



Determinants of the Perceived Supply Chain Cost

Faisal Saleem Mushabbar*

Iqra University, Karachi, Pakistan

ABSTRACT

This paper aims to investigate the impact of warehousing and transport costs on the perceived supply chain cost. Besides, this paper also examines the moderating effect of perishability in the relationship between the cost of warehousing and the perceived supply chain cost and the role of transit time in the relationship between transport and the perceived supply chain cost. Data collected from 254 consumer goods respondents. Multiple regression analysis is used as a statistical technique. The moderating effect was tested by regressing the interactions of independent variables and moderators. Results suggested that warehousing and transport have a significant relationship with the perceived supply chain cost. Perishability and transit time was also significantly related to the perceived supply chain cost. Results also suggested that perishability moderated the relationship between warehousing and perceived supply chain costs, while transit time moderated the relationship between transport and perceived supply chain costs.

Keywords: Warehousing, perishability, transportation, transit time, perceived supply chain cost.

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***Address of Correspondence:**

faisalmushabbar@gmail.com

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1. INTRODUCTION

The business world is becoming increasingly complex (Ghayas and Siddiqui, 2012; Ghayas and Hussain, 2015). It has, therefore, become quite a difficult task to create a sustainable competitive edge (Ghayas, 2015). Costs incurred in any way are the most important part of any organization and cannot be ignored in any way whatsoever. While manufacturing from raw material to finished product, the fixed costs incurred do not indicate how many units of the products have been produced. However, while the cost variable depends on the number of units produced. In this way, quality costs become an important element of variable costs. Researchers including (Akturk, Bayramoglu, Savran, & Tatlidil, 2010) considered this to be an issue that affects production and costs. Manufacturing costs are a significant element and are also significantly associated with the pricing of the product (Lee, 1986). Since the processing cost is the cost of the number of products produced, any alteration in the processing cost is not only directly related to the cost of production but also inversely related to the revenue. From now on, the cost of manufacturing that maintains quality cannot be overlooked.

This topic is administered by the cost of production value theory, a concept in economics that recommends that the price of any product or service can be determined only by summarizing the total cost of the resources

used in the production of that product or service. According to this particular theory, therefore, the cost is a vital element and is based on several sub-units, such as the cost of land, labor or capital, *etc.* Some researchers also studied transport costs (Marufuzzaman, Ekşioğlu, & Hernandez, 2015), processing costs (Wood, Li, Daniel, 2015) and storage costs (Shahraki, Shahraki, & Javdan, 2014).

1.1. Problem Statement

It's hard for rivalries to make easy money. To compete with them and increase profitability, there is a need to cut costs at every step from start to finish in every possible way while not compromising the quality of the product. As supply chain management is involved at every stage of the process, therefore, organizations are now looking at all possible solutions through supply chain management to reduce costs at all likelihood. That's why it is widely observed that many business analytics and researchers around the world are focusing on reducing costs at every level of the organization's processes. Usually, it has been seen that business analysis focuses on the three main areas of cost incurrence. These are shipping costs (Ghaderi, 2019; Radelet, & Sachs, 1998; Lu, Chen, Fransoo, & Lee, 2018), warehouse costs (Kusrini, Asmarawati, Sari, Nurjanah, Kisanjani, Wibowo, & Prakoso, 2018; Ma, Chai, & Zhang, 2018) and processing costs (Mori, Kidode, Shinoda, & Asada, 2018; Wang, Srivathsan, A., Foo, Yamane & Meier, 2018). The main purpose of studying these three main cost areas is to have a significant impact on the value of the product. Related to this abundance of work in many countries, but not in Pakistan, the focus of this research is on the management of the supply chain and the price of the product.

1.2. Importance and Significance of the Study

This research analysis responds to the following research questions:

- a. What is the moderating role of transit time in the relationship between transport and the perceived cost of the supply chain?
- b. What is the moderating role of perishability in the relationship between the warehouse and the perceived cost of the supply chain?

As a result, this research analysis is of significant importance for understanding the fundamental costs and their impact on product pricing.

2. LITERATURE REVIEW

2.1. Theoretical Background

As costs are a vital part of any business process, the main areas include transport costs, warehouse costs, quality costs, and timing costs. Production Theory in Economics argues that the cost-of-production theory of value is the theory that the price of an object or condition is determined by the sum of the cost of all the resources that went into the production/production of that product/service. Cost is, therefore, an important issue to consider when defining the price of a product. Various subdivisions of costs include land, labor, capital, transport, warehousing, quality, timing or taxation. All of this discussion involves not only the importance of the cost factor but also the cost factor. The main aim of this research is to see the participation of the costs incurred in the entire supply chain process and, ultimately, the price to be fixed in Pakistan.

