

# Supply Chain Management and Firm Performance

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## Abstract

Effective supply chain management is essential for firm performance. Past studies have measured the direct impact of antecedents to supply chain management on firm performance. However, this study examines how the success of a supplier-buyer relationship mediates the effect of predictor variables (i.e. trust, dependence, supplier selection and supplier-buyer engagement) on the dependent variable (i.e. firm performance). The data was gathered from employees working in the textile sector of Karachi. The scales and measures of the constructs were adapted from the previous literature. After preliminary analysis, the mediating effect was examined through the Hayes, Nicolous & Rockwood (2017) approach. The results indicate that the supplier-buyer relationship had a partial mediating effect in all the cases. In addition, the success of supplier-buyer relationship has a positive effect on firm performance. Future studies may examine the mediating role of supplier-buyer relationship on other antecedents of the supply chain.

**Keywords:** *Trust, dependence, supplier selection, supplier-buyer relationship, supply chain management.*

## Introduction

Supply chain management is an important determinant of firm performance (Hassan, Habib & Khalid, 2014). However, firms in Pakistan do not focus on all the aspects of supply chain management. Local companies tend to focus on limited aspects of supply chain management such as the strategy for purchasing, selection of suppliers, cooperation and development of suppliers (Hassan, Habib & Khalid, 2014). A properly managed supply chain provides a competitive edge to a firm. Therefore, it is necessary for firms to develop a long term relationship with all the stakeholders in the supply chain. In addition, as customers are highly price sensitive, therefore, it is important for firms operating in Pakistan to be cost-effective. Previous studies have measured the direct impact of supply chain antecedents on

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firm performance (Villena et al., 2011). Therefore, this study examines how the success of a supplier-buyer relationship mediates the effect of predictor variables (i.e. trust, dependence, supplier selection and supplier-buyer engagement) on the dependent variable (i.e. firm performance).

## **Literature Review**

### **Success of Supplier-Buyer Relationship, Trust and Firm Performance**

Trust is a critical element for building a strong supply chain network (Sahay, 2003; Doney & Cannon, 1997). Trust refers to “one party’s belief that the other party in the relationship will not act opportunistically and not exploit its vulnerabilities” (Villena et al., 2011). In addition, Benton & Maloni (2005) defines trust as “the expectation that other individuals or companies with whom one interacts will not take advantage of a dependence upon them. It is the belief that the trusted party will behave in an ethical, dependable and socially appropriate manner and will fulfill their expected commitments.”

Trust has three levels (Barney & Hansen, 1994). The first level is weak. There are no vulnerabilities at this level (Barney & Hansen, 1994; Paulraj, Lado & Chen, 2008). The second level is semi-strong. At this level there are violation clauses and penalties (Barney & Hansen, 1994). The third level is strong. In this case, the parties have a trustworthy relationship which is consistent with their operating philosophy (Barney & Hansen, 1994). Buyers with a trustworthy relationship with suppliers assume that the goods supplied will be defect free and would not require inspection. This level of trust helps in reducing the cost as buyers would not be required to maintain expensive buffer inventory (Paulraj, Lado & Chen, 2008). In long term relationships, buyers and sellers share information related to real time product demand, inventory requirement and customer’s service level. The exchange of information helps to improve the quality and efficiency of the network (Paulraj, Lado & Chen, 2008). Past studies have found that the trust level between buyers and sellers is a key determinant of the long term relationship (Sheridan, 1998; Sik-Jeong & Hong, 2007). For example, Walmart developed a trustworthy relationship with suppliers and delegated complete product management and inventory control to them. This strategy not only helped Walmart reduce its cost but also enabled it to compete successfully with rival retail businesses (Petersen, Handfield & Ragatz, 2005).

*H1: The success of supplier-buyer relationship mediates the association between trust and firm performance.*

### **Success of Supplier-Buyer Relationship, Dependence and Firm Performance**

The dependence between the buyer and supplier is important for the supply chain.

