Journal of Management and Economic Studies
2022, 4(1): 1-14 DOI: 10.26677/TR1010.2022.955
Journal Homepage: https://www.jomaes.org

Apparel Supply Chain Optimization Focusing On Right Supplier Selection

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Abstract

The apparel manufacturing organization has been suffering from delivery issues due to the unavailability of materials in a timely manner. In this paper, the analysis has been focused on the selection criteria of the suppliers to find the right supplier to place the material's orders to get it on time and optimize the supply chain. Furthermore, it has seen the delay delivery status of the conventionally selected suppliers in the disaster situation. Meanwhile, the results have been found after the placement of the orders to the right suppliers to get the best outcome. 20% efficiency has been intensified because of the timely inhoused of the materials, which helps to reduce the productivity gap and the smooth supply chain can be maintained due to the right supplier's selection by the analysis through cost ratio analysis method and dimensional analysis method. Moreover, the profit-loss analysis has shown the consequences of the erroneous supplier's assortment.

Keywords: Cost minimizing, Apparel Supply Chain, Quality, On-time delivery, Higher Efficiency.

1. INTRODUCTION

Higher Efficiency depends on a smooth supply chain. As raw materials of the apparel manufacturing industry purchase from overseas, so it is an obligatory factor to optimize the supply chain in the garment manufacturing organization to maximize the profit. However, it has been observed that the majority of the garment manufacturers agony for receiving materials in a timely manner. The giant reason behind that is traditional the selection of suppliers without evaluation of the supplier's performance. Consequently, factories are being suffered to maintain

the delivery dates. In this context, the selection of the right suppliers is a vital task for the apparel manufacturing organization to retain in the competitive market. Apparel manufacturing industry have been trying to update like green supply chain concept has introduced to implement in the apparel industry (Akhter et al,2020).

The merchandising team of the apparel manufacturing industry places the orders of the raw materials to the suppliers by picking the number or email or via any known person without having realistic information regarding quality, delivery, and other important criteria. The scientific analysis of the supplier's selection methods can implement to select the right suppliers in real time in apparel manufacturing organization. Supply chain management has a significant impact on product and service quality, emphasizing the relevance of the interaction between procurement, external suppliers, and quality (Bal.M et al.,2013). Appropriate supplier selection in today's modern supply chain is a strategic challenge for the company. The total business of the corporation is a crucial strategic aspect. The significance of this is that at the start of the last decade of the previous century, adequate supplier selection was recognized (Liao C.N et al.,2011). Some researchers emphasized that the inability of providers to meet their delivery commitments and expectations regarding delivery is one of the supply chain's three key sources of uncertainty (Davis.T,1993). Because of the vital role of suppliers in supply chain management, supplier selection is a crucial procurement operation. The providers' features in terms of pricing, quality, delivery, and service in achieving the objectives of the supply chain (Kagnicioglu, C. H. ,2006). The measures characterized by Dickson and later altered by Weber are still generally acknowledged in various investigations; in any case, the climate and significance of specific measure changes affirm the work in which the creators incorporate over 110 works that were examined on the issue of providers' choice (Cheraghi, S. H et al.,2011). Later, this led to an overview among an enormous number of supervisors to inspect how they arrive at a compromise while choosing suppliers (Verma, R et al.,1998). Their exploration showed that supervisors place the highest priority on quality as the main property of providers, trailed by conveyance and cost. Research on the effect of measures in the production network proceeds toward the start of this century, and perceived dependability of conveyance as a rule of choice (Krause, D. R et al.,2001), while some others in their review notice the need to add development as another equivalent rule (Karpak, B,2001).

According to some researchers in 2001, before starting with defining the most important criteria by which it is necessary to assess the suppliers, you must first define an approach that involves the relationship between the customer and supplier (Birch, D. ,2001). Therefore, procurement managers must first make certain agreements with suppliers and determine the conditions for negotiations. According to the same author, the criteria for suppliers' selection can be classified into five different categories: cost, logistics, quality, development, and management; while in their study, they used four criteria for evaluating suppliers: price, quality, technology, and service (Bhutta, K. S et al.,2002). Later on, in a study, it processed similar criteria as was the case in (Çebi, F et al.,2003). One of the core hindrances to the smooth supply chain is the purchase of materials from overseas for the Bangladeshi apparel manufacturing industry. Orthodoxly, it takes 60 days for materials to arrive from a peregrine country like China to Bangladesh, and the factory gets less than 30 days to manufacture and ship the products to the cessation customers. Meanwhile,

selecting the right supplier at the right time is the key factor to making a smooth supply chain and achieving optimized chain performance. Hence, the paramountcy of supply chain optimization through precise supplier choosing to garment factories in our territory is essential. Deployment of artificial perspicacity in supplier selection can ameliorate the method of activity-predicated costing (Roodhoft et al., 1996).

Furthermore, many mathematical expressions implement to optimize the supply chain, however, when such a mathematical expression cannot be obtained, there is a need to utilize an estimation technique to commence the solution procedure. The estimated gradient direction guides the search process to peregrinate from one potential solution to another in an iterative scheme in a process called stochastic approximation (Robbins et al., 1951).Supplier selection incorporates a variety of implements, including cluster analysis, statistical methods, data development, analysis, case-based reasoning systems, decision support systems, total cost of ownership models, mathematical programming, and so on (De Boer et al., 2001)(Taluri S., 2002)(Choy et al., 2003)(Zhu. J., 2004). The special concentration on the ANN exercise set has to be given to avoid overfitting approximations that directly affect the predictive precision resulting from ANN. (Alam et al. 2004) suggest that the design of experiments (DOE) can be cumulated with ANN to surmount the overfitting quandary. Several simulation techniques are accordingly implemented to assess the variety of configurations of the system to be optimized. In the Operation Research (OR) literature, this type of optimization is referred to as "simulation optimization" (Tekin et al., 2004).On the other hand, another method used to optimize the stochastic objective functions is called direct search method, since the dubiousness is treated directly by optimizing stochastic functions (Tezri et al., 2004).