2.2. Transportation Cost

In any business, transport costs related to the placement of the raw material or the finished product. In this way, the cost of shipment is always a vital and integral part of the suppliers to the organization as raw material, within the organization as well as the processing and from the organization to the customers as finished goods.

This will become a very important course in any organization in this way. That is why any type and any delay in transport can result in a serious loss, a loss of profits, a cancelation of contracts and sometimes so serious that it even cancels the contracts of the parties concerned. This is so important that it cannot be ignored in any way. Transportation costs are an essential cost component of the supply chain. Furthermore, if any kind of postponement occurs, it is essential to reduce the cost of transport if possible (Womack and Jones, 2003; Ohno, 1988). However, transport is an essential action for any organization; therefore, it can not be eradicated abruptly because without transport goods it can not deliver to customers. Henceforth, all other organizational actions will remain unproductive without transport. However, transport is an essential action for any organization; therefore, it cannot be eradicated abruptly because without transport goods it cannot deliver to customers. Henceforth, all other organizational actions will remain unproductive without transport. Thus, when mapping the supply chain, useless transport becomes a major waste to categorize, measure, and eliminate. (McKinnon *et al.* 1999) and (Fugate *et al.* 2009) argued that redundant shipment glitches and waste can be fixed by increasing the efficiency of shipment-linked maneuvers. Subsequently, in this regard (Hines and Taylor, 2000), it was proposed that the disposal of waste in the shipment would be essential. The idea of reducing transport costs was also supported and the Just-in-Time approach for rice processing would be integrated with traditional operations (Villarreal *et al.* 2012). Villarreal, 2012 also adapted the Value Stream Mapping tool to support efficiency improvement programs in shipment operations. Later, he called this modified Transportation Value Stream Mapping tool. Consequently, considering the most recent deviations in transport costs, it turns out to be unpredictably complex. Changes in the forms of goods traded the power with which they use transport services, and whether those goods transported by sea or by land all affect the calculated costs. Improvements in shipping technology have often been somewhat balanced by noteworthy fluctuations in input costs and like what is traded. Furthermore, the economic effects of better transport, not only in how much trade have grown but also in how trade has grown. Developments in the superiority of transport services can be like increased speed, reliability, *etc.*

2.3. Warehousing Cost

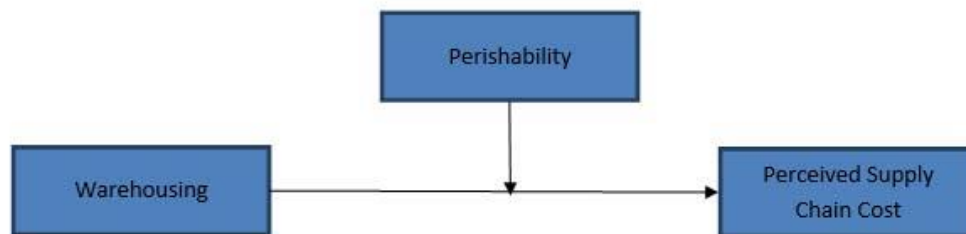
Participation in activities from the very beginning (supplier) to the end (customer) is a key concern for business organizations (Gupta and Maranas, 2003) since warehousing can have a significant impact on the profitability of business organizations (Guillén *et al.*, 2005). However, numerous study challenges continue to be reported to achieve coherent supply chain preparation (Sarmiento and Nagi, 1999; Erengüç *et al.*, 1999; Meixell and Gargeya, 2005; Melo *et al.*, 2009; Nikolopoulou and Ierapetritou, 2012). Production planning and inventory control and distribution and logistics, including warehousing and transport, are two extremely interrelated processes in the supply chain according to Beamon, (1998). Significant research efforts have been involved in manufacturing and distribution combinations (Yan *et al.*, 2003; Yılmaz and Çatay, 2006; Fahimnia *et al.*, 2013b). Warehousing is well defined as the cost that must be paid for the storage of the product until it is finally shipped to the customer. Warehousing and material management have become very significant for supply chain specialists, and the requirements for warehousing and management operations have increased significantly in recent years (Manzini, 2015). This type of cost is involved in every type of business and is paid by all organizations. In this way, this becomes a very important type of cost and directly affects the price of the products. That is why warehousing costs are a crucial cost component and can not be ignored because warehousing gives firms the ability to store and preserve the products they deal with. Warehousing costs fall within the fixed cost category and are required to be paid for the premises without taking into account the quantity stored therein.