Zhang & Huo (2013) argue that “dependence shows the extent to which one party needs to uphold the relationship with the partner in order to attain the preferred objective”. Dependence is not similar to trust. Trust depicts the level of mutual understanding between the supplier and the buyer. However, in case of dependence either the buyer or the seller would have more power to manipulate the terms and conditions related to the supply chain. For example, past studies have found that bulk buyers tend to dictate their terms and conditions with sellers (Hassan, Habib & Khalid, 2014). The terms and conditions may include delivery schedules and other product specifications. In addition, the practice of stipulating the terms and conditions to suppliers tends to decrease the inventory holding cost of buyers (Zhang & Huo, 2013). However, when suppliers have a monopoly in the market they are in a position to dictate the terms and conditions to buyers. As a result, the buyers will face a higher inventory holding cost.

*H2: The success of supplier-buyer relationship mediates the association between dependence and firm performance.*

### **Success of Supplier-Buyer Relationship, Supplier Selection and Firm Performance**

The cost of production for a firm is strongly dependent on the efficiency of the supply chain. Buyers tend to use different methods for selecting suppliers (Ávila et al., 2012). Some commonly used techniques for gauging the effectiveness of suppliers include goal programming, multi-objective programming, linear programming, non-linear programming and mixed programming (Hassan, Habib & Khalid, 2014). Prior studies have found that selecting efficient suppliers not only improves firm performance but makes the relationship more sustainable (Duffy & Fearne, 2004; Ávila et al., 2012).

Duffy & Fearne (2004) argue that the supplier-buyer relationship also depends on the buyer's requirements. Some firms tend to develop strategic supplier-buyer partnerships. In a strategic supplier-buyer relationship, a third party does all the strategic planning and manages the interactions. The relationship tends to maximize the value from the interaction (Duffy & Fearne, 2004). Other supplier-buyer relationships include “buyers at different points in the supply chain” and “single versus multiple sourcing” (Narasimhan, Nair, Griffith, Arlbjørn & Bendoly, 2009). Most buyers give importance to reliability and service quality in selecting sellers. However, Wagner & Krause (2009) suggest that the reputation of the supplier and the situation should also be considered.

*H3: The success of supplier-buyer relationship mediates the association between supplier selection and firm performance.*

## **Success of Supplier-Buyer Relationship, Supplier-Buyer Engagement and Firm Performance**

A successful supplier-buyer engagement is beneficial for both buyers and suppliers. In this engagement, the supplier assures the buyer of supplying an agreed quantity. In addition, the buyer is confident that goods will be received on time and quality will be maintained (Benton & Maloni, 2005). Wilson (1995) argues that the supplier-buyer relationship is of four main types, i.e. weak, semi-strong, strong and strategic. Thus, the effectiveness of the supplier-buyer relationship depends upon the type of the relationship (Neilson, 1998). For improving the efficiency of the supply chain, firms have also developed benchmarks related to the development of new products, performance of delivery, elasticity, customer satisfaction and product availability (Ávila et al., 2012; Benton & Maloni, 2005).

Suppliers also help buyers to reduce their purchasing cost while providing technology transfers (Ávila et al., 2012). Some factors in the supplier-buyer relationship can be easily quantified such as lead time improvements, quality, market related performance, overall financial and cost reductions. However, other factors such as accountability, creativity and the level of alliance are difficult to measure but contribute significantly towards the success of the supplier-buyer relationship (Neilson, 1998; Stewart, 1995).

*H4: The success of supplier-buyer-relationship mediates the association between supplier-buyer engagement and firm performance.*

## **Success of Supplier-Buyer Relationship and Firm Performance**

The success of the supplier-buyer relationship is a key strategic factor for increasing organizational effectiveness and achieving organizational goals such as enhanced competitiveness, better customer care and higher profitability (Gunasekaran, Patel & Tirtiroglu, 2001). A successful supplier-buyer relationship involves reducing non-value added activities and operating costs. In addition, it may also increase customer responsiveness and cost competitiveness (Stewart, 1995). Ashtiani & Bosak (2013) argue that supply chain management also helps firms in achieving a sustainable competitive advantage. Many companies are now relying on a successful supplier-buyer relationship for efficiently managing business activities (Gunasekaran, Patel & Tirtiroglu, 2001). A supplier-buyer relationship is an essential element of supply chain integration. However, each component of the supply chain is important for enhancing firm efficiency and performance (Benton & Maloni, 2005).