Supply chain optimization is an ascendant, pragmatic implement that can amplify the performance now and hold the position of the supply chain for the future. Although simulation is one of the most prosperous ways of analyzing supply chain processes (Beyer et al., 2007), furthermore, Artificial Neural Networks (ANNs) are another efficacious method to estimate arbitrary smooth functions and can be fine-tuned by utilizing stochastic replication values (Haykin's, 2008).In today's ecumenical and competitive environment, SCM and decision-making processes arise both from strategic and operational standpoints (Papageorgiou, 2009).Several review papers have been published in the last two decades that address miscellaneous aspects of SCs, e.g., SC management (Croom et al. (2000), green aspects of SCs (Srivasta 2007), ecumenical SC models and design (Meixell and Gargeya 2005), and multi-objective optimization (Trisna et al. 2016).It is generally acknowledged that one of the main obligations within the buying capacity of a business is the assessment and determination of providers. Moreover, it is well-founded that choices for buying can be scrambled and are regularly found on various measures (Cousins, Lawson, and Assistant, 2006; Pohl and Förstl, 2011). There are so many methods to analyze the selection procedure, however, we will implement the cost ratio analysis method and dimensional analysis method to identify the right suppliers for the manufacturing unit. In addition to this, we have collected data from two production units to analyze the consequences for the traditional supplier's selection process.

1.1. Traditional Supplier Selection Strategy and its impact on apparel supply chains:

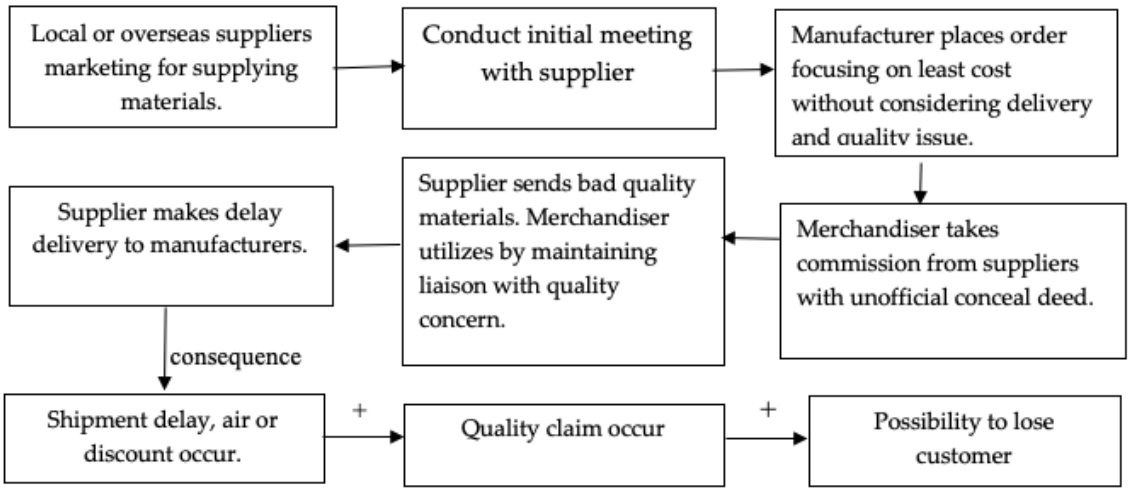

Figure 1: Traditional Suppliers' Selection Strategy

The supply chain (SC) department selects the suppliers based on the traditional method. Initially, the SC department is introduced to the materials supplier through friends or familiar people. On the other hand, if the suppliers find the responsible person's contact number or email for any company, they send an email to the manufacturers with prior knowledge of the factory's strength to the suppliers. There is an opening discussion about whether the suppliers are able to make the required items. If a manufacturing company sees that the unit price is reasonable, order will eagerly place with these designated suppliers without conducting any evaluation process based on supplier evaluation criteria. In this case, the purchaser takes a commission from those suppliers. Both parties agreed with the unofficial hidden dead to stay in a win-win situation, hence there is a gigantic possibility of getting bad quality products as well as nonprofessional delivery. In most cases, the merchandiser motivates the inspection quality controller (IQC) to approve this item, and consequently, the IQC takes advantage from the merchant end. Once the materials are received with bad quality, they do the production and ship the goods. In addition, the materials are received after 15 to 40 days of the actual delivery date. As a result, goods are shipped by air, or at a reduced rate. In this context, owners cannot do anything as they are dependent on merchandisers, and openly, they misunderstand the owner by stating this is a nominated supplier from the buyer's end or the suppliers for these specific items are rare in the world. The traditional supplier selection process is nothing but a vicious cycle that must be ruined in the factory professional environment which has shown in figure 1.

