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Supply chain optimization in apparel manufacturing

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Abstract

Wages increased drastically in apparel manufacturing industry in Bangladesh. Owner is suffering a lot to survive in the market though price did not increase in spite of having augment of the gross in this sector. Hence supply chain optimization is crucial to cut the cost from different echelon of the supply chain. In this research, Wages increased drastically in apparel manufacturing industry in Bangladesh. Management is suffering a lot to survive in the market though price did not increase in spite of having augment of the gross in this sector. Hence supply chain optimization is crucial to cut the cost from different echelon of the supply chain. In this research, Artificial Neural Network (ANN) has been implemented on two of the leading garments manufacturing organization. It has found that error between observed versus predicted are more for east west fashion garments limited due to poor supply chain than energypac fashion limited. In this paper, we have been proposed by analyzing ANN that rate of error reduced to 10%. Consequently, both of the factory's efficiency has been improved to 20% and 15 % profit got intensification focusing on supply chain optimization.

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

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. Company has to be involved with Outsourcing either due to poor supply chain performance or overbooking. It has also risk factor i.e goods quality and delivery cannot be achieved because of proper monitoring since key person unable to provide time 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, factory has to make sure that there is a good team to lead the company forward by providing appropriate guidelines and training to 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 facilitate services to the company to attain the goal of chain optimization. It can save up to 30 % of the total cost.

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

The optimization for the apparel supply chain is essentials to continue the robust business as the costing for the apparel manufacturing industry are being increased day by day and profit margin becomes tiny. Optimization includes inventory, cost and usage of the materials, man and machine for the manufacturing of the apparel industry. The similarity of supply chains to dynamic engineering systems is extremely cooperative for building an integrated management framework. Most business problems can be described as:

optimize $f_i(x)$ $i=1,...I$
subject to: $g_j(x) <= 0$ $j = 1,...J$

$$h_k(x) = 0 \qquad k = 1,\ldots k$$

Where $f_i(x)$ is the objective function i, x represents decision variables vector, and gi(x), hi(x) are the set of inequality and equality constraints. Finding the set of values of decision parameters (x) that optimize (minimize/maximize) the interested performance criterion (f) faces many challenges. Initially, gaining a mathematical description of $f_i(x)$ is not attainable. This is because of the uncertain relations between the system components that describe the behavior of the system. That is the reason, why the usage of traditional optimization techniques in precise those typically use analytical tools to get the optimum values of the variables are not acceptable for complex problems. Secondly, supply chains are usually characterized by multi-objectives that tend to be conflict (Min and Zhou, 2002).

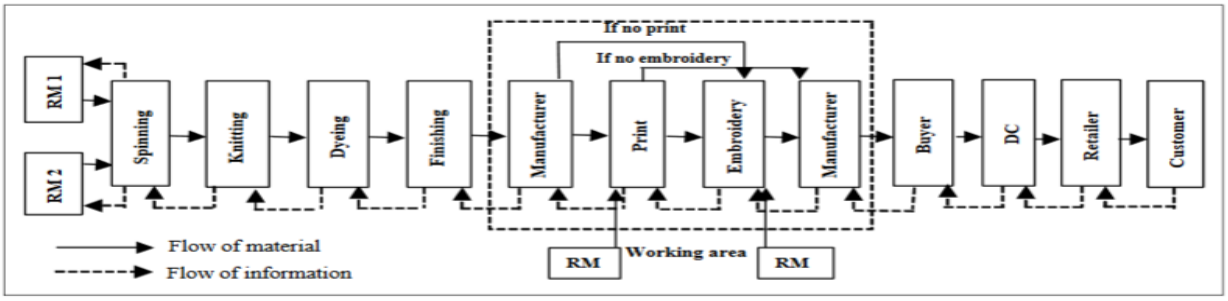

Figure 1: Schematic view of Apparel supply chain (M.Marufuzzaman,2011)

4. Application of Artificial Neural Network to apparel manufacturing

4.1 Ways to optimize supply chain

4.1.1 Tier 2 Supplier Management

Tier 2 suppliers are the suppliers who provide components, raw materials and sometimes services to our suppliers. By negotiating with our Tier 2 suppliers, we can lower factory's suppliers' cost of goods and lead times. Oftentimes a Tier 2 supplier might supply more than one of our suppliers.