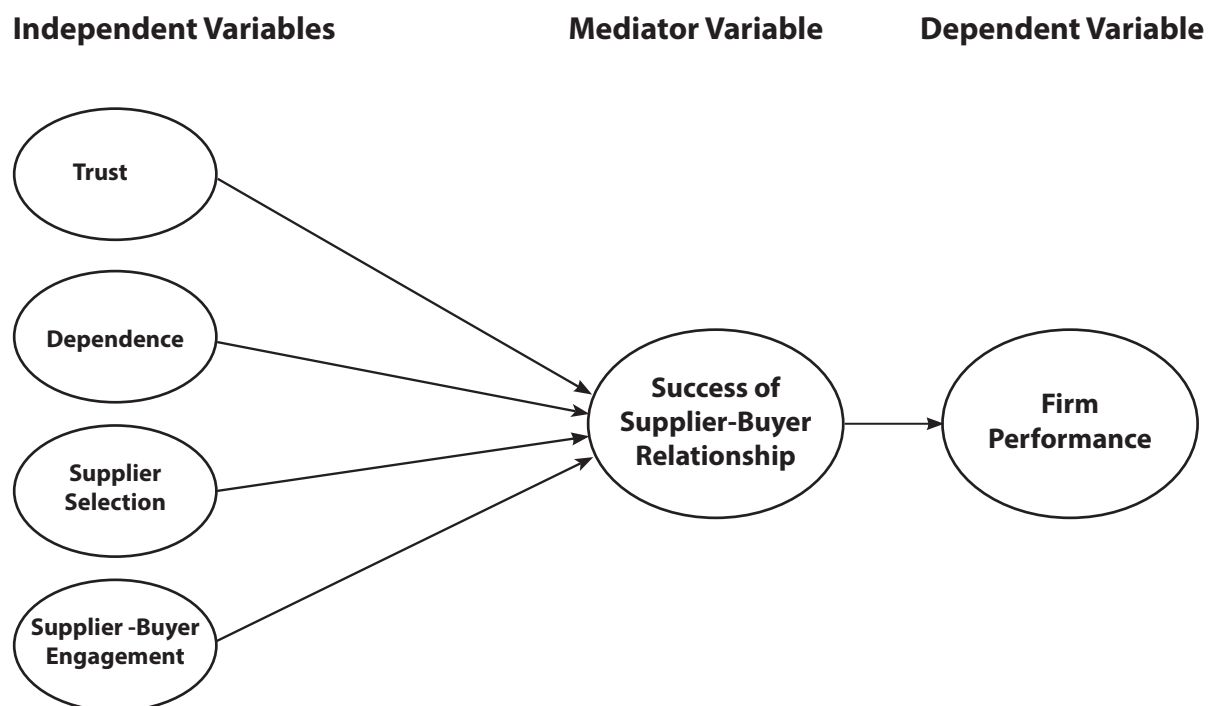
As retailers face fluctuating consumer demand, therefore, it is necessary for them to develop a flexible relationship with multiple suppliers (Zhang & Huo, 2013). Past studies

have found that the supplier-buyer relationship positively effects the financial performance of a firm (Wang, Liu & Wang, 2008; Yeung & Tung, 1996). It is argued that firms that have a long term relationship with the customer tends to have higher profitability and ROI (Kalwani & Narayandas, 1995). Moreover, a strong supplier-buyer relationship also has a positive effect on the efficiency of the entire supply chain (Benton & Maloni, 2000). Similarly, a firm's purchasing practices also positively influence its supply chain management strategy and financial performance (Tan, Kannan & Handfield, 1998). Firms with weak supply chain management tend to hold higher inventory and thus face the risk of inventory obsolescence and poor firm performance (Kalwani & Narayandas, 1995).

*H5: The success of supplier-buyer relationship has a positive effect on firm performance.*

### Conceptual Framework

Based on the above discussion a conceptual framework has been developed which is presented in Figure 1.



