Stochastic Procurement Lead-time, Its Major Determinants and Their Impact on Operational Performance of Textile Firms: A Case Study of Faisalabad Pakistan

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Abstract

This study examined the supplies procurement lead-time, its key determinants, and operational performance. Main intention behind this study is to explore impact of lead-time factors on operational performance of large textile firms. Moreover, the mediating role of stochastic supplies procurement lead-time between key determinants and operational performance is also investigated. Explanatory and cross-sectional research design has been used for this study and the primary data were collected through structured questionnaire from 283 middle-higher procurement management officials. Structural equation model (SEM) is applied to derive the research results. The study results confirm the significance of procurement lead-time in superior operational performance. Moreover the study revealed that the professionalism of procurement staff, characteristics of required

products and suppliers are key determinants of lead-time and significantly affect the operational performance. The stochastic procurement lead-time mediates the relationship between staff professionalism, product characteristic, supplier factors and operational performance. The study recommends reduction in procurement lead-time by managing key determinants, which would lead to efficient manufacturing process. This study is limited to the procurement officials and ignores the other operational staff. Therefore, in future study may be conducted while targeting the other operational staff to get complete comprehension.

Key words:

Stochastic Procurement Lead-time; Supply Chain Management; Supplier Factor; Operational performance; Product Characteristics; Procurement Strategy.

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1. Introduction

The procurement function is not a new concept in this business world and it is evident from a written red clay tablet recently founded in Syria. According to that, the most primitive written purchase order was issued in the vicinity of 2400-

2800 BC and the purchase order was for "50 containers of perfumed soft oil for 600 small weights in grain" (Coe 1989; Thai 2001). Another historical confirmation of authentic procurement is evident from the trade agreement between China and Greek in 800 BC for silk business. Nevertheless, there were no expert purchasing authorities on that time and all required goods and services to the government were provided by commission agents, who received a commission on their purchases either they bought for the army or other civil authoritative units (Huston, 1966 &Thai K., 2001).

The effective utilization of organizational resources is of foremost importance in recent times as there is the extreme competitive environment. The idea of comparative advantage is the central point of developing competitive strategies which leads a firm to gain a competitive advantage in new and existing markets. Efficent usage of time and elimination of delays improve speed to market which leads to customer satisfaction. All the actions taken in the reduction of product design time, cycle times and delivery times, have great importance in firm performance (Ireland & Webb, 2007). Improvement in product flow and elimination of delays involve specialized skills, inventiveness, behavioral changes, and additional resource investments. In today's ferocious competitive global market, the business enterprises have been forced by shorter product life cycle and changing customer buying behavior, to invest in and focus on their supply chain. The ongoing advancement in transportation and communication technologies has motivated the firms for incessant development of the supply chain techniques and its effective management. The traditional strategies to manage supplies of goods that were very much successful in the near past, may not be wrong, but may be incomplete in today's world, require regular refocus or addition. In an ever more global environment, it becomes a great challenge for companies to remain competitive. This challenge has led many firms to improve their supply chains in order to bring better customer value by maintaining a competitive advantage. The effective and efficient supply chain management has been related with a number of advantages like reduction in cycle time, average inventory levels, costs, improvement in product design, profitability and customer value (Tan, 2009).

In today's global market, the competition is not only between companies, but it is also among networks and organizations which are called supply chain (Christopher, 2000). Hence, there is a definite need for an organization that can manage its supply chains for product and service customization or most

advantageous utilization in globalization (Cousins, 2005). Through this mechanism of relationships, organizations are able to achieve competitive advantage which led to maximize the organizational effectiveness and also reduction in operating costs (Mason, 2008).