2.4. Cost and Pricing

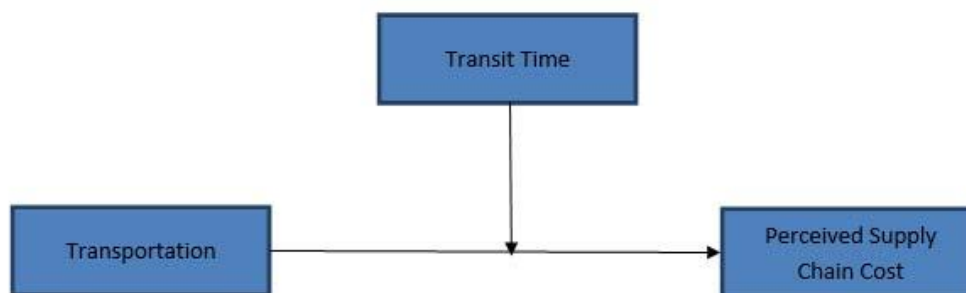
Costs incurred in any way are the most important part of any organization and can not be ignored in any way whatsoever. While manufacturing from raw material to finished product, the fixed costs incurred do not or do not indicate how many units of the products have been produced. However, while the cost variable depends on the number of units produced. In this way, the cost of quality is becoming a significant element of the van. Manufacturing costs are a significant element and are also significantly associated with the pricing of the product (Lee, 1986). Since the processing cost is the cost of the number of products produced, any alteration in the processing cost is not only directly related to the cost of production but also inversely related to the revenue. From now on, the cost of manufacturing that maintains quality can not be overlooked. This subject is administered by the cost of production value theory, a concept in economics that recommends that the price of any product or service can be determined only by summarizing the total cost of the resources used in the production of that product or service. According to this particular theory, therefore, the cost is a vital element and is based on many sub-units, such as the cost of land, labor or capital, *etc.* Some researchers also studied transport costs (Marufuzzaman, Ekşioğlu, & Hernandez, 2015), processing costs (Wood, Li, Daniel, 2015) and storage costs (Shahraki, Shahraki, & Javdan, 2014). Some of them have even studied the impact of these cost elements on prices. However, no such study has been carried out for the Pakistani industries, which is why this research study seeks to explain the relationship between these cost components and the price of dairy products in Karachi.

3. DATA AND METHODOLOGY

Data collected from 253 people working in the consumer goods industry. These include wholesalers and retailers. Seventeen items were adapted from Mbah and Ikemafuna (2008) to measure the variables used in the research. Moderation tested using multiple regression analyses. Two separate models were used to test the relationship because there were two moderators. Since there were two moderators; therefore, two separate models were designed to test the hypotheses given below:



Model 1: Moderating effect of Perishability.



Model 2: Moderating effect of Transit Time.

4. RESULTS

4.1. Reliability

Cronbach's alpha test run to check for internal reliability. The standard value is 0.70 or higher, reflecting the reliability of the data received from the questionnaire and for further statistical analysis and interpretation of the results. The alpha values of the Cronbach variables given below:

Table 1. Reliability of Instrument.

Variable Names	Number of Items	Cronbach's Alpha
Warehousing	4	0.897
Transportation	4	0.852
Perishability	4	0.876
Transit Time	4	0.952
Perceived Supply Chain Cost	4	0.944

The reliability of the instrument is shown in Table 1. A total of 20 questions were asked; 4 items are in Warehousing, 4 items are in Transportation, 4 items are in Perishability and 4 items are in Transit Time. Statistical test run Cronbach alpha test to check internal reliability. The standard value is 0.70, whereas the value in our analysis is as follows:

Warehousing has a value of 0.897, which is well above the particular standard value and reflects that the data we have received from respondents through the questionnaire is reliable and can be used for further statistical analysis and interpretation of the results.

Transportation has a value of 0.852, which is well above the particular standard value and reflects that the data we have received from respondents through the questionnaire is also reliable and can be used for further statistical analysis and interpretation of the results.

