

Impacts of optimization in apparel supply chain focusing on ANN and Genetic Algorithm

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Abstract

As the labor cost, increasing day by day in the garment manufacturing industry so there is no alternative way to optimize the supply chain to maximize the profit and retain in the competitive market. In this research, we have been implemented ANN to optimize the apparel supply chain. Furthermore, we have been implemented and found out the precise way of selecting the right supplier at real time to attain best possible optimization in the supply chain. Meanwhile, supply chain optimization is crucial to cut the cost from different echelon of the supply chain. In this research, we have seen that minimum 25% of the profit intensify through the supply chain optimization.

Keywords: Supply chain maximization, ANN, Efficiency, RQS, PQD,GA.

1. Introduction

Optimizing supply chain is very crucial for the apparel manufacturing organization since it has to pay a plenty of cost to make the supply chain smooth from manufacturer's end. The company has to be involved with Outsourcing either due to poor supply chain performance or overbooking. It has also risked factor i.e goods quality and delivery cannot be achieved because of proper monitoring since key person unable to provide timely into Subcontract factory and hence it cost more for airing or claim issues. So in order to earn the goal of supply chain optimization, company has to improve productivity, quality and delivery (PQD) . To do so, the factory has to make sure that there is a good team to lead the company forward by providing appropriate guidelines and training for the lower level management. Additionally, conduct continuous training to workers for their upskilling which add value to optimization for supply chain. Quality management system (QMS) and Requirements for quality system (RQS) responsible are to be dedicated to facilitating services to the company to attain the goal of chain optimization. It can save up to 30 % of the total cost. The cost of component parts and raw materials, initiate a key slice of the product cost in many factories. For instance, the cost of apparatuses and parts bought from external sources by vast automotive or textile machinery manufacturers may total more than 50% - 80% of the incomes. In this process of procurement, supplier selection has long been predictable as imperatives and has been a pivot emphasis for the majority of the industrial marketing research over the past three decades (Patton,1996). The purpose of the supplier selection is to examine how many and which suppliers should be designated as the sources of the supplies and how order quantities would be assigned midst the nominated suppliers. Selection is said to be effectual when we attain not only a desirable solution, but also an optimal solution. Traditional supplier selection decisions are mostly based on procurement cost, product quality, delivery performance and supply capacity criteria. The combined thought of the above criteria complicates the selection decision even for an experienced purchase manager because competing vendors have different levels of achievement under these criteria. For example, the wholesaler with the minimum price in a given industry may not have the best delivery performance or product quality. In addition to the multi-objective nature of supplier selection,

the appearance of a discount pricing schedule becomes a major hindrance for procurement managers in finding the best purchasing strategy. There is numerous discount strategy like discounts depending on the quantity of each product ordered from a supplier, and discounts based on the total worth of all products ordered from a supplier end. Quantity concession models include distinct price breaks for every product.

2. Review on Supply chain optimization

Western countries source production to reduce costs but on the other hand they are bound to pay a high price for ineffective logistics when transporting the goods from the local manufacturer in China. Not only is sourcing to China connected with relatively higher logistics costs even worsen product quality is most often linked to sourcing. Majority of the Bangladeshi garments manufacturing organizations source fabrics, and trims from China which is more time consuming as well as costly. One of the core hindrances for the smooth supply chain is due to purchase materials from China. Usually it takes 60 days' time to arrive materials from this country to Bangladesh later than placing orders and factory only get 30 days to producing and shipment for the goods to the end customers. These processes cost more to apparel manufacturing organization in Bangladesh. Meanwhile, selecting right supplier at the right time is also key factor to smooth supply chain. Hence, the importance of the supply chain optimization through accurate supplier selection is superior to garments factory in our territory. The method of activity-based costing (roodhoft et al,1996) artificial intelligence employed in supplier selectin. Furthermore, differentiation in the gradient context is usually used to abridge the objective function in order to find an optimum solution. Gradient-based approach is subject to have a mathematical expression of the objective function. When such mathematical expression cannot be obtained, there is a need to use an estimation technique to start the solution procedure. The estimated gradients direction guides the search process to move from one potential solution to another in an iterative scheme in a process called stochastic approximation (SA) (Robbins et al,1951).