Johnston & Lewin (1996) analysed and summarised the firm's purchasing behaviour by detailed study of 165 articles published from 1967 to 1995 and presented an organizational purchasing integrated model, which was the combination of all original works as well as new construct developments during last 25 years. The research work of Johnston & Lewin (1996) was based on the review of influential work done by Robinson, Faris, & Wind (1967), Fredrick, Webster, & Wind, (1972) and Sheth, (1973). Robinson, Faris, & Wind (1967) explained that firm's purchase decision process consists of four variables which are i)- environmental determinants, ii)- organizational determinants, iii)- interpersonal determinants and iv)- the individual decision making participants. Sheth has introduced more two constructs, first product characteristics and second supplier characteristics in his firm purchasing model. Most of the research work in procurement and supply chain is done after 1996 and still, there are many gaps in the existing literature. The theory of Supply Chain Management is introduced by Lamming (1996) which was an extension of logistics. Larson & Halldorsson (2004) introduced four different perspectives explaining the supply chain management and logistics relationships. Akkermans, Bogerd, & Vos (1999); Tan, Choon, Steven, & Wisner (2002) and Romano & Vinelli (2001) have tried to differentiate between logistics and supply chain management but failed to provide theoretical grounds for such type of arrangements. Halldorsson et al., (2007) discuss and develop the supply chain management as a scientific discipline by combining four different supply chain management theories, i)- Resource-based view (RBV), ii)- The principle-agent theory, iii)- The network theory and iv)- Transaction cost analysis (TCA). Halldorsson et al.(2003) have tried to present theoretical foundations for organizational theories related to different areas of supply chain, by critically evaluating the resource-based view theory by Barney, (1991) & Wernerfelt, (1984), transactional-cost analysis theory by Commons (1931) later revised by Anderlini and Felli (2006), materials logistics management (MLM) theory by Donald J. Bowersox (1985), just-in-time theory (JIT) by Ohno (1988). Material requirements planning (MRP) byJoseph Orlickly (1975), time-based competition (TBC) an extension of just in time theory by Stalk & Hout, (2003) agile manufacturing by Goldman, Preiss, &

Nagel, (1994) available-to-promise (ATP) theory by Ball(2004) and Zhao(2005) and supply chain roadmap by Perez (2013).

2. Literature Review

In today's turbulent global markets and fierce competition, speed-to-market of a product is extremely important, which is characterized by products with shorter life cycles, quick response, and fast information flow between buying firm and supplier (Zhang, Wang, & Gao, 2015). Without any doubt, one might say that the purchasing function is an indispensable function at the foundation of all enterprises. The buying of raw materials, machinery, finished products, service inventories, and support services is an essential action build up in all enterprises. Proficiently outlined and executed procurement designs supply many direct advantages to the organization. Procurement assumes as a fundamental part of the firm's operational planning identified with production, supply chain delivery, supply flexibility, quality, and costs. Subsequently, the finance-related effect of procurement specifically influences the budgetary steadiness and benefit of relatively every trading partner in the supply chain procedure. Keeping in view the nature of the business concern, purchasing costs alone territory from 50% to 70 % estimation of each delivered product. Due to the critical impact of purchasing activity on incomes, costs, and operational efficiencies, procurement is a key player in the supply chain (Ross, 2015). Due to continue development in communication and transportation technologies, the traditional purchasing strategies which were successful in the past, now looks incomplete. In this global environment, most of the firms are focusing on improving their supply chains, in order to maintain a strategic competitive advantage. An efficient supply chain leads towards many market advantages like an increase in customer value, profitability, reduction in operational lead time, low inventory cost and even batter and innovative products. Today's competition is not only between companies, but it is also among networks and organizations which are called supply chain (Christopher, 2000). In a global environment, there is a definite need of such networks which can contribute to product and service customization (Cousins, 2005). Efficient use supply chain networks, the firm achieve a distinct competitive advantage which ultimately leads towards the reduction in operating costs and maximization of organizational efficiency (Mason, 2008).