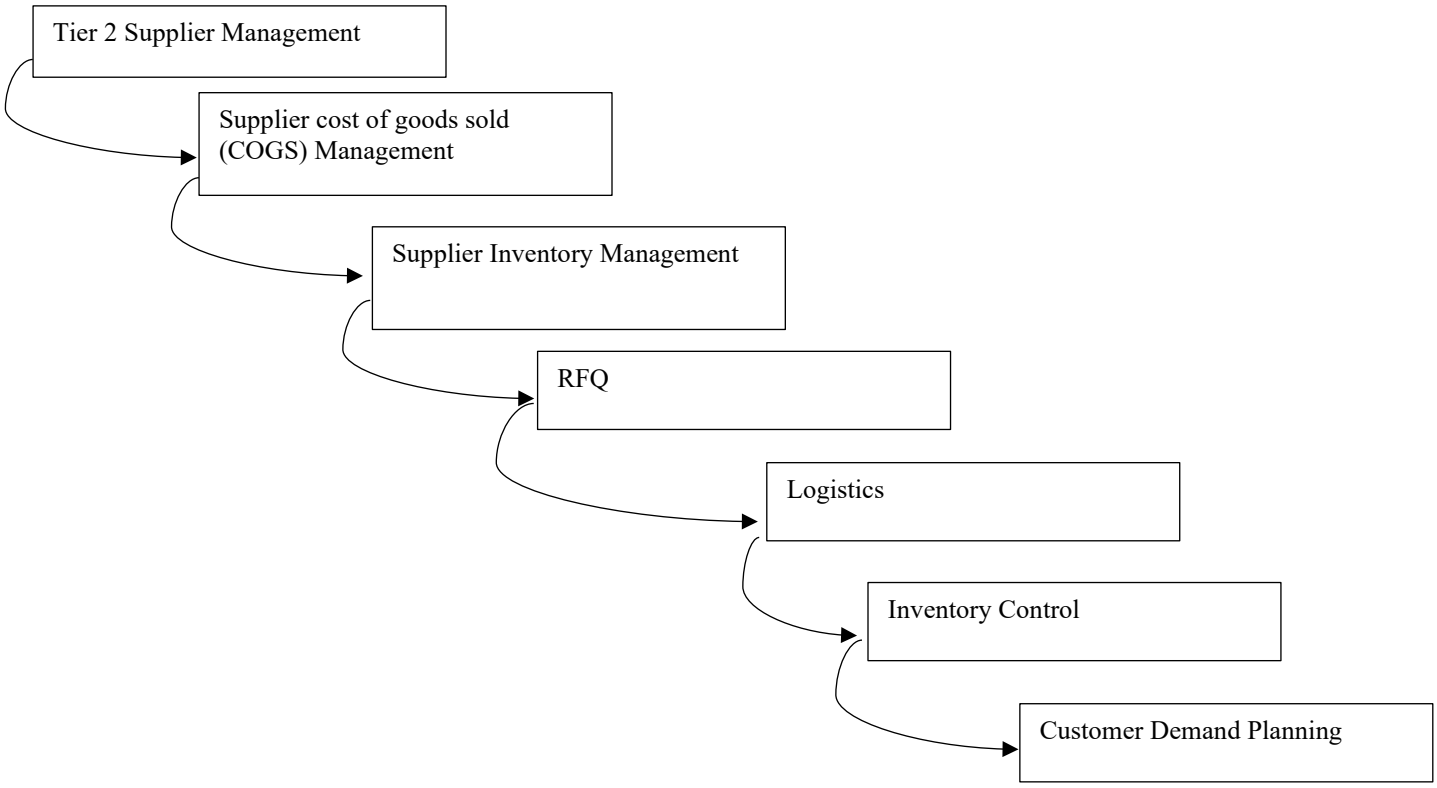

Figure 2 : seven ways to optimization

4.1.2 Supplier cost of goods sold (COGS) Management

COGS management is like auto maintenance. Suppliers should be optimizing their own internal costs so that they are not losing money with this arrangement, year-over-year.