Perishability is 0.876, which is well above the particular standard value and reflects the fact that the data we have received from our respondents through the questionnaire is also reliable and can be used for further statistical analysis and interpretation of the results.

Transit Time is 0.952, which is well above the particular standard value and reflects that the data we have received from our respondents through the questionnaire is also reliable and can be used for further statistical analysis and interpretation of the results.

Perceived Supply Chain Cost is 0.944 which is well above the particular standard value and reflects that the data we have received from our respondents through the questionnaire is also reliable and can be used for further statistical analysis and interpretation of the results.

4.2. Regression Analysis

4.2.1. Moderating Effect of Perishability (Model 1)

Table 2. Model Summary of Regression Results with Perishability as Moderator.

Model	R	R ²	Adjusted R ²	Std. Error	Change Statistics				
					R ² Changes	F Changes	Df1	Df2	Sig. F Changes
1	0.644 ^a	0.415	0.410	0.72733	0.415	89.015	2	251	0.000
2	0.738 ^b	0.545	0.540	0.64264	0.130	71.514	1	250	0.000

a. Predictors: (Constant), PER, WH

b. Predictors: (Constant), PER, WH, WHPER

c. Dependent Variable: PSC

The summary of the model is shown in Table 2. The summary of the model shows the values of R, R2 square, and adjusted R2 square. We have 2 models in the Table 2. The first model suggests that warehousing and perishability have regressed against the perceived pricing of the supply chain, whereas the second model adds an interaction between warehousing and perishability.

The adjusted R square for the first model was 0.410 with a sig value of 0.000, which shows that 41 percent of the variance in the dependent variable can be explained by independent variables. Whereas the adjusted R square for the model with the moderator is 0.540, this shows that 54% of the variance in the dependent variable can be explained with the independent variables and the interaction.

Table 3. Anova Table of Regression Results.

Model	Tests	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	94.179	2	47.089	89.015	0.000 ^a
	Residual	132.780	251	0.529		
	Total	226.959	253			
2	Regression	123.713	3	41.238	99.853	0.000 ^b
	Residual	103.246	250	0.413		
	Total	226.959	253			

a. Predictors: (Constant), PER, WH

b. Predictors: (Constant), PER, WH, WHPER

c. Dependent Variable: PSC

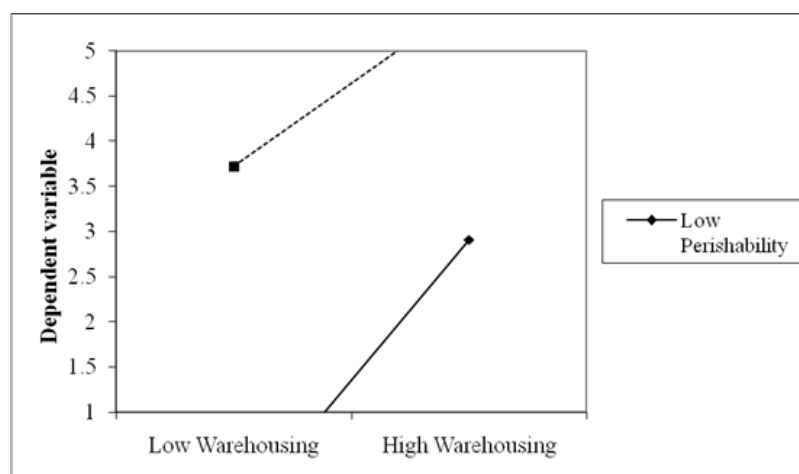
To show that either the model selected for this study is the correct model, F Value is used in the ANOVA test. If the F statistic model is higher than 3.5, the correct model selected for this analysis will be shown. In the Table 3, the F statistics for both models are greater than 3.5 and the sig value for both models is 0.000, which is less than 0.05. This indicates that both models are statistically appropriate.

Table 4. Regression Results.