Numerous factors were identified by different researchers which contribute to supply risks and stochastic procurement lead-time. Zsidisin & Ellram (2003) identified some supply factors like demand change, incomplete delivery requirements, fail to give competitive prices and failure to meet required quality standards. Chopra & Sodhi (2004) explored factors like natural disasters, bullwhip effect, demand uncertainty and lack of information sharing between buyer and supplier., labor disputes, financial problems at supplier end, reliance on a single source, supplier incompetence, information breakdowns, and transportation problems. Cucchiella & Gastaldi (2006); Gaudenzi & Borghesi (2006) discussed political/economic instability, supplier quality, information delays, stochastic costs, lack of logistic integration, lack of inter-organizational information flow, sudden demand rise and production capacity constraints as major supply risks. Wagner &Neshat (2010); Tummala &Schoenherr (2011); Hahn & Kuhn (2012); Samvedi et al. (2013), also classify socio-political factors, demand factors, manufacturing factors, supplies uncertainties; financial factors, communication factors and transportation factors as major risk factors in supply chain process.

Staff in the procurement and planning department are the major contributors to delays, by planning procurement inappropriately, inability to present RFQ's on time to the suppliers, getting deficient data from bidders, inability to frame the comparison statement of bids in time, delay by the bid evaluation panel in completing the evaluation process, extended price negotiations process, long queue of approving hierarchy to review and approve the purchase order and underestimation of product lead-time (Lynch J, 2004).

According to supply chain management (SCM) theory, the developing need and significance of procurement professionals are changing because of globalization. It can be characterized as supply chain procedures requiring complete frameworks perspectives of the linkages in the chain that cooperate effectively to make consumer satisfaction (Hines, 2004). The procurement professionals can use supply chain management to address issues in organizing distribution channels, appropriate strategies for distribution, creating balance in logistics activities, information and cash-flow as well (Holger Schiele, 2011). Because of globalization, the expansion of multinational organizations worldwide and the expanding requirement for business partnerships, companies are progressively thinking that it is important to depend on significant supply networks that can enable them to compete in the global and networked economy. Therefore, there

is a demand for experienced and professional procurement staff that possesses all the necessary skills and technical expertise which plays a crucial role in international procurement. This clarifies the significant role of procurement professionals in whole supply chain network and their need for all type of business concerns, mostly in high-growth oriented firms in improving their operations to expand efficient procurement activities (Arora, 2014).

In selecting an appropriate procurement strategy, the first step for all manufacturing concerns is to evaluate characteristics of required products, including the length of product life cycle, demand prediction, variety of products and required lead-time as per market standard (Fisher, 1997). Efficient procurement managers constantly look for preeminent quality materials from the most trustworthy supplier at a lowest possible price. While identifying and selecting alternative suppliers, the important consideration is on the quality and availability time of the material. Availability time or lead-time is a key factor of procurement policies. Shorter supplies lead-times are advantageous, but getting in short lead-time from suppliers is a quite challenging job. The manufacturers usually create a competitive edge by developing long-term relationships with their suppliers (Noordewier, 1990; Anderson, 1992; Ganesan, 1994; Ulaga, 2006). Strategic procurement accentuates the strategically managed long termed buyer-supplier relationships (D.Cousins, 1999; Paulraj & J., 2006). Another important factor is Information sharing between buyer and supplier which enable the manufacturer to enhance its manufacturability, decrease in total cost and process time, and enhance the order completion time (Li, 2006 & Takeishi, 2001).

3. Methodology

An explanatory and cross-sectional research design was utilized by this study and primary data were collected using questionnaire from procurement professionals working in large textile firms. In this study, non-probability and convenience sampling technique are used.

3.1. Respondent's Characteristics

All respondents were top and middle-level procurement managers/officials, from which 16% were working in top management while 84% were officials working in middle management of textile firms. As for as education is concerned all respondents were educated 14years or above. With respect to professional experience 60% of the respondents were experience more than 5 years while 40% were experienced up-to5 years.

3.2. Data Analysis

Descriptive, correlation, reliability, SEM and mediation analysis were performed by using SPSS and AMOS 24.