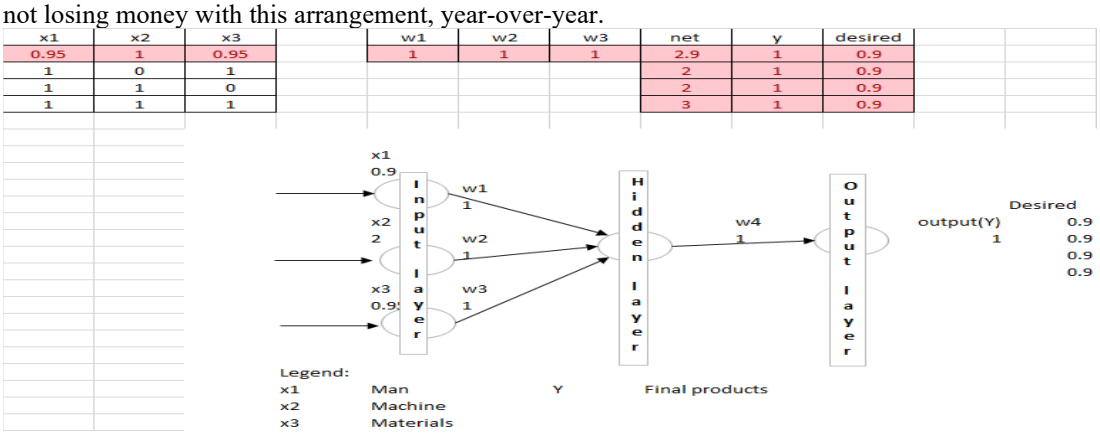

Figure 3 : ANN of East West Fashion Garments Ltd

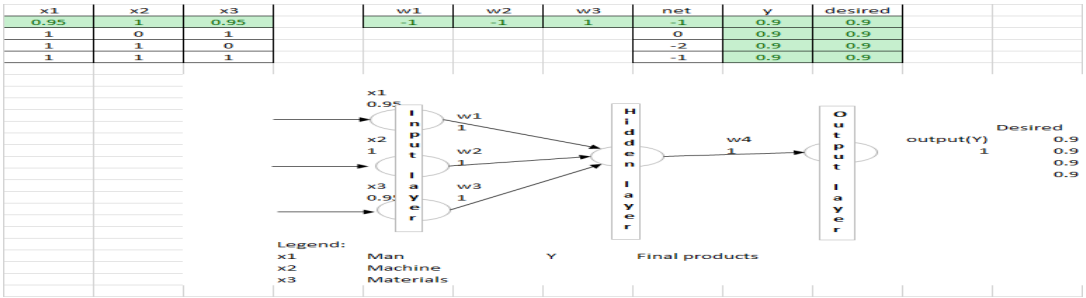

Figure 4 : ANN of East West Fashion Garments Ltd

4.1.3 Supplier Inventory Management

By sharing demand information with your suppliers, your suppliers can do their own demand planning to ensure that they are optimizing their inventory management. That demand information can be in the form of forecasts, with defined time fences that convert those forecasts to order, or blanket orders.