**Figure 1: Conceptual Framework**

## Methodology

### Population and Sample Size

The population of the study includes all textile firms operating in Karachi. The textile sector contributes heavily towards the GDP of Pakistan. Over the past decade, the growth of the textile sector in Pakistan has diminished considerably due to several reasons including an energy crisis (Tahir, Sohail, Qayyam & Mumtaz, 2016). The sample size for the study was 92 calculated through the G\*power3 model developed by Faul, Erdfelder, Lang & Buchner (2007).

### Scale and Measures

The questionnaire for the study was adapted from the scale and measures developed in earlier studies. This questionnaire has 6 variables, i.e. trust (5 items), dependence (3 items), supplier selection (8 items), supplier-buyer engagement (6 items), success of supplier-buyer relationship (4 items) and firm performance (5 items). The questionnaire was based on the five point Likert scale, where five represents strongly agree and one represents strongly disagree.

### Statistical Analysis

The study performed various preliminary statistical analyses on the data to ensure the validity of the empirical results. These include reliability and validity tests, correlations analysis and diagnostic tests. In addition, the mediating role of successful supplier-buyer relationship was also examined using the Hayes, Nicolous & Rockwood (2017) approach.

## Results

### Validity Analysis

The study ascertained the validity of all the constructs. The results suggest that composite reliability, average variance explained, maximum shared variance and square root of average variance explained are within the prescribed limits. Therefore, we may conclude that the constructs are valid for empirical estimation (Fornell & Larcker, 1981).

### Descriptive Statistics

The descriptive statistics of the variables are presented in Table 1.

**Table 1: Descriptive Statistics**

Construct	Mean	Std. Dev.	Skewness	Kurtosis	Cronbach's Alpha
Trust	3.47	0.31	-.37	0.32	.64
Dependence	3.50	0.42	.17	1.40	.61
Supplier selection	3.61	0.32	.31	2.80	.84
Supplier-Buyer Engagement	3.54	0.31	.31	2.24	.72
Success of Supplier Buyer Relationship	3.49	0.37	.45	1.66	.65
Firm Performance	3.52	0.34	.03	1.99	.77

The results show that the highest skewness value is for success of supplier-buyer relationship (Mean = 3.49, SD = 0.37, SK=.45) and the lowest for firm performance (Mean = 3.52, SD = 0.34, SK= .03). On the contrary, the highest kurtosis value is for supplier selection (Mean = 3.61, SD = 0.32, K= 2.80) and the lowest for trust (Mean = 3.47, SD = 0.31, KR= 0.32). Since the kurtosis and skewness values are between  $\pm 3.5$ , therefore the constructs fulfill the requirement of univariate normality (Hair Jr., Black, Babin & Anderson, 2006). The results also show that the highest Cronbach alpha value is for firm performance ( $\alpha = .77$ , Mean = 3.53, SD= -0.34) and the lowest for dependence ( $\alpha = .61$  Mean = 3.50, SD= 0.42). Nunnally, Cox & Chilman (1988) suggest that a Cronbach alpha value greater than 0.60 is acceptable in most cases.

### Pearson Correlation Analysis

Pearson correlations analysis was used for estimating the correlations between the research variables. The results are presented in Table 2.

**Table 2: Pearson Correlations Analysis**

Construct	1	2	3	4	5	6
Trust	1					
Dependence	0.35**	1				
Supplier selection	0.33**	0.32**	1			
Supplier-Buyer Engagement	0.42**	0.42**	0.53**	1		
Success of Supplier Buyer Relationship	0.32**	0.38**	0.48**	0.55**	1	
Firm Performance	0.31**	0.39**	0.50**	0.53**	0.57**	1

**\*\* Correlation is significant at the 1% level.**

The results show that the predictor variables have a positive correlation with the dependent variable. As the correlation coefficients between the variables are below 0.90, therefore, there is unlikely to be a multi-collinearity problem (Hair Jr., Black, Babin & Anderson, 2006).

### **Regression Diagnostic Analysis**

A number of diagnostic analyses were conducted prior to estimating the regression model. The results are discussed in the following sections.

#### **Univariate Normality**

The skewness and kurtosis values of the research variables are reported in Table 1. Since all the kurtosis and skewness values lie between  $\pm 3.5$ , therefore, the dataset does not violate the requirement of univariate normality (Hair Jr., et al., 2006).