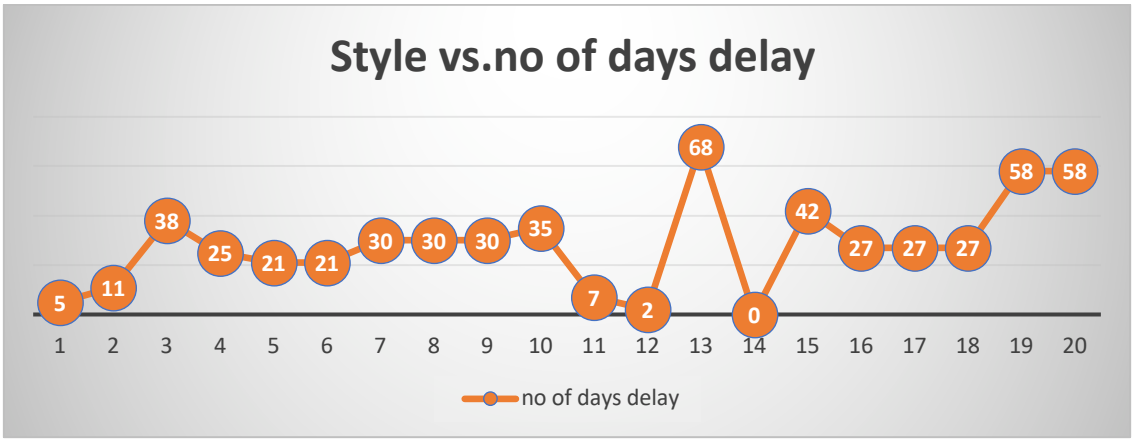

Figure 2: PO vs. Delay Status (PU-1)

From figure 2, the supplier is supplied materials after the minimum zero days to a maximum of sixty-eight days after the actual delivery date. This is an absurd delivery status. For such delays, the goods must be shipped by air, even if buyers cancel their orders, resulting in a massive loss for the manufacturing unit.

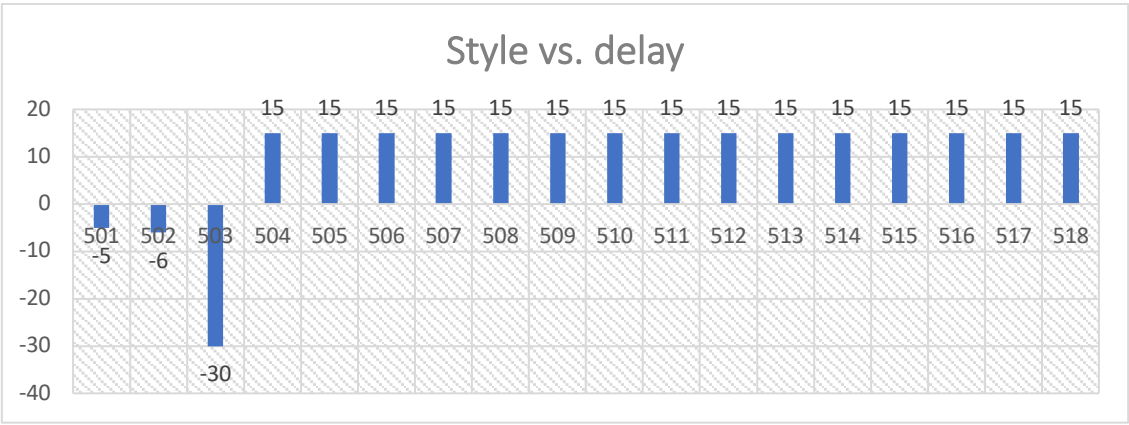

Figure 3: PO vs. Delay Status (PU-2)

Similarly, another manufacturing unit is suffered from delayed delivery of raw materials. It is found from figure 3 that two weeks are delayed for each purchase order. Subsequently, manufacturers have to pay more for air shipment and discount purposes. It is happened due to selecting the suppliers without any evaluation prior to the order placement. Customers are thus dissatisfied with placing orders to the same location in the long run. The business is in the risk zone. Many factories had to shut down since they were unable to pay workers' salaries on time due to delayed shipments and their related consequences.

Table 1: Factory Wise Income vs. Profit Loss

Factory	Order quantity	price	Income	Production cost	Air cost	Discount	Total cost	Profit/loss
PU1	500000	$ 0.16	$ 80,000.00	$95,000		$15,000	$110,000	$ (30,000.00)
PU2	350000	$ 0.25	$ 87,500.00	$70,840	$20,000		$90,840	$ (3,340.00)

After the analysis, the consequences are discussed in Table 1 for the manufacturing units 1 and 2. For instance, a customer placed five hundred-thousand-piece orders with the manufacturing unit 1. The unit price for those garments is $0.16. Hence, the income is $80000 from whole orders, whereas the production cost is $95000, which is higher than the income as additional machines is used to do quick delivery since the materials are twenty days delayed from the actual delivery. Finally, the shipment is made two weeks later than the actual delivery date. That is why the buyer has imposed an 18.75% discount on the orders. The company is paid a discount of $20,000.00. The total cost incurred to ship the goods is $110.000, which is $30000 more supplementary than income. On the other hand, production unit 2 is taken 350000 orders whose unit price is $0.25. However, it is seen that the manufacturing cost is $70,840. The goods are delivered by air. Hence, an additional $2000 is added to the total cost, and it is come to $90,840, but the actual income from those orders was $87,500.00. The ultimate results are $3,340 lost and is paid from the manufacturer's pocket merely because of the materials' acknowledged delay.

