A Research on Supply Chain Network of RMG Sector of Bangladesh

Sadman Alam, Md. Shafiul Alam, Md. Irfan Uzzaman, Mohammad Shakilur Rahman

Abstract— Readymade Garment (RMG) industry is one of the strongest sectors supporting the economy of Bangladesh and proper business strategies need to be applied to maintain its growth. One way to decrease the supply time is layout improvement and a better forecasting method. Here, different forecasting methods, comparison between them and improvement of plant layout are mainly focused using data collected from several factories. To determine the future demand (forecasting) of a certain company different methods (exponential smoothing, weighted moving average etc.) are used. By analyzing and comparing; a better method is proposed to predict more accurate future demand. Production efficiency and Achieved target are also found from collected data. In this research, an improved layout is proposed to a company; where line balancing is better and lead time is minimized making the supply chain more efficient. With all these analysis and data collection, a better and improved supply chain network can be used in Bangladeshi RMG sector.

Index Terms— Supply Chain Management, RMG, Line Balancing, Forecasting, Production Efficiency.

1 Introduction

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers [1]. In supply chain management, the information between business partners are optimized and collaborated and most importantly, SCM systems help in reducing inventories, which can lessen operational costs, compress order cycle time, enhance asset productivity as well as increase the company's responsiveness to the market. Readymade garment industry of Bangladesh commenced its journey in the late '70s and within a short period of time emerged as an important player in the economy in terms of export earnings, employment generation, and poverty alleviation and empowering of women. In order to improve, by modifying some of the existing business procedures of the apparel companies, like their SCM systems, continuous progress and development may be observed. Again, with the development of SCM system, company's connection with the retailers can be improved. The participation of the retailers with the SCM system of the company helps the apparel companies to obtain valuable consumer data which then help in reducing the manufacturers' errors in determining raw material and production volume. In other words, Demand forecasts form the basis of all supply chain planning [2]. Also, proper plant layout and efficient production system are as much as important as demand forecasting in a SCM system. Now the primary purpose of this research is to focus on improving the Supply Chain Management system in the RMG sector of Bangladesh. However, Poor housekeeping, unsystematic storage system