There are many methods implemented in supplier selection , such as, cluster analysis , statistical methods (De Boer et al,2001), data development analysis (Taluri S,2002), case based reasoning systems (Choy et al,2003), decision support systems (Choy et al,2003), total cost of ownership models (Choy et al,2003), mathematical programming (Zhu.J,2004) etc. A special attention for the ANN training set has to be given to avoid over-fitting approximation that directly affects the predictive accuracy resulting out of ANN. Design of experiments can be combined with ANN to overcome over-fitting problem (Alam et al,2004).

Measurement of the performance and the function of the aspiration mostly cannot be illustrated using a mathematical model because of the inborn certainty level. Some of the simulation models are consequently applied to assess the different configurations of the system to be optimized. This type of optimization is known as simulation optimization in Operation Research (OR) literature (Tekin et al,2004). Other methods used to optimize the stochastic objective functions are called direct search methods, because the uncertainty is treated directly by optimizing stochastic functions (Tezri et al,2004).

Ascertaining a developed and working quality control (QC) system is frequently an issue and the expenditure might be elevated rates of rejection, repackaging, scrap and rework, and lost sales due to out-of-stocks and slow turns (Nassimbeni et al,2006). Apart from logistics and quality problem areas at the time of sourcing from China, must pay attention to the Chinese business and political culture too. When engaging and maintaining business relations with a Chinese partner it will be impossible to thrive if not taking into account Chinese culture and their way of doing business. The delay materials shipment from the overseas penalize the factory by airing and discounting goods to the customer. Effective supply chains must be elastic and approachable to the changing dynamics in the marketplace, in manufacturing and technology, and in consumer expectations. This is also factual for public health supply chains, which must respond and adapt to dynamic environments. However, change must be anticipated and based on today's demands and tomorrow's opportunities and risks. Supply chain optimization is an influential, realistic tool that can magnify performance now and hold position of the supply chains for the future. Though simulation is one of the most thriving gear for analyzing supply chain processes (Beyer et al,2007).

In this paper, AHP model will be implemented to make the decision for the selection of the right supplier who supplies materials in a timely manner to the manufacturer to avoid air cost and archives the goals of the supply chain optimization. Artificial Neural Networks (ANNs) to be another effective method to approximate arbitrary smooth functions and can be fitted using stochastic response values (Haykin s,2008).

But gathering a result from the methods defined above necessitates widespread computation as well as time overwhelming. Also, the above methods are not competent to handle complex and unstructured situation. So, we need to use a result -oriented and better method i.e Analytical Hierarchy Process (AHP) to break down a complex and

unstructured situation into component parts, then arranging those parts or variables into a hierarchical form to assume a decision, like selecting a supplier with multiple objectives. This method has been successfully implemented in an apparel manufacturing industry and still the effort continues.

3. Apparel supply chain optimization

Since labor cost is snowballing day by day in Bangladesh so it is the crying need to optimize supply chain to make the profit for the organization. Figure 1 showed observed versus predicted scenario of the leading garments manufacturing organization before starting initiate of the optimization in different echelon of the supply chain.