2. METHODS

2.1. Cost Ratio Analysis Method:

In this research, the application of the cost ratio analysis method to select the right supplier based on cost, focusing on quality, delivery, and service, is the basis of this research. Table 2 shows the cost analysis of the ten suppliers for the same items. The analysis has been done by using equation 1. For example, the total penalty for the supplier A is 3%. The quoted price per unit for this item is $1.10. From equation 1, we have got a net adjusted cost of $1.10 (1+3%) = $1.13. Likewise, the rest of the suppliers' costs have been analyzed and found to be suppliers D, I, and J, selected as the best suppliers as the production unit needs three suppliers for the required items.

$$\text{Net Adjusted cost} = \text{Quoted price/unit } (1+ \text{ total penalty}) \qquad (1)$$

Table 2: Implementation of Cost Ratio Analysis Method to Select The Right Suppliers For PU-1

Supplier	Quality cost ratio	Delivery cost ratio	Service cost	Total Penalty	Quoted price/unit ($)	Net Adjusted cost
A	1%	1%	1%	3%	$1.10	$1.13
B	2%	2%	3%	7%	$1	$1.07
C	3%	1%	4%	8%	$1	$1.08
D	2%	2%	1%	5%	$1	**$1.05**
E	1%	1%	1%	3%	$1.12	$1.46
F	2%	1%	1%	4%	$1.05	$1.09
G	3%	2%	2%	7%	$1	$1.07
H	1%	2%	1%	4%	$1.03	$1.07
I	2%	1%	1%	4%	$1.02	**$1.06**
J	2%	2%	2%	6%	$0.90	**$0.95**

At the same time, Table 3 portrays the suppliers' selection scenario for production unit 2. It is showed that suppliers D, F, and J are selected as the right suppliers to place the orders. In this way, the right suppliers can be selected for the manufacturing unit.

Table 3: Implementation of Cost Ratio Method to Select The Right Suppliers For PU-2

Supplier	Quality cost ratio	Delivery cost ratio	Service cost	Total Penalty	Quoted price/unit ($)	Net Adjusted cost
A	2%	1%	1%	4%	$1.05	$1.09
B	1%	1%	1%	3%	$1.20	$1.24
C	2%	2%	2%	6%	$1.05	$1.11
D	2%	2%	1%	5%	$1	**$1.05**
E	1%	2%	2%	5%	$1.15	$1.21
F	2%	1%	2%	5%	$1.02	**$1.07**
G	3%	1%	2%	6%	$1	$1.17
H	2%	2%	1%	5%	$1.07	$1.12
I	2%	2%	2%	6%	$1.05	$1.11
J	2%	3%	2%	7%	$0.95	**$1.02**

*2.2. Dimensional Analysis Method***:**

In this paper, the dimensional analysis method is applied to pick the right supplier in real time for the apparel manufacturing industry to optimize the supply chain.

$$VPI = \sqrt[w]{\prod_{i=1}^{n} \left(\frac{X_i}{Y_i}\right)^{w_i}} \qquad (2)$$

Here,

VPI=Vendor Parameter Index
Xi= Performance Criteria Score for Supplier
Yi=Standard Performance Criterion (i=1,2,3,……...nth)
Wi=Weight (Relative Importance) Assigned to Criterion

$$w = \sum_{i=1}^{n} |w_i|$$

In this research, the supplier selection process is analyzed using equation 2. Table 4 shows that the VPI scores for suppliers A, B, and E are higher than any other for production unit 1. Hence, these three suppliers can be selected as the right suppliers. The demo calculation is given below for understanding the selection methodology using the dimensional analysis method.

$VPI(A) = \sqrt[14]{(0.98/1.00)^{6}.(29/27)^{-5}.(3/2)^{-3}}$

$=7.13$

Similarly, the VPI scores of suppliers A and B are higher than the others. Thus, these two suppliers is selected as the best ones, which is depicted in Table 5 for manufacturing unit 2. The analysis is done for five suppliers who are supplying the same materials. By studying the selection criteria, the decision can be taken from such an analysis as to which one would be the best and right supplier.

Table 4: Implementation of Dimensional Analysis Method to Select The Right Suppliers For PU-1

	Quality (%)	Delivery (days)	Cost ($)	VPI
Weights	6	-5	-3	
Supplier A	98	29	3	7.13
Standard	100	27	2	
Weights	5	-2	-3	
Supplier B	80	33	3	5.36
Standard	100	27	2	
Weights	4	-5	-5	
Supplier C	70	35	3	1.25
Standard	100	27	2	
Weights	3	-6	-5	
Supplier D	60	31	3	1.53
Standard	100	27	2	
Weights	8	-3	-2	
Supplier E	99	28	3	8.51
Standard	100	27	2	

Table 5: Implementation of Cost Ratio Method to Select The Right Suppliers For PU-2

	Quality (%)	Delivery (days)	Cost($)	VPI
Weights	5	-6	-5	
Supplier A	95	21	3	9.49
Standard	100	27	2	
	Quality(%)	Delivery (days)	Cost($)	
Weights	2	-5	-5	
Supplier B	85	23	3	6.41
Standard	100	27	2	
	Quality(%)	Delivery (days)	Cost($)	
Weights	4	-2	-5	
Supplier C	78	25	3	3.31
Standard	100	27	2	
	Quality(%)	Delivery (days)	Cost($)	
Weights	3	-4	-5	
Supplier D	75	38	3	1.59
Standard	100	27	2	
	Quality(%)	Delivery (days)	Cost($)	
Weights	8	-3	-5	
Supplier E	65	35	3	0.07
Standard	100	27	2	

3. RESULTS

In addition, it is also detected from Figures 4 and 5 that the benefit-to-cost (BR) ratio intensified. BCR is shown 1.10 on average from figure 4 while materials are taken from traditionally selected suppliers, and the significance of the delay in delivery of the materials to the production unit is clear. However, the BCR is increased by 42%, which portrayed in figure 5.