3.3. Research Model

The research model shows interrelationships among variables t as shown in figure 1:

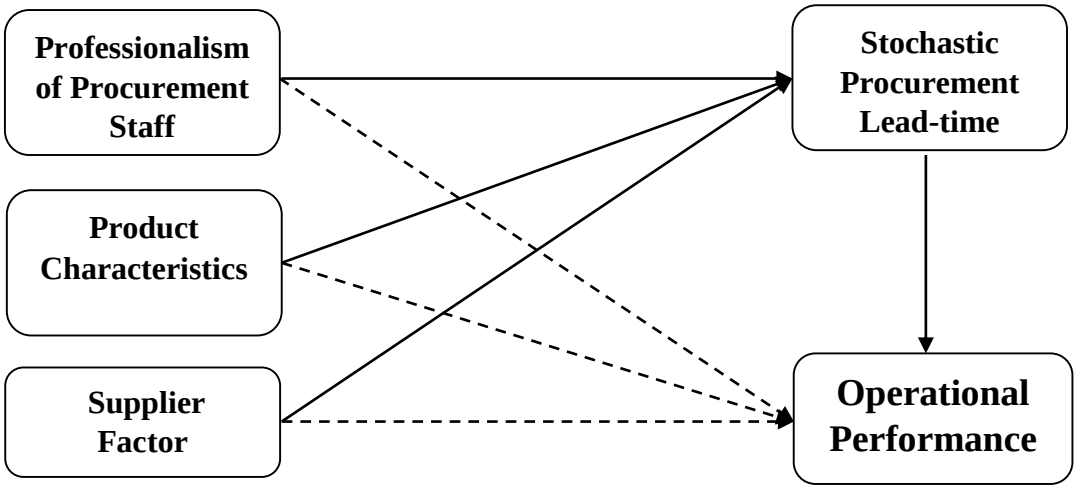

Figure 1: The research model

4. Empirical Results

4.1. Reliability Analysis

Data reliability was assessed by using Cronbach's alpha coefficient. Nunnally & Bernstein, (1994) recommended a value of 0.70 or greater for internal consistency of all survey items in social sciences. The results of reliability analysis are summarized in table1 as given below:

Table1: Summary of the Constructs Reliabilities

Construct Name (No. of items)	**Cronbach's Alpha**
Professionalism of Procurement Staff (5 items)	0.91
Product Characteristics (5 items)	0.91
Supplier Factor (8 items)	0.85
Stochastic Supplies Lead-Time (9 items)	0.84
Operational Performance (8 items)	0.93

4.2. Descriptive and Correlation Analysis

Results of Pearson correlation matrix and descriptive analysis are summarized in table 2.

Table 2: Mean, Standard Deviation, Correlations and Significance Level

Variables	***Mean***	***Std. Dev.***	***ProPer***	***ProdChar***	***SupFact***	***OpsPer***	***LeadTime***
ProPer	3.700	0.825	1				
ProdChar	3.881	0.710	.534**	1			
SupFact	3.812	0.776	.624**	.588**	1		
OpsPer	3.842	0.676	.574**	.620**	.682**	1	
LeadTime	4.039	0.454	.612**	.627**	.676**	.640**	1

N= 283

*****. Correlation is significant at the 0.01 level (2-tailed).***

ProPer= Procurement Professionalism, ProdChar=Product Characteristics; SupFact=Supplier Factor; OpsPer=Operational Performance, LeadTime=Stochastic Procurement Lead-time

The correlation results confirm the constructs' divergent validity as the correlation among study variables are below 0.85 as recommended by Kline, (2005).

4.3. Individual Measurement Models

CFA was conducted to check the individual fitness of all study variables. The results are shown in table 3. RMSEA, TLI, CFI, and IFI fit indices were used to confirm the individual structural model. According to Kline, (2005) and Bentler & Hu, (2009), values > 0.95 for CFI, TLI, IFI, and values < 0.08 for RMSEA, indicates good model fit.