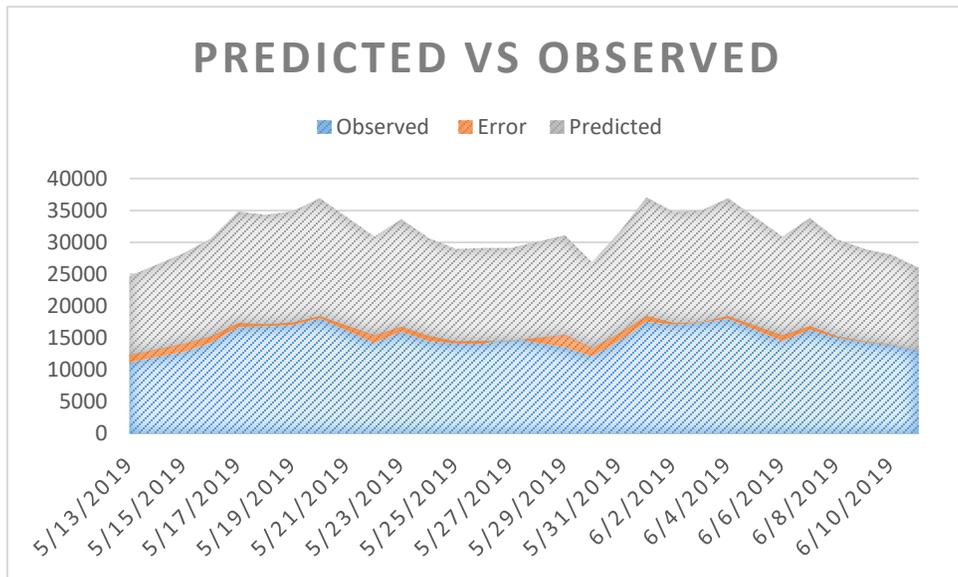


Figure 1 : Predicted vs. Observed (Before)

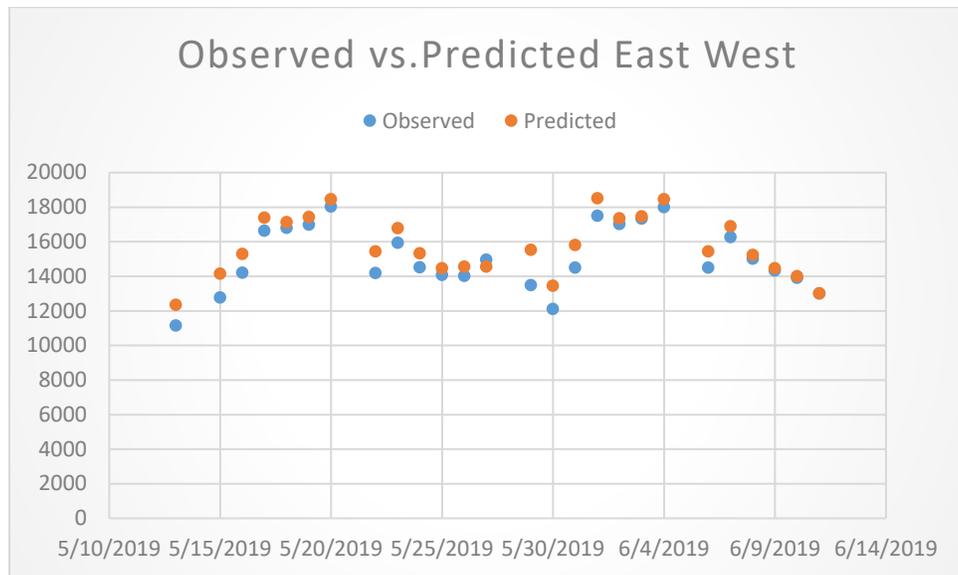


Figure 2 : Predicted vs. Observed (After)