#### **Multivariate Outliers**

The presence of multivariate outliers was examined through Mahalanobis distance. The test statistic was insignificant at the 95% confidence level, therefore, we can conclude that the dataset does not contain multivariate outliers (Hair Jr., et al., 2006).

#### **Heteroscedasticity**

The study used the Levene test to examine whether the homoscedasticity assumption was satisfied. The results suggest that the Levene test statistic remains insignificant at the 5% level of significance, thus, we can conclude that there is no issue of heteroscedasticity in the model.

#### **Multi-Collinearity**

Potential multi-collinearity between the independent variables was investigated through the VIF and tolerance values. The VIF and tolerance values are reported in Table 3. As the VIF values are substantially below 10 and tolerance values are considerably higher than 0.1, there seems to be no issue of multi-collinearity among the variables.



**Table 3: Regression Results and Collinerity Statistics**

	Standardized Coefficients	T	Sig.	Collinearity Statistics	
	Beta			Tolerance	VIF
Constant	.526	1.883	.061		
Trust	.025	.403	.687	.784	1.276
Dependence	.113	1.790	.075	.766	1.305
Supplier Selection	.200	2.939	.004	.659	1.517
Supplier Buyer Engagement	.189	2.544	.012	.556	1.800
Success of Supplier Buyer relationship	.322	4.619	.000	.631	1.586

*Dependent Variable: Firm Performance*

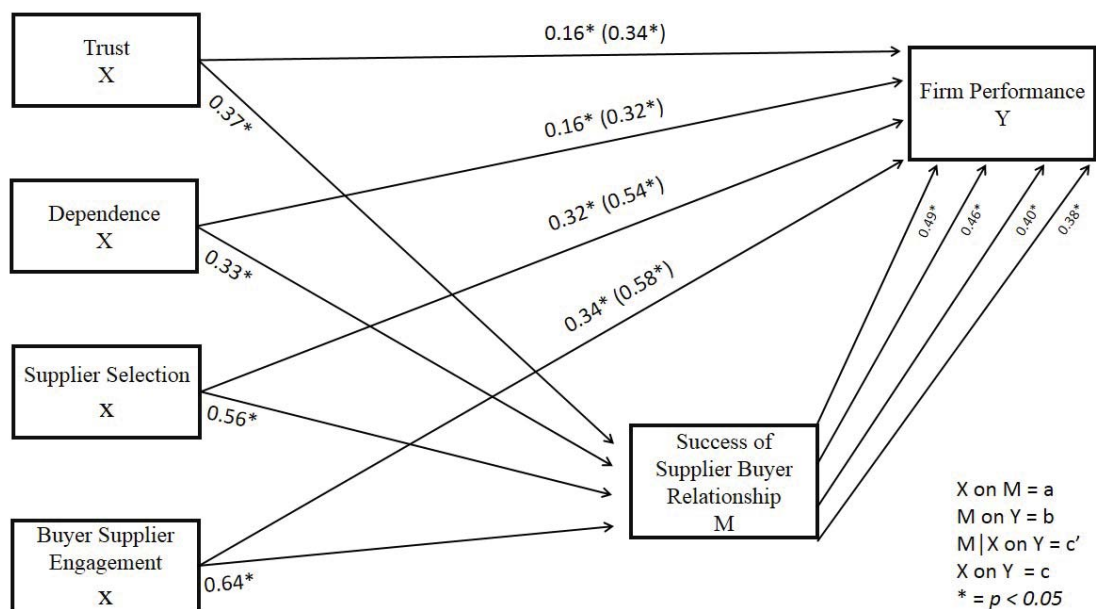
### Mediation Analysis

The study examines how the success of a supplier-buyer relationship mediates the effect of predictor variables (i.e. trust, dependence, supplier selection and supplier-buyer engagement) on the dependent variable (i.e. firm performance). In general, a mediator variable i.e. M, is an intermediate process that plays an essential part between the predictor variable i.e. X (Independent variable) and outcome variable i.e. Y (dependent variable). The results from mediation analysis using the Hayes, Nicolous & Rockwood (2017) approach are presented in Table 4. In addition, a diagrammatic representation of the results is provided in Figure 2.