Table: 3. Individual Measurement Model Fitness Results

Individual Measurement Models	Models	Fit Indices			
		RMSEA	**IFI**	**TLI**	**CFI**
Professionalism of Procurement Staff	Original	0.07	0.99	0.98	0.99
Product Characteristics	Original	0.06	0.99	0.98	0.99
Supplier Factor	Original	0.12	0.95	0.93	0.95
	Revised	0.06	0.99	0.98	0.99
Stochastic Supplies Lead-Time	Original	0.15	0.85	0.80	0.85
	Revised	0.06	0.98	0.97	0.98
Operational Performance	Original	0.14	0.92	0.89	0.92
	Revised	0.06	0.99	0.98	0.99

4.4. Structural Model

The projected study model has one endogenous variable (operational performance), one mediating variable (stochastic procurement lead-time) and three exogenous variables (professionalism of procurement staff, product characteristics and supplier factor). All the study variables collectively tested to examine the overall model fitness and the results are given in table 4.

Table 4: Comparison of model-fit

Index	***Initial Model***	***Revised Model***	***Cut-off value***	***References***
X^2/d.f.	3.14	2.04	≤ 3.00	Hayduck, (1987)
CFI	0.89	0.96	≥ 0.95	Hair et al., (2010)
TLI	0.88	0.95	≥ 0.95	Hair et al., (2010)
IFI	0.89	0.95	≥ 0.95	Schumacker & Lomax, (2010)
RMSEA	0.09	0.05	≤ 0.08	Bentler & Hu, (2009)

CFI =comparative fit index; IFI = incremental fit index; RMSEA = root mean square error of approximation; TLI =Tucker–Lewis fit index.

The initial model-fit results which were shown in table 4 reveal that there is not a good model-fit but after following modification indices; excellent model-fit results are achieved.

4.5. Test of Hypothesis

Study hypothesis were tested by performing Structural Equation Modeling (SEM) using AMOS 24, and the results are shown in tables 5 and 6.

Table 5: Standardized Coefficients for Structural Paths

NO	***IV***	⟶	***DV***	***Path* Coefficients**	***S.E***	***P-Value***
H1	Procurement professionalism	⟶	OP	.769	.085	***
H2	Product characteristic	⟶	OP	.846	.091	***
H3	Supplier factors	⟶	OP	.770	.082	***
H4	Procurement Lead-time	⟶	OP	.901	.094	***

*** *p<.001, ** p<.005, * p<.01 OP = Operational Performance*

The results of standardized coefficients for structural paths as shown in table 5, depicts that there is significant effect of professionalism of procurement staff (β = .769, p < .001) , product characteristic (β = .846, p < .001), supplier factors (β = .770, p < .001), and procurement lead-time (β = .901, p < .001) on operation performance of the firms. As a result all developed hypothesis are accepted.

The mediation effect was tested using the Hayes & Preacher, (2014)model for statistical mediation analysis. The results of the mediating effect of stochastic supplies procurement lead-time between operational performance and independent variables are shown in table 6.

Table 6: The Mediating effect of stochastic procurement lead-time

NO	*IV*	⟶	*M* ⟶	*DV*	*LL(95%)CI*	*UL(95%)CI*
H5	Procurement professionalism	⟶	LT ⟶	OP	0.149	0.328
H6	Product characteristic	⟶	LT ⟶	OP	0.237	0.445
H7	Supplier factors	⟶	LT ⟶	OP	0.304	0.496

LL= lower limit; UL=upper limit; CI = confidence interval, LT= Lead-Time, OP = Operational Performance

The study results depict that the procurement lead-time mediates the relationship between all four variables as the indirect effect of procurement lead-time in relation between professionalism of procurement staff, product characteristic, supplier factors, and operational performance lies between values greater than zero. There is no presence of zero in the 95% confidence interval; hence we can conclude that procurement lead-time mediates the relationship between all independent and dependent variables. Hence all mediation hypotheses are accepted.