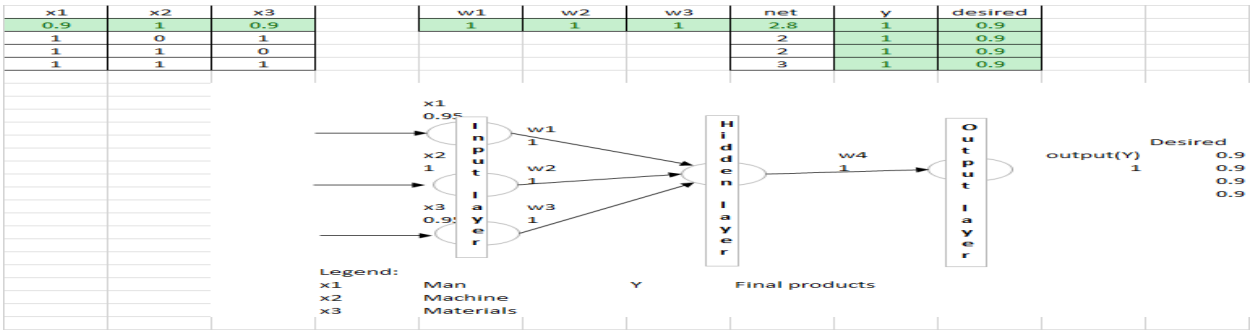

Figure 5 : ANN of Energypac Fashion ltd

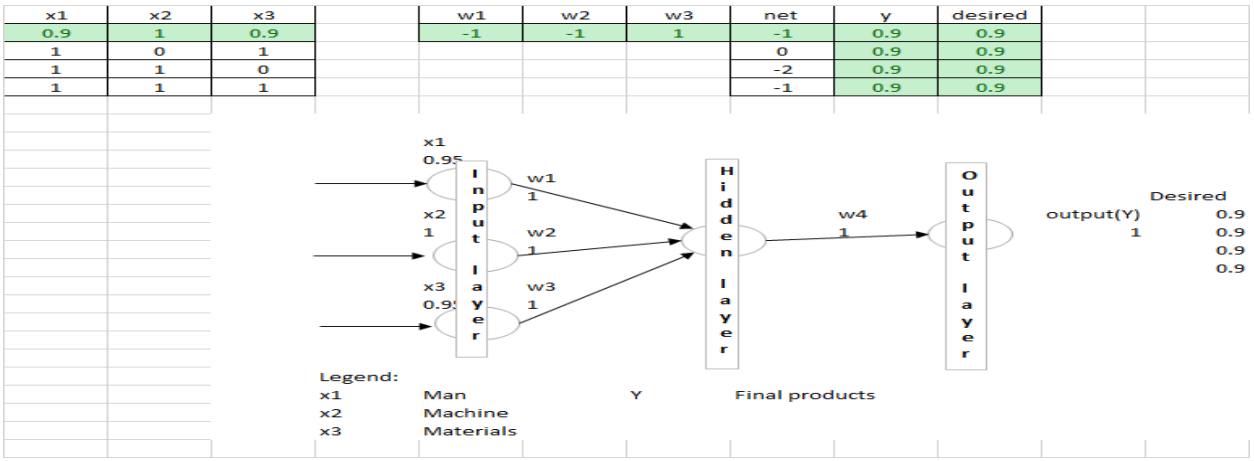

Figure 6 : ANN of Energypac Fashion ltd

4.1.4 RFQ

In many cases, the RFI is used to survey the supplier landscape. The RFI is an opportunity to understand the infrastructure, financial strength, and capabilities of new suppliers. The RFI is an excellent tool to identify potential new suppliers.

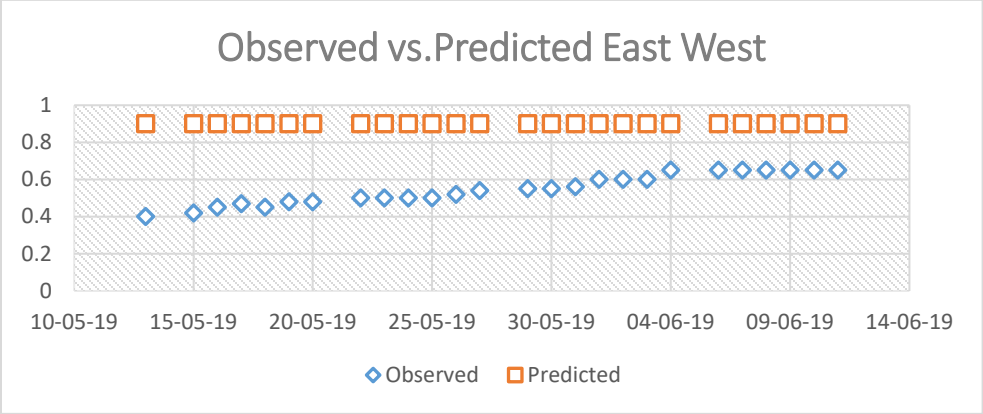

Figure 7: Observed vs. Predicted efficiency of East West fashion garments ltd

4.1.5 Logistics

“Poor planning does not constitute an emergency,” might suggest, poor planning throughout end-to-end supply chain does constitute a logistics emergency. Robust demand planning and lead time management can help minimize the amount of money you might be spending on logistics expedite and rush fees. It can also help reduce the number of air shipments you might need from low-cost suppliers in Asia. Understanding lead times and having access to long-term demand are the top two ways to help reduce logistics costs.