**Table 4: Mediation Results**

Independent Variable (X)	Mediating Variable (M)	Dependent Variable (Y)	Effect of X on M (a)	Effect of M on Y (b)	Direct Effect (c')	Indirect Effect (c-c') or(ab)	Total Effect (c)
Trust	Success of Supplier Buyer Relationship	Firm Perf.	0.37**	0.49**	0.16*	0.18**	0.34**
Dependence	Success of Supplier Buyer Relationship	Firm Perf.	0.33**	0.46**	0.16**	0.16**	0.32**
Supplier Selection	Success of Supplier Buyer Relationship	Firm Perf.	0.56**	0.40**	0.32**	0.22**	0.54**
Buyer Supplier	Success of Supplier Buyer Relationship	Firm Perf.	0.64**	0.38**	0.34**	0.24**	0.58**

Note: \*\*, \* indicates statistical significance at the 1% and 5% level respectively.



**Figure 2: Diagrammatic representation of results from mediation analysis**

The results from mediation analysis are elaborated in the following section. The results suggest that the mediator variable is statistically significant at the 5% level of significance.

### **Success of Supplier-Buyer Relationship, Trust and Firm Performance**

The first hypothesis postulates that the success of the supplier-buyer relationship mediates the association between trust and firm performance. The hypothesis was analyzed through a four step procedure of mediation analysis developed by Hayes, Nicolous & Rockwood (2017). The step-wise results from mediation analysis are presented in Annexure 2. The results indicate that the supplier-buyer relationship partially mediates the association between trust and firm performance. Past studies have found that the trust level between buyers and sellers is a key determinant of the long term relationship (Sheridan, 1998; Sik-Jeong & Hong, 2007). For example, Walmart developed a trustworthy relationship with suppliers and delegated complete product management and inventory control to them. This strategy not only helped Walmart reduce its cost but also enabled it to compete successfully with rival retail businesses (Petersen, Handfield & Ragatz, 2005).

### **Success of Supplier-Buyer Relationship, Dependence and Firm Performance**

The second hypothesis postulates that the success of the supplier-buyer relationship mediates the association between dependence and firm performance. The hypothesis was analyzed through a four step procedure of mediation analysis developed by Hayes, Nicolous & Rockwood (2017). The step-wise results from mediation analysis are presented in Annexure 2. The results indicate that the supplier-buyer relationship partially mediates the association between dependence and firm performance. Past studies have found that bulk buyers tend to dictate their terms and conditions with sellers (Hassan, Habib & Khalid, 2014). The terms and conditions may include delivery schedules and other product specifications. In addition, the practice of stipulating the terms and conditions to suppliers tends to decrease the inventory holding cost of buyers (Zhang & Huo, 2013). However, when suppliers have a monopoly in the market they are in a position to dictate their terms and conditions to buyers. As a result, the buyers will face a higher inventory holding cost.

### **Success of Supplier-Buyer Relationship, Supplier Selection and Firm Performance**

The third hypothesis postulates that the success of the supplier-buyer relationship mediates the association between supplier selection and firm performance. The hypothesis was analyzed through a four step procedure of mediation analysis developed by Hayes, Nicolous & Rockwood (2017). The step-wise results from mediation analysis are presented in Annexure 2. The results indicate that the supplier-buyer relationship partially mediates the association between supplier selection and firm performance. Prior studies have found that

selecting efficient suppliers not only improves firm performance but makes the relationship more sustainable (Duffy & Fearn, 2004; Ávila et al., 2012).

### **Success of Supplier-Buyer Relationship, Supplier-Buyer Engagement and Firm Performance**

The fourth hypothesis postulates that the success of the supplier-buyer relationship mediates the effect of supplier-buyer engagement on firm performance. The hypothesis was analyzed through a four step procedure of mediation analysis developed by Hayes, Nicolous & Rockwood (2017). The step-wise results from mediation analysis are presented in Annexure 2. The results indicate that the supplier-buyer relationship partially mediates the effect of supplier-buyer engagement on firm performance. A successful supplier-buyer engagement is beneficial for both buyers and suppliers. In this engagement, the supplier assures the buyer of supplying an agreed quantity. In addition, the buyer is confident that goods will be received on time and quality will be maintained (Kalwani & Narayandas, 1995). Benton & Maloni (2005) argue that the supplier-buyer relationship is of four main types, i.e. weak, semi-strong, strong and strategic. Thus, the effectiveness of the supplier-buyer relationship depends upon the type of the relationship (Wang, Liu & Wang, 2008). For improving the efficiency of the supply chain, firms have also developed benchmarks related to the development of new products, delivery, elasticity, customer satisfaction and product availability (Ávila et al., 2012; Benton & Maloni, 2005).