5. Conclusions

The outcomes demonstrate that there is a variety of factors which have a significant effect on the firm's lead-time and operational performance. The researcher found major determinants of supplies procurement lead-time and operational performance, which include professionalism of procurement staff, suppliers and product attributes. To investigate the research questions"how to enhance the manufacturing performance of textile and clothing firms by decreasing their procurement lead-time", several hypotheses were developed and tested. The results indicate that factors like Professionalism of procurement staff, product characteristics, and supplier factors, significantly affect the procurement lead-time and operational performance. The results also reveal that there is a

significant impact of supplies procurement lead-time on operational/manufacturing performance of the firms. This is because of facts evidenced by previous studies done on lead-time and operational performance. Findings of this study are supported by Zhang et al., (2015) and Timothey (2017). The finding of this study further supported by Handfielf (2011) who found an important role of procurement staff in fulfillment of firm's procurement goals and objectives in order to make a possible overall success of the firm in its respective industry. The study of Steve Brown, (2013) and Arora, (2014) also found significant role of procurement staff in procurement efficiency and operational performance of the firm. The study results also reveal that for effective and efficient procurement strategy, the first step for all manufacturing concerns is to evaluate the characteristics of the required item. This is evident from the study of Selldin, (2007) and Caniels&Gelderman, (2005). The study findings about the impact of supplier factor on manufacturability of firm is well supported by the study findings of Poppo, L. et al., (2016), that shorter supplier lead-time, inter-firm relationship with suppliers, long-term buyer-supplier relationships, trust and information sharing between supplier and buying firm have significant effect on operational performance. Moreover, the study results explore that buyer-supplier logistics process integration smooth the progress of material and information flow between both entities which enable the firm to have a smooth manufacturing process. This is supported by study finding of Daniel I. (2016). In underdeveloped economies like Pakistan, there are very few or rare studies based on the factors contributed to the lead-time for procurement of raw materials and the impact of stochastic supplies procurement lead-time on manufacturing performance of textile firms. The finding of this study contributes to the existing body of knowledge about stochastic procurement lead-time, its effect on operational performance and measures to improve the lead-times of Pakistani textile industry where people have very inadequate comprehension about this fact.

The study finding will help the top management of textile firms to formulate efficient procurement strategy that can enhance the organizational operational efficiency as well as industry outcomes. This study presents imperative implications for the textile industry. First and principle finding is that in the textile industry the lead-time plays an important role in the operational performance of the firms and significantly affected by factors which were discussed in this study in detail. The textile industry can get a competitive

advantage over its competitors by lowering down the overall industry lead-time. The major part of overall industry lead-time is time taken in purchasing of raw materials and any improvement in this procurement lead-time will benefit the firm.

Proposed strategies to enhance operational performance by reducing supplies lead-time through this study are as below:

1. Shifting of current procurement and production systems to improved and modern systems like lean production systems and implementation of ERP. Previous researches on lean manufacturing and ERP systems shows that by implementing these strategies there is continuous process mapping and wastes reductions which can consider as the main reason for increased lead-time. These strategies also help in efficient inventory management system, smooth information flow, and timely availability of required raw materials and optimization of the whole supply chain, which can increase operational performance.
2. Regular training of procurement and production staff can also help in lead-time reduction and improvement in productivity.
3. The buyer-supplier relationship should be more open-ended and there should be long-term partnerships between the supplier and manufacturers.
4. Improvement in infrastructures, good transportation and logistics system, improvement in port and shipping facilities.
5. Political and economic stability, government regulations, tax relief, uninterrupted gas, and electricity supply on economical prices can also help the industry to enhance its efficiency. All these measures can help the industry to decrease the per unit production cost which is already higher than the textile manufacturing countries in the region to become more competitive in textile and clothing markets.

Furthermore, the study is limited to the professionalism of procurement staff, supplier's lead time, and product characteristics but it has not explained behavioral factors related to employee's and manager's personality, attitudes, and experience levels. It also ignores the manufacturing firms other than textile, which require more investigation. Organizational composition, size, and business nature of the firm is also excluded from this research study. There is also limited amount of field research due to time constraints. Marketing, sales and other

stakeholders which plays an important role in speed-to-market of a product or service, are not considered in this study. The main focus of the author was to improve operational performance through reduction of procurement lead-time, other aspects of industry lead-time are not considered. Finding of this study can be used as a starting point for further research studies in industry lead-time.

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