Model	Variables	Unstandardized Coefficients		Standardized Coefficients	t-Values	Sig.	Collinearity Statistics	
		β	S.E	β			Tolerance	VIF
1	(Constant)	1.771	0.216		8.185	0.000		
	WH	0.298	0.078	0.284	3.837	0.000	0.424	2.358
	PER	0.386	0.071	0.401	5.410	0.000	0.424	2.358
2	(Constant)	-1.769	0.460		-3.843	0.000		
	WH	1.241	0.131	1.185	9.478	0.000	0.116	8.584
	PER	1.647	0.162	1.713	10.172	0.000	0.064	15.593
	WHPER	-0.315	0.037	-2.111	-8.457	0.000	0.029	34.238

a. Dependent variable PSP

Table 4 shows the non-standardized and standardized values of the coefficients, the t-values, the sig values, the tolerance, and the VIF values. The VIF values are based on multicollinearity. If the VIF value is greater than 10, this indicates the existence of multicollinearity. Since the VIF values of all the variables in the first model are less than 10, there is, therefore, no issue of multicollinearity in the first model. Whereas, in the second model, the presence of multicollinearity appears to be logical as the interactions added to the second model to moderate the effect. In the first model, the sig value of all variables is less than or equal to 0.05, which shows that all variables have a significant effect on the dependent variable. On the other hand, the interactions in the second model and the independent variables and moderators were regressed against the dependent variables in the presence of interaction between the independent variable and the moderator. In the second model, the sig values of all independent variables and interactions were less than 0.05 indicating that the variables had a significant impact even in the presence of moderators. The moderator's significant values were also less than 0.05; this confirms the presence of a moderating effect of perishability. The following Figure 1 further strengthen above statements that the two variables warehousing and perishability have a significant relation in between them.

**Figure 1:** Relation between Warehouse and Perishability.

4.2.2. Moderating Effect of Transit Time (Model 2)

Table 5. Model Summary of Regression Results with Transit Time as Moderator

Model	Tests	Sum of Squares	df	Mean Square	F	Significant
1	Regression	93.766	2	46.883	88.350	0.000 ^a
	Residual	133.193	251	0.531		
	Total	226.959	253			
2	Regression	131.544	3	43.848	114.888	0.000 ^b
	Residual	95.415	250	0.382		
	Total	226.959	253			

a. Predictors: (Constant), TT, TR

b. Predictors: (Constant), TT, TR, TRTT

c. Dependent Variable: PSC

The summary of the model is shown in Table 5. The summary of the model shows the values of R, R², and adjusted R². We have 2 models in the Table 5. The first model suggests that transport and transit times have decreased compared to the perceived price of the supply chain, whereas the second model adds transport and transit time interactions.

The adjusted R² for the first model was 0.408 with a sig value of 0.000, which shows that 40.8 percent of the variance in the dependent variable can be explained by independent variables. Whereas the adjusted R² for the moderator model is 0.575, which shows that 57.5 percent of the variance in the dependent variable can be explained with the independent variables and the interaction.

Table 6. Anova Table of Regression Results.

Model	Tests	Sum of Squares	df	Mean Square	F	Significant
1	Regression	93.766	2	46.883	88.350	0.000 ^a
	Residual	133.193	251	0.531		
	Total	226.959	253			
2	Regression	131.544	3	43.848	114.888	0.000 ^b
	Residual	95.415	250	0.382		
	Total	226.959	253			

a. Predictors: (Constant), TT, TR

b. Predictors: (Constant), TT, TR, TRIT

c. Dependent Variable: PSP

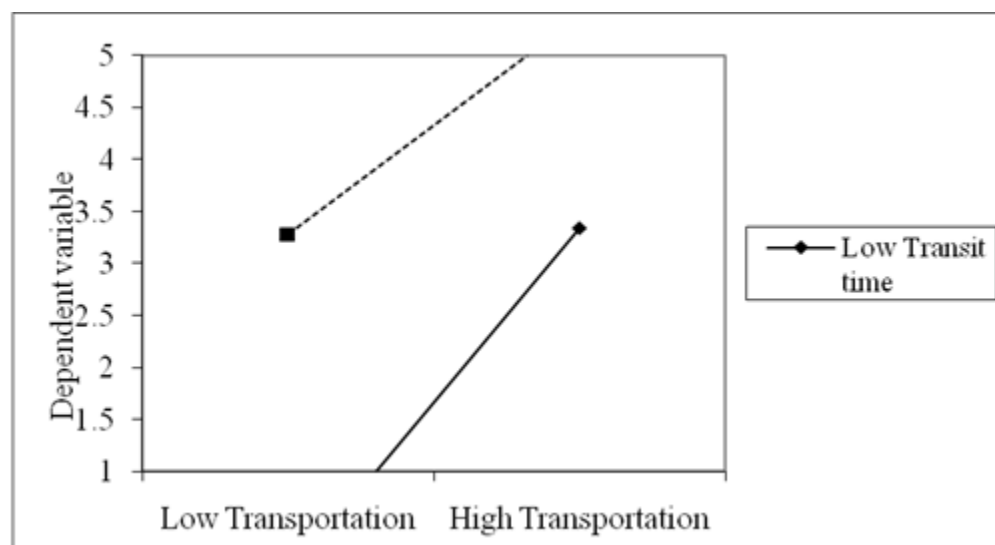
To show that either the model selected for this study is the correct model, F Value is used in the ANOVA test. If the F statistic model is higher than 3.5, the correct model selected for this analysis will be shown. In the Table 6, the F statistics for both models are greater than 3.5 and the sig value for both models is 0.000, which is less than 0.05. This indicates that both models are statistically appropriate.