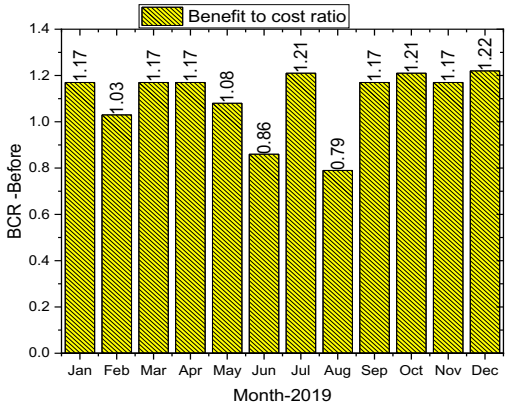

Figure 4: Benefit -to-Cost Ratio Analysis -Before (PU-1)

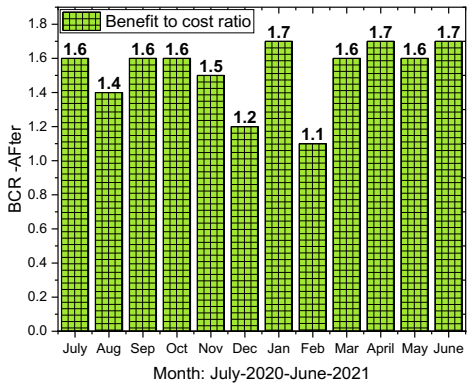

Figure 5: Benefit to Cost Ratio Analysis -After (PU-1)

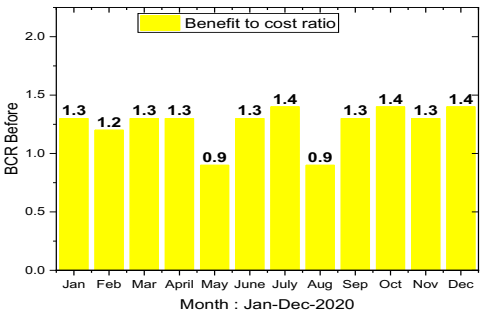

Figure 6: Benefit -to-Cost Ratio Analysis -Before (PU-2)

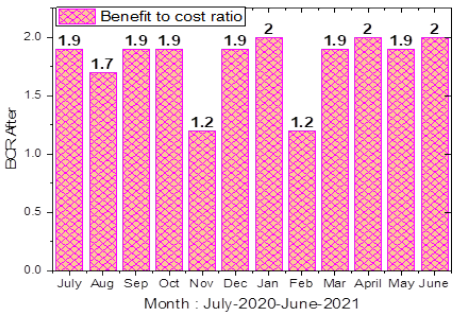

Figure 7: Benefit -to-Cost Ratio Analysis -Before (PU-2)

Similarly, the BCR ratio is augmented from 0.9 to 2.0 which has shown in figure 6 and 7 respectively where the improvement over the earlier BCR because of the best supplier selection for purchasing the raw materials from the right suppliers, which leads to an optimized supply chain. After the selection process through cost ratio analysis and the dimensional analysis method, manufacturing units 1 and 2 are placed material orders to the best selected suppliers. It is seen from figure 8 that the materials receiving status improved to 94% to 96% and 94% to 97% once the right supplier's selection.

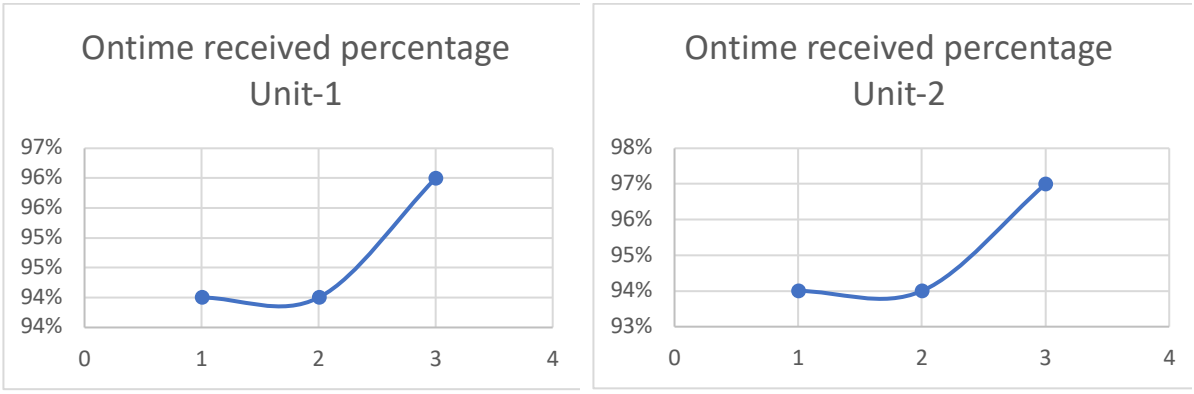

Figure 8: Ontime Materials Received Status

The right supplier's selection is the core task for any apparel manufacturing to keep the supply chain smooth and get the optimal results from the chain as a whole. That's why the research is emphasized on hunting for the right supplier's selection based on the criteria, i.e., quality, delivery, and least cost.