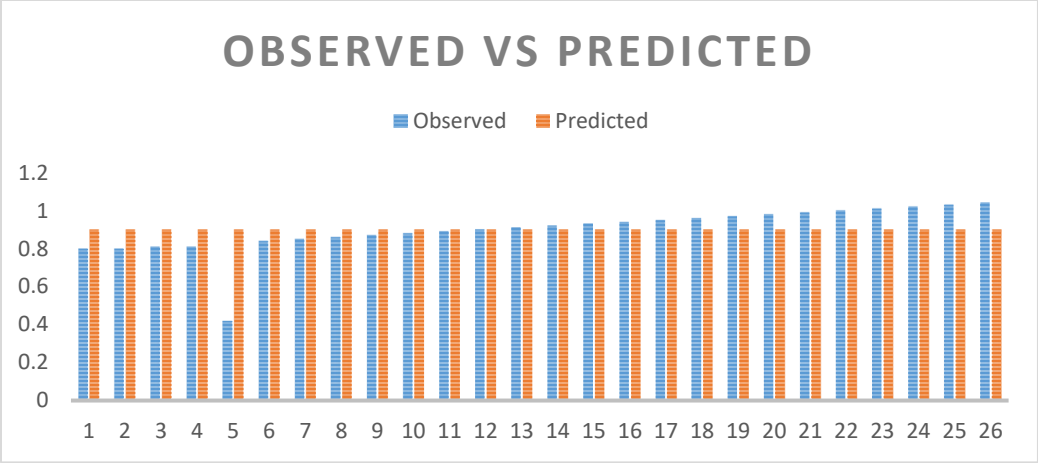

Figure 8 : Proposed Optimized efficiency of East West Fashion Garments ltd

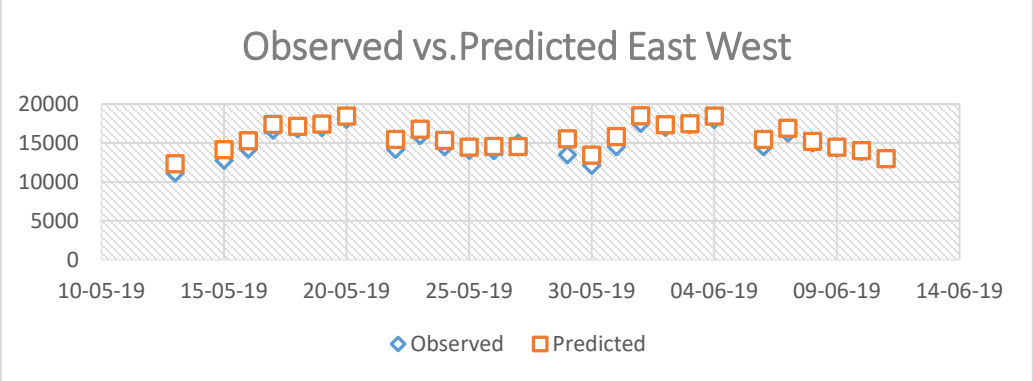

Figure 9 : Optimized productivity of Enegrypac Fashion ltd

4.1.6 Inventory Control

Every company's goal should be 100% inventory accuracy and the only way to accomplish that is by conducting regular, systematic cycle counts and physical inventories. Without 100% inventory accuracy, factory may or may not be able to ship to their customers on-time. Lack of inventory accuracy also means that company are buying inventory that they already have on hand or buying items factory don't need.