### **Success of Supplier-Buyer Relationship and Firm Performance**

The fifth hypothesis postulates that the supplier-buyer relationship has a positive effect on firm performance. The regression results indicate that the supplier buyer relationship has a positive and statistically significant effect on firm performance. Past studies have found that the supplier-buyer relationship positively effects the financial performance of a firm (Wang, Liu & Wang, 2008; Yeung & Tung, 1996). It is argued that firms that have a long term relationship with the customer tend to have higher profitability and ROI (Kalwani & Narayandas, 1995). Moreover, a strong supplier-buyer relationship also has a positive effect on the efficiency of the entire supply chain (Benton & Maloni, 2005). Similarly, a firm's purchasing practices also positively influence its supply chain management strategy and financial performance (Tan, Kannan & Handfield, 1998). Firms with weak supply management tend to hold higher inventory and thus face the risk of inventory obsolescence and poor firm performance (Yeung & Tung, 1996).

### **Conclusion**

The study examines how the success of a supplier-buyer relationship mediates the effect of predictor variables (i.e. trust, dependence, supplier selection and supplier-buyer

engagement) on the dependent variable (i.e. firm performance). The results indicate that the supplier-buyer relationship had a partial mediating effect in all cases. The study has some limitations. The sample size was limited and restricted to the textile sector in Karachi. In addition, the study did not consider the role of supplier-buyer attitude which may have a strong impact on firm performance. Future studies may examine the mediating role of supplier-buyer relationship on other antecedents of the supply chain.

## Annexure-1

### Constructs and Items Used To Measure the Constructs

#### Trust

1. The supplier is open in dealing with us.
2. When making important decisions, the supplier is concerned about our welfare.
3. When we share our problems with the supplier, we know that it will respond with understanding.
4. In the future, we can count on the supplier to consider how its decisions and actions will affect us.
5. We are confident with this supplier's ability to fulfill our agreements.

#### Dependence

1. If our relationship was discontinued, we would have difficulty replacing this supplier.
2. The supplier is crucial to our business.
3. Our firm would suffer greatly if we lost the supplier.

#### Supplier Selection

1. When selecting the supplier, Supplier's testing capability is important.
2. When selecting the supplier, Supplier's scope of resources is important.
3. When selecting the supplier, Supplier's technical expertise is important.
4. When selecting the supplier, Supplier's commitment to quality is important.
5. When selecting the supplier, Supplier's process capability is important.
6. When selecting the supplier, Suppliers' ability to meet delivery due dates is important.
7. When selecting the supplier, Supplier's Commitment to continuous improvement in product and process is important.
8. When selecting the supplier, Supplier's Reserve capacity or the ability to respond to unexpected demand is important.

### **Supplier-Buyer Engagement**

1. It is important to use informal information sharing with supplier and customers in engaging with firm's key suppliers.
2. It is important to use of formal information sharing agreements with suppliers and customers in engaging with firm's key suppliers.
3. It is important to improve the integration of activities across your supply chain in engaging with firm's key suppliers.
4. It is important to communicating your firm's future strategic needs to your suppliers in engaging with firm's key suppliers.
5. It is important to create a greater level of trust among your firm's supply chain members.
6. It is important to create a compatible communication/information system with your suppliers and customers in engaging with your firm's key suppliers.

### **Success of Supplier-Buyer Relationship**

1. Success of our relationship with supplier is determined by increased product quality.
2. Success of our relationship with supplier is determined by lowered product cost.
3. Success of our relationship with supplier is determined by reduced new product development time.
4. Success of our relationship with supplier is determined by increased buyer-supplier cooperation/communication.