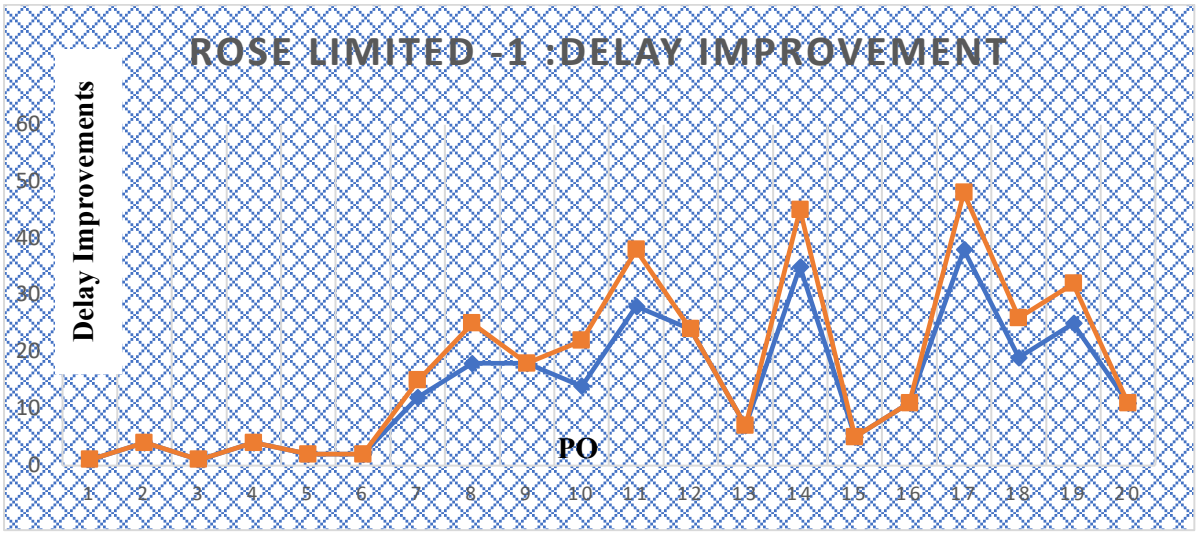

Figure 9: Optimized Delay Improvements (PU-1)

Figure 9 shows the reflection of the delayed delivery improvement while bringing raw materials from the analytically selected suppliers through the cost ratio and dimensional analysis method for the production unit 1. The receiving date and delivery date are very close, which is manageable to keep the smooth production and get the best outcome, which leads to higher efficiency.

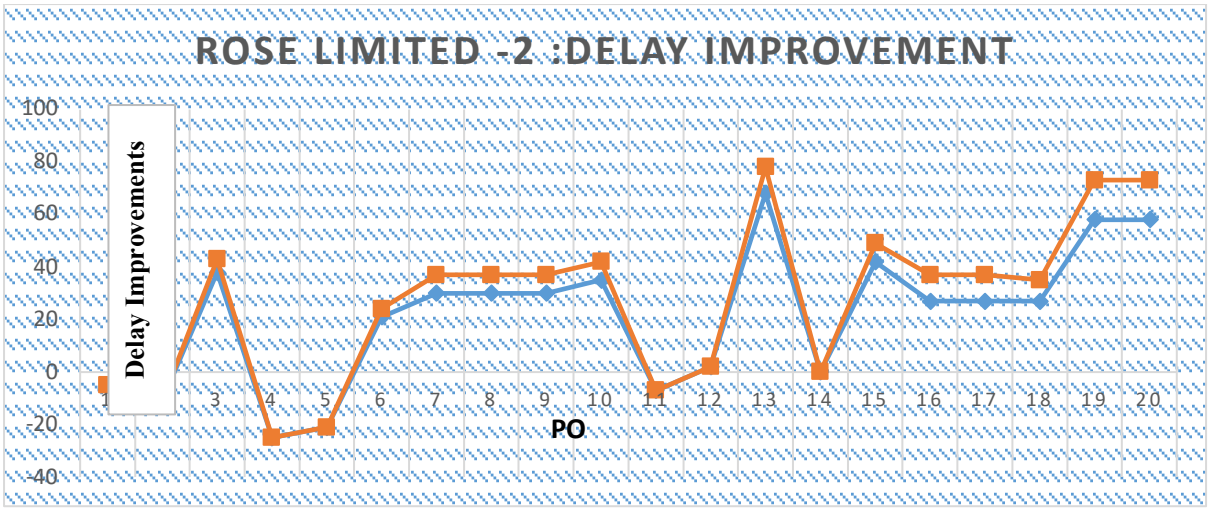

Figure 10: Optimized Delay Improvements - (PU-2)

The same is true for manufacturing unit 2. Figure 10 displays the enhancement of the delay days, which is very narrowed to the actual receiving date. The study shows that 95% of the on-time tracking (OTT) or actual receiving dates are met. That implies that the delivery commitment of the selected suppliers is correct and the results are result-oriented. As a result, production units 1 and 2 are able to produce goods and ship them at the right time. The efficiency level of production units 1 and 2 has increased by 15%–20%, which is shown in Figures 11 and 12.