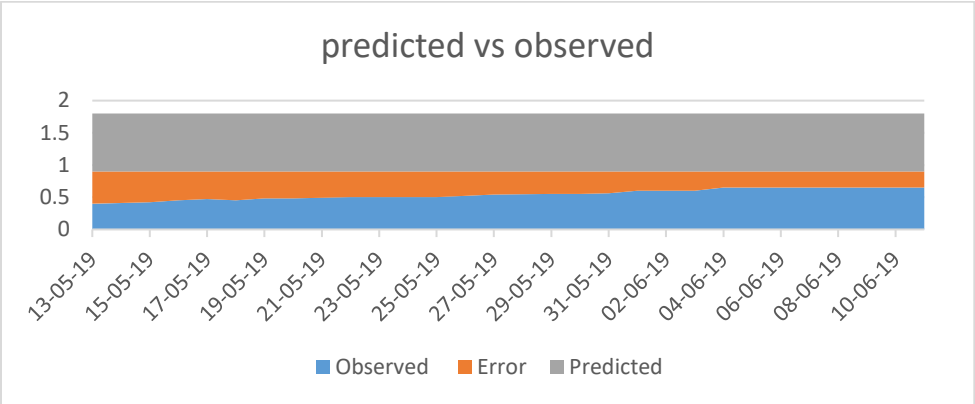

Figure 10: Observed Error of East West Fashion Garments ltd

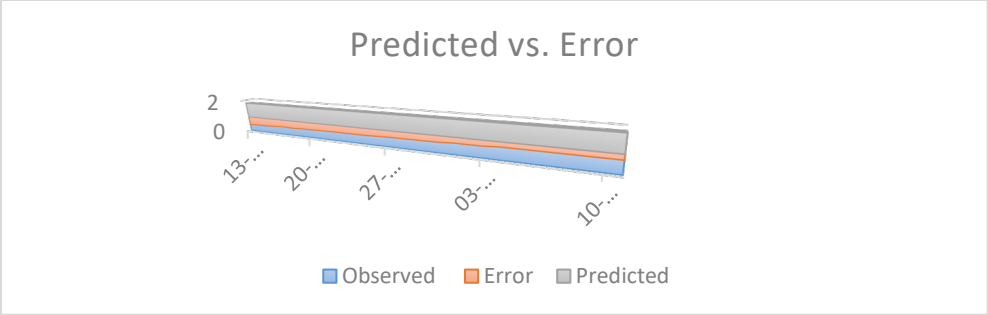

Figure 11: Optimized Error of East West Fashion Garments ltd

4.1.7 Customer Demand Planning

The customer might even send factory long-term or blanket orders. But does our customer know what it actually wants—and when it wants it?