Table 7. Regression Results.

Model	Variables	Unstandardized Coefficients		Standardized Coefficients	t-Values	Sig.	Collinearity Statistics	
		β	S.E	β			Tolerance	VIF
1	(Constant)	2.317	0.173		13.379	0.000		
	WH	0.260	0.068	0.298	3.846	0.000	0.388	2.574
	PER	0.307	0.062	0.382	4.923	0.000	0.388	2.574
2	(Constant)	-0.918	0.357		-2.573	0.011		
	WH	1.366	0.125	1.569	10.921	0.000	0.081	12.274
	PER	1.333	0.116	1.661	11.501	0.000	0.081	12.402
	WHPER	-0.313	0.032	-2.441	-9.949	0.000	0.028	35.797

a. Dependent variable PSP

Table 7 shows the non-standardized and standardized values of the coefficients, the t-values, the sig values, the tolerance, and the VIF values. The VIF values are based on multicollinearity. If the VIF value is greater than 10, this indicates the existence of multicollinearity. Since the VIF values of all the variables in the first model are less than 10, there is, therefore, no multicollinearity issue. Whereas, in the second model, the presence of multicollinearity appears to be logical as the interactions added to the second model to moderate the effect. In the first model, the sig value of all variables is less than or equal to 0.05, which shows that all variables have a significant effect on the dependent variable. On the other hand, the interactions in the second model and the independent variables and moderators were regressed against the dependent variables in the presence of interaction between the independent variable and the moderator. In the second model, the sig values of all independent variables and interactions were less than 0.05 indicating that the variables had a significant impact even in the presence of moderators. The moderator sig values were also less than 0.05; this confirms the presence of the moderating effect of the transit time. The following Figure 2 further strengthen above statements that the two variables Transportation and Transit Time have a significant relation in between them.

**Figure 2:** Relation between Transportation and Transit Time.

5. DISCUSSION

Like previous research (Prakasch and Ghayas, 2019; Zaidi, Ghayas and Durrani, 2019), this study seeks to study the organization of related issues. Analysis of the results of the study shows that warehousing has a significant impact on the cost of the supply chain. This is consistent with the findings of Yilmaz and Çatay (2006). Transit time also has a significant relationship with the cost of the supply chain. This finding is consistent with the findings of Womack and Jones (2003). Research also found that perishability moderates the relationship between warehousing and perceived supply chain costs, while transit time moderates the relationship between transport costs and perceived supply chain costs.

6. CONCLUSION

Research is significant because it enhances the knowledge base of supply chain managers by working further on the concepts presented by Yılmaz and Çatay (2006) and Womack and Jones (2003). This research adds transit time as a moderator in the relationship between transport and the perceived cost of the supply chain. It also tests the moderating effect of perishability in the relationship between the warehouse and the perceived cost of the supply chain.

7. POLICY IMPLICATIONS

The recommendations and policy implications of this research are as follows:

- Since perishability is found to moderate the relationship between warehousing and perceived supply chain costs, it is recommended that managers in the supply chain assess the need to store the perishable and then decide whether or not to store it.
- Besides, while purchasing managers should focus on current requirements and thus avoid, where possible, obtaining excessive quantities of perishable materials.
- Since transit time is found to moderate the relationship between the cost of transport and the perceived cost of the supply chain, managers in the supply chain should be mindful of distance and transit time while making any purchase decision, especially if it is to be purchased from a place where transport takes time.

8. FUTURE RESEARCH

This research was conducted in Karachi and data collected only from respondents in Karachi. The data were cross-section data, suggesting that future research should be conducted on longitudinal data. Furthermore, since the firm size gives the organization bargaining power over the people in the supply chain, future researchers should, therefore, take the firm size as the control variable and see the impact of independent variables and moderators on the perceived cost of the supply chain.

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