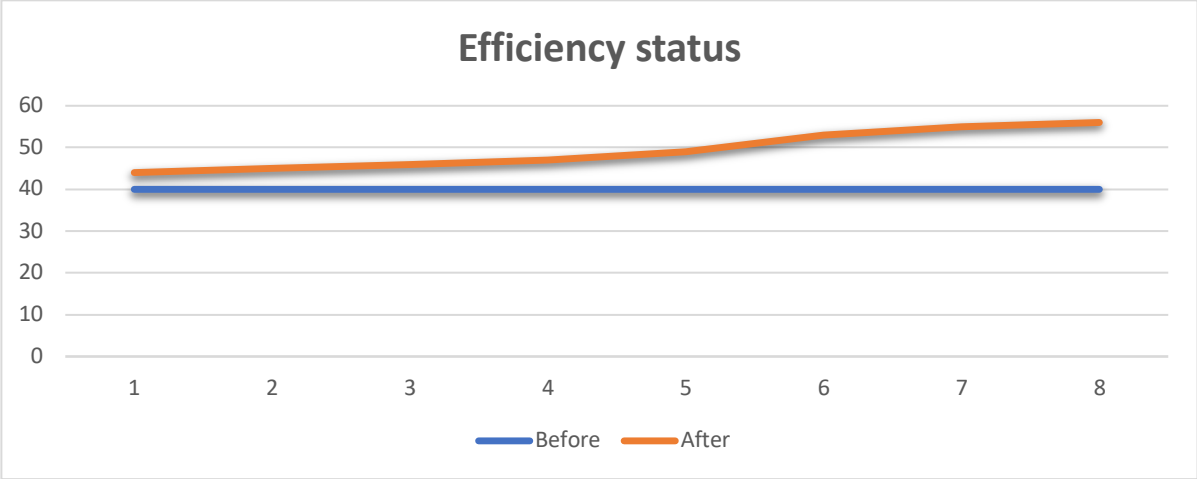

Figure 11: Comparison of Efficiency Improvement Status (PU-1)

The comparison of the efficiency improvement status while purchasing the materials from conventional suppliers and the best results after sourcing the raw materials from the right suppliers at the right time is shown in Figures 11 and 12 for the production units 1 and 2 successively.

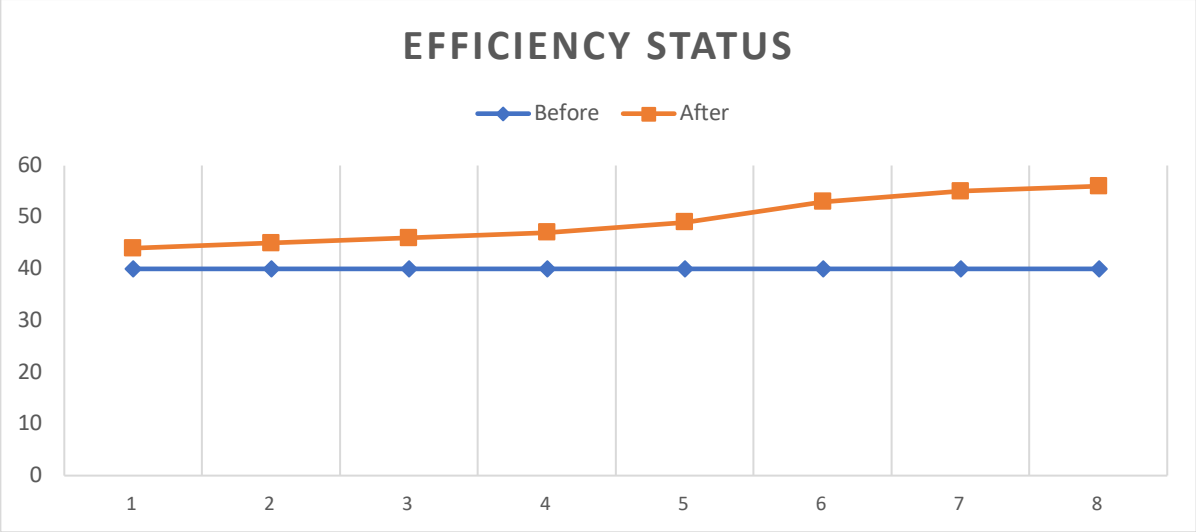

Figure 12: Comparison of Efficiency Improvement Status (PU-2)

4. DISCUSSIONS

The company pays more money to get optimized supply chain in the apparel manufacturing industry. In this research, the analysis has been made based on the conventional supplier's delivery status and the improvement status after the scientifically selection of the right suppliers by the performance evaluation of that suppliers using dimensional analysis method and cost ratio analysis method. It has been found that suppliers selected through analytical study, were able to provide the materials to the manufacturer warehouse on time to meet the shipment which leads to increase the efficiency. Overall, the supply chain optimized because of the reduction of the time and cost.

5. CONCLUSIONS

The mission and vision of the apparel manufacturing industry is to make a profit by cutting costs in all echelons of the supply chain. The majority of the product cost is incurred on materials rather than manufacturing costs (CM). It is observed that 30% of the FOB (freight on-board) price for any garment acquired for cutting and making charge, while the remaining 70% is acquired for the materials cost. Hence, sometimes it is impossible to make money with CM costs. In this case, the manufacturers must save money on materials and transportation costs by optimizing the overall supply chain. To accomplish this task, the selection of the right suppliers is one of the biggest jobs for the apparel manufacturers. Henceforth, the right supplier's selection is the crucial factor as the money saving depends on time materials received and the better quality of the resource. In this research, the data is taken from two apparel manufacturing organizations to analyze the current status of the materials received as well as the profit margin scenario. It is originated that the timely material delivery status is 60%, where the possible loss for the manufacturing unit is 40% for the undelivered materials on time. In this case, the manufacturers are unable to ship the goods on time. Accordingly, a factory cannot make enough money to pay the workforce's salary within the specified period, which means depreciating the better working environment. That's why the analysis is completed to select the right suppliers to get the materials on time. The cost ratio analysis and dimensional analysis methods are implemented to identify the criteria and would be able to take the decision for the right supplier's selection at the right time to get the best service in the case of delivery, quality, and cost. The efficiency is dramatically improved for the selected manufacturing unit since the materials are taken from the

analytically selected best suppliers. The rate of on-time delivery is drastically heightened compared with the previous status, merely because of the right supplier's selection. The analysis for the right supplier's selection could be done by applying more methods to ten manufacturing units to get more precise results. That would be the future research recommendation.