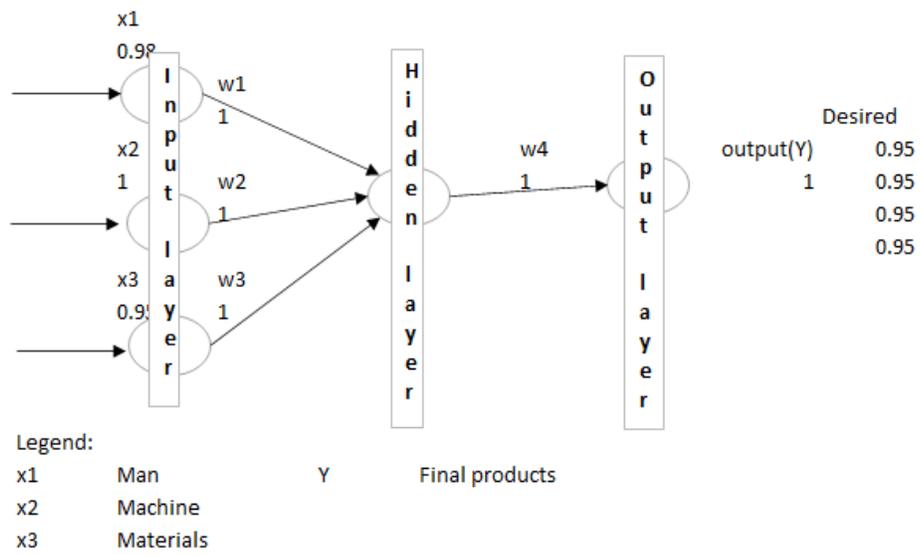


Figure 3: Artificial Neural Network (ANN) design for manufacturing unit

Table 1 : Suppliers selection criteria

Criteria	Supplier					
	1	2	3	4	5	6
Efficiency	0.81	0.82	0.87	0.70	0.85	0.88
On Time Delivery	0.85	0.80	0.82	0.76	0.91	0.90
Quality	0.94	0.98	0.82	0.85	0.95	0.91
Ethics	0.95	1	1	1	1	0.92
Cost	1	0	0	1	2	0

Initial Population

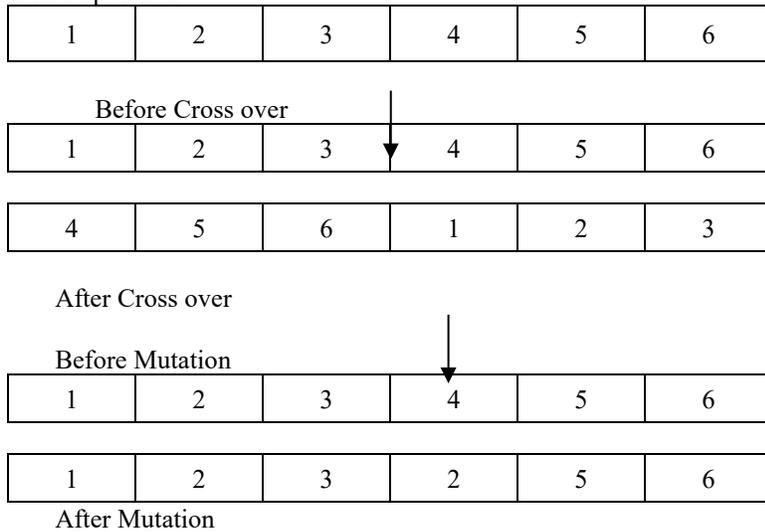


Figure 4 : Cross over and mutation in GA

4. Results and Discussions

Figure 2 depicted the outcomes after the implementation of the ANN and Genetic Algorithm (GA) techniques into optimization problem. It has been observed that the achievement status of the production against the target are almost equivalent to 99%. Meanwhile, Artificial neural network (ANN) portrayed in the figure 3 of a leading apparel manufacturing organization where shown the desired output of the factory and related feeding status. It has been analyzed that the planned optimization has been accomplished through applying ANN .

Supplier selection criteria have been discussed in the table -1 where major focus has been brought into efficiency, quality and delivery. The performance of the supplier 3 is good enough than any other supplier. So, supplier 3 is the best supplier selected amongst the five of them. Figure 4 demonstrated the initial population for the GA analysis. Supplier 2 has been selected as the best supplier by the cross-over and mutation. Hence, factory can purchase raw materials from above mentioned the best selected suppliers.

5. Conclusions

Supplier selection is the procedure by which companies identify, evaluate, and contract with suppliers. The supplier selection process organizes an incredible amount of a factory’s economic possessions. In return, firms expect significant benefits from constricting with suppliers offering high value. The aim of the supplier selection is not the reduction of the supplier from the supply chain network however the main purpose of this study is to select the right supplier at real time and make a mutual collaboration among the suppliers from manufacturing end. In the interim, we have been implemented ANN and GA to optimize the supply chain as a whole. There is no alternative way to gain maximum achievable optimization in the apparel manufacturing industry to survive in the market. These two techniques have been implemented into a leading apparel manufacturing origination to analyze the best and possible ways of selecting the right supplier at the real time in order to improve the optimization level of the overall supply chain. Implementing and testifying the same data with database software would be the further research.

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