### **Firm Performance**

1. Level of your firm's performance compared to that of major competitors increased in terms of market share due to success of relationship with supplier.
2. Level of your firm's performance compared to that of major competitors increased in terms of return on assets due to success of relationship with supplier.
3. Level of your firm's performance compared to that of major competitors increased in terms of overall quality due to success of relationship with supplier.
4. Level of your firm's performance compared to that of major competitors increased in terms of overall competitive position due to success of relationship with supplier.
5. Level of your firm's performance compared to that of major competitors increased in terms of overall customer service levels due to success of relationship with supplier.

## Annexure-2

### Step-wise Results From Mediation Analysis

#### Hypothesis 1

- 1) X variable predicts Y – Path c
  - a.  $F(1,189)=19.79, p<.01, R^2=.09$
  - b.  $b=.34, t(189)=4.45, p<.01$
- 2) X variable predicts m – Path a
  - a.  $F(1,189)=21.06, p<.01, R^2=.10$
  - b.  $b = 0.37, t(189)=4.59, p<.01$
- 3) X and m together predicting Y
  - $F(2,188)=49.35, p<.01, R^2=.34$
  - a. m variable predicts Y – Path b
    - $b = .49, t(188)= 8.46, p<.01$
  - b. X variable no longer predicts Y or is lessened predicting Y – Path c'
    - i.  $b = .16, t(188)=2.27, p=.025$
- 4) Sobel Test (Normal Theory Test) = z score test if  $c-c' \neq 0$   
 $Z=4.01, p<.01$  (Sobel, 1982)

#### Hypothesis 2

- 1) X variable predicts Y – Path c
  - $F(1,189)=33.15, p<.01, R^2=.15$
  - $b=.32, t(189)=5.76, p<.01$
- 2) X variable predicts m – Path a
  - $F(1,189)=31.90, p<.01, R^2=.14$
  - $b = 0.33, t(189)=5.65, p<.01$
- 3) X and m together predicting Y
  - $F(2,188)=52.83, p<.01, R^2=.36$
  - a. m variable predicts Y – Path b
    - $b = .46, t(188)= 7.86, p<.01$
  - b. X variable no longer predicts Y or is lessened predicting Y – Path c'
    - $b = .16, t(188)=3.14, p=.002$
- 4) Sobel Test ( Normal Theory Test) = z score test if  $c-c' \neq 0$   
 $Z=4.56, p<.01$

### Hypothesis 3

- 1) X variable predicts Y – Path c  
 $F(1,189)=62.37, p<.01, R^2=.25$   
 $b=.54, t(189)=7.90, p<.01$
- 2) X variable predicts m – Path a  
 $F(1,189)=56.05, p<.01, R^2=.23$   
 $b = 0.56, t(189)=7.49, p<.01$
- 3) X and m together predicting Y  
 $F(2,188)=60.58, p<.01, R^2=.39$ 
  - a. m variable predicts Y – Path b  
 $b = .40, t(188)= 6.67, p<.01$
  - b. X variable no longer predicts Y or is lessened predicting Y – Path c'  
 $b = .32, t(188)=4.50, p=.000$
- 4) Sobel Test ( Normal Theory Test) = z score test if  $c-c'\neq 0$   
 $Z=4.95, p<.01$

### Hypothesis 4

- 1) X variable predicts Y – Path c  
 $F(1,189)=72.55, p<.01, R^2=.28$   
 $b=.59, t(189)=8.52, p<.01$
- 2) X variable predicts m – Path a  
 $F(1,189)=79.88, p<.01, R^2=.30$   
 $b = 0.64, t(189)=8.94, p<.01$
- 3) X and m together predicting Y  
 $F(2,188)=60.67, p<.01, R^2=.39$ 
  - a. m variable predicts Y – Path b  
 $b = .38, t(188)= 5.96, p<.01$
  - b. X variable no longer predicts Y or is lessened predicting Y – Path c'  
 $b = .34, t(188)=4.52, p=.000$
- 4) Sobel Test ( Normal Theory Test) = z score test if  $c-c'\neq 0$   
 $Z=4.94, p<.01$



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