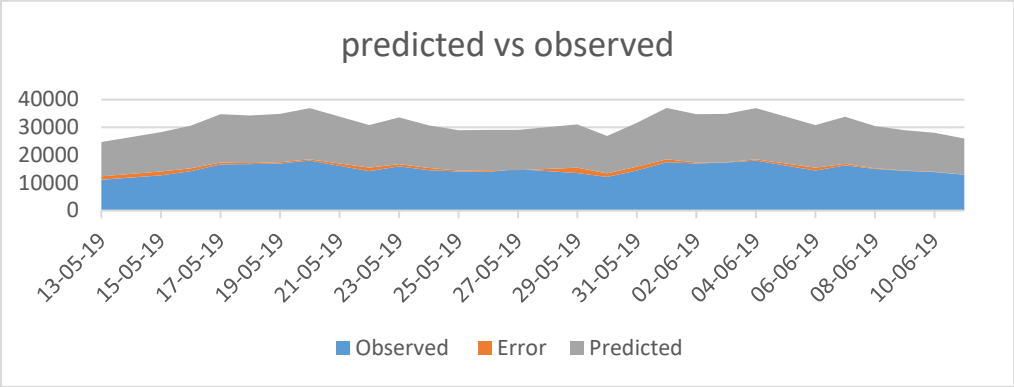

Figure 12 : Observed error of Enegrypac Fashion ltd

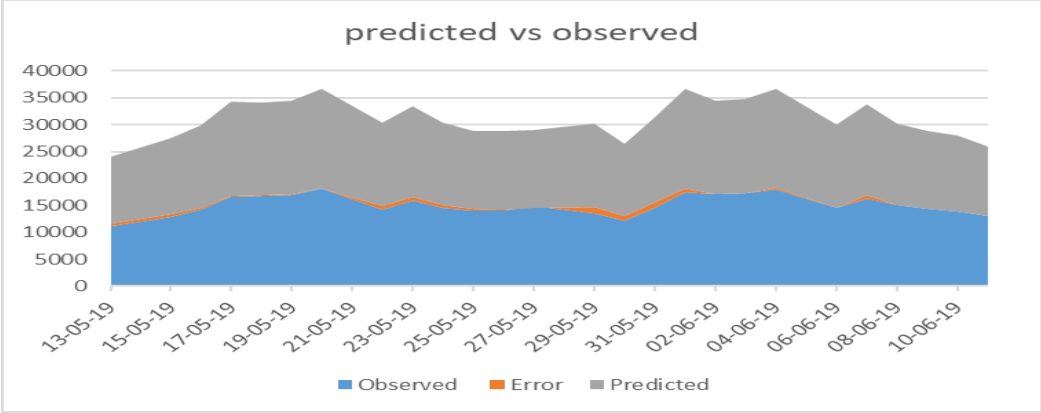

Figure 13 : Optimized error of Enegrypac Fashion ltd

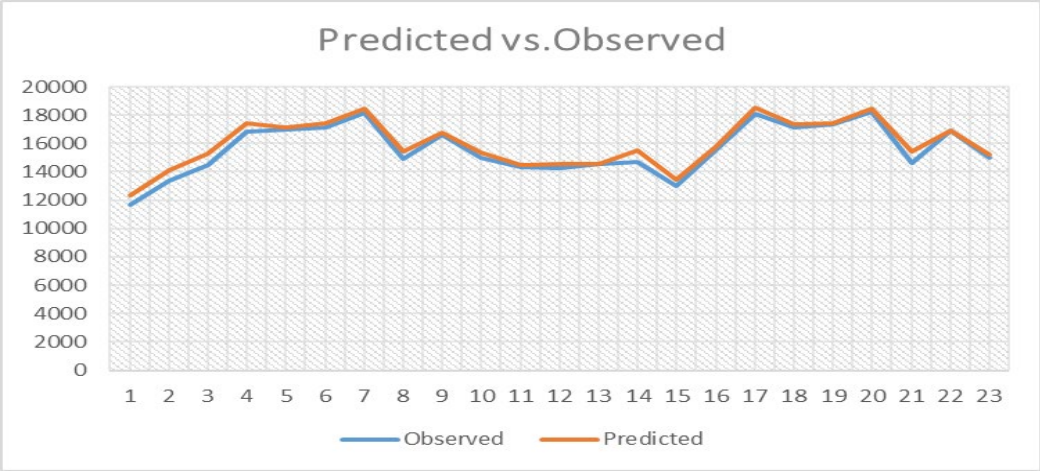

Figure 14 : Proposed Optimized productivity of Energypac Fashion ltd

Results and Discussions

Figure 1 showed the supply chain network of an apparel manufacturing organizations. Figure 3 depicted that the supply chain performance of east west fashion garments that is not optimistic since the required outcome did not achieve at the right time. Consequently, product delivery was delayed and subsequently whole supply chain being affected.

At the same time figure 5 portrayed the output of the manufacturing status of Elergypac fashion which was not too at the expected level. As a result, product went to buyer by air shipment which cost members of the supply chain and destroy the chain performance. The date between observed and predicted efficiency of the east west fashion garments found deficient which described in the figure 7. To be acquired optimization of the supply chain, we proposed quantity of the creation necessary to optimize loss which described in the figure 4 and 6 for east west and Elergypac respectively through artificial neural network analysis. Experiment had done by the neural network via changing weight to gain the desired throughput and finally proposed the anticipated output in the figure 8. The observed vs predicted productivity of the Energypac fashion depicted in the figure 9 . That's figure made were very close to the wanted level. The error amongst observed vs predicted of the east west fashion was severe which deviated from expectable level portrayed by the figure 10. A proposed optimized error figure declared for the east west fashion garments which showed in the figure 11. Figure 12 described the observed error for the energypac fashion which was adjacent to the targeted value. The optimized error and productivity analysis figure depicted in the figure 13 and 14 respectively. Overall, supply chain optimization is the primary need for the apparel manufacturing industry to continue factory as a profitable organization's and survive in the apparel market.

Conclusion

A comparison analysis has been done between two leading apparel suits manufacturing organizations. The experiment had done through ANN and consequent results depicted and analyzed. The results shown that Energypac fashion observation were result oriented though tiny proposal has been implemented to achieve the required output. However, the result of the east west fashion was far from the optimized level. More concentration needs to provide by the management to acquire the optimized output. Provide the training to the mid-level management and workers to achieve planned target and to meet the delivery date to get optimized production value. Implementing ANN and Genetic Algorithms to compare two or more apparel industry would be the further suggestions in order to get optimized supply chain.

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