	,398	,83941		
2	,562 ^a	,315	,312	,89729		
3	,547 ^a	,299	,296	,90795		
4	,170 ^a	,029	,024	1,06868		
a. Predictors: (Constant), 1- SCCISGC, 2- SCCDSJKCIA, 3-SCCRS, 4-SCCCC						
b. Dependent Variable: COST						

Table 5: H1 Hypothesis Model Summary (SCC – SCP COST)

Anova tables of these regression tests were all significant, p values 0,000 (< 0.05). F values were; SCCISGC 140,489, SCCDSJKCIA 96,727, SCCRS 89,573, SCCCC 6,234. Coefficient tables were also combined to see all factors in the same table (Table 6). The most powerful effect on SCP cost factor was from SCCISGC factor, the beta value was 0,633.

Table 6: H1 Hypothesis Combined	Coefficients Table	(SCC factors -	- SCP COST
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			C	pefficients ^a				
		Unstanda Coeffici	ardized ents	Standardized Coefficients			Collinearit	Statistics
Model		В	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	,718	,270		2,657	,008		
	SCCISGC	,745	,063	,633	11,853	,000	1,000	1,000
2	(Constant)	2,070	,191		10,839	,000		
2	SCCDSJKCIA	,551	,056	,562	9,835	,000	1,000	1,000
2	(Constant)	1,792	,226		7,930	,000		
3	SCCRS	,519	,055	,547	9,464	,000	1,000	1,000
4	(Constant)	3,197	,271		11,816	,000		
	SCCCC	,174	,070	,170	2,497	,013	1,000	1,000
a. Depend	ent Variable: CO	ST		•				

The investigation of the individual variables' regression coefficients and standardized regression coefficients show that all SCC factors have significant and positive contributions to SCP perspeed and SCP cost factors. Among SCC factors, SCC Information sharing and Goal congruence is the leading factor which has the most powerful positive regression with both SCP factors. As a result of above regression analyses, H1 hypothesis was supported with all factors (Table 7).

MODIFIED HYPHOTHESES AFTER FACTOR ANALYSIS (REGRESSION)						
Hypothesis 1	In a supply-chain relationship, Supply chain collaboration has a significant positive effect on supply chain performance. The higher level of supply chain collaboration (SCC), the better in terms of supply chain performance	RESULT				
H1a	The higher level of SCC IS and GC, the better in terms of supply chain performance (PERSPEED).	SUPPORTED				
H1b	The higher level of SCC DS, JKC and IA, the better in terms of supply chain performance (PERSPEED).	SUPPORTED				
H1c	The higher level of SCC RS, the better in terms of supply chain performance (PERSPEED).	SUPPORTED				
H1d	The higher level of SCC CC, the better in terms of supply chain performance (PERSPEED)	SUPPORTED				
H1e	The higher level of SCC IS and GC, the better in terms of supply chain performance (COST).	SUPPORTED				
H1f	The higher level of SCC DS, JKC and IA, the better in terms of supply chain performance (COST).	SUPPORTED				
H1g	The higher level of SCC RS, the better in terms of supply chain performance (COST).	SUPPORTED				
H1h	The higher level of SCC CC, the better in terms of supply chain performance (COST).	SUPPORTED				

Table 7: H1 Modified Hypotheses and Results

5. CONCLUSION

Supply chain management (SCM) itself requires very well connected inter organizational relationships between supply chain partners to have a better supply chain to achieve customer satisfaction and ultimately competitive advantage. Supply chain collaboration between partners is vital for inter organizational relationship of focal firms nowadays. Trust based and longtime relationships with suppliers have many benefits for focal firms to achieve better supply chain performance on the customer side of the chain.

In this study, we set our research on focal firm which has critical suppliers to collaborate to achieve supply chain performance. Our hypothesis was basically suggesting that "SCC has positive impact on SCP". As supported with literature, SCC can deliver many benefits to all partners, for example, reducing risk and cost and increasing productivity and profit (Cao and Zhang, 2011). SCC facilitates the cooperation of participating members along the supply chain to improve performance (Bowersox, 1990). Our research shows that all SCC factors are affecting SCP factors positively in line with literature.

According to the results, there is a strong regression between SCC factors and SCP factors. Among all SCC factors, SCC Information Sharing and Goal Congruence factor had the most powerful positive effect on SCP. This finding can give clue to focal firms about which collaboration style can be the most useful for improving supply chain performance.

As a conclusion, SCC has significant and positive relation with supply chain performance, which means supply chain collaboration may help to increase organization's supply chain performance related with ultimate customer.

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