Data Availability Statement:

The basis data supporting the results of this research are stated in the manuscript.

REFERENCES

Alam, F. M., McNaught, K. R., & Ringrose, T. J. (2004). A comparison of experimental designs in the development of a neural network simulation metamodel. Simulation Modelling Practice and Theory, 12(7-8): 559-578.

Akter, S. , Ji, X. , Sarker, M. , Cai, L. , Shao, Y. , Hasan, M. , Abir, S.,& Quan, V. (2020). Clean Manufacturing and Green Practices in the Apparel Supply Chain, Open Journal of Business and Management, 8, 104-113. doi: 10.4236/ojbm.2020.81007."

Birch, D. (2001). Made for each other? Supply Management, pp.42-43.

Beyer, H. G., & Sendhoff, B. (2007). Robust optimization–a comprehensive survey. Computer Methods In Applied Mechanics And Engineering, 196(33-34): 3190-3218.

Bhutta, K. S., & Huq, F. (2002). Supplier selection problem: a comparison of the total cost of ownership and analytic hierarchy process approaches. Supply Chain Management: An International Journal, 7(3): 126-135.

Bal, M., Demirhan, A., (2013). Using rough set theory for supply chain management process in business. In Proceedings of the XI Balkan conference on operational research (BALCOR 2013), Belgrade-Zlatibor, Serbia (pp. 367-374).

Çebi, F., & Bayraktar, D. (2003). An integrated approach for supplier selection. Logistics Information Management, 16(6): 395- 400.

Cheraghi, S. H., Dadashzadeh, M., & Subramanian, M. (2011). Critical success factors for supplier selection: an update. Journal of Applied Business Research (JABR), 20(2).

Choy, K. L., Lee, W. B., & Lo, V. (2003). Design of a case based intelligent supplier relationship management system—the integration of supplier rating system and product coding system. Expert Systems With Applications, 25(1): 87-100.

Cousins, P. D., Lawson, B., & Squire, B. An empirical taxonomy of purchasing functions. International Journal of Operations & Production Management, 2006, 26(7): 775-794.

Davis, T. (1993). Effective supply chain management. Sloan management review, 34(4): 35.

De Boer, L., Labro, E., & Morlacchi, P. (2001). A review of methods supporting supplier selection. European Journal Of Purchasing & Supply Management, 7(2): 75-89.

Haykin, S. (2008) Neural networks: a comprehensive foundation, Prentice Hall.

H. Robbins et al (1951), A Stochastic Approximation method, Ann. Math. Statist. 22(3): 400-407 (September, 1951). DOI: 10.1214/aoms/1177729586.

Kagnicioglu, C. H. (2006). A fuzzy multi objective programming approach for supplier selection in a supply chain. The Business Review, 6(1): 107-115.

Krause, D. R., Pagell, M., & Curkovic, S. (2001). Toward a measure of competitive priorities for purchasing. Journal of Operations Management, 19(4): 497-512.

Karpak, B., Kumcu, E., & Kasuganti, R. R. (2001). Purchasing materials in the supply chain: managing a multi-objective task. European Journal of Purchasing & Supply Management, 7(3): 209-216.

Liao, C. N., & Kao, H. P. (2011). An integrated fuzzy TOPSIS and MCGP approach to supplier selection in supply chain management. Expert Systems with Applications, 38(9): 10803-10811.

Papageorgiou, L. G. (2009). Supply Chain Optimisation for the Process Industries: Advances and Opportunities. Computers & Chemical Engineering, 33(12):. 1931-1938.

Pi, W., & Low, C. (2006). Supplier evaluation and selection via taguchi loss functions and an AHP. The International Journal of Advanced Manufacturing Technology,, 27(5-6): 625-630

Roodhooft, F., & Konings, J. (1997). Vendor selection and evaluation an activity based costing approach. European Journal of Operational Research, 96(1): 97-102.

Srivastava, S. K. (2007). Green supply-chain management: a state-of-the-art literature review. International Journal of Management Reviews, 9(1): 53-80.

Tekin, E., & Sabuncuoglu, I. (2004). Simulation optimization: A comprehensive review on theory and applications. IIE Transactions, 36(11): 1067-1081.

Terzi, S., & Cavalieri, S. (2004). Simulation in the supply chain context: a survey. Computers in Industry, 53(1): 3-16.

Trisna, T., Marimin, M., Arkeman, Y., & Sunarti, T. (2016). Multi-objective optimization for supply chain management problem: A literature review. Decision Science Letters, 5(2): 283-316

Talluri, S. (2002). A buyer–seller game model for selection and negotiation of purchasing bids. European Journal of Operational Research, 143(1): 171-180.

Verma, R., & Pullman, M. E. (1998). An analysis of the supplier selection process. Omega, 26(6): 739-750.

Zhu, J. (2004) 'A buyer seller game model for selection and negotiation of purchasing bids:an extensions and new models', European Journal of Operation Research,Vol. 154(1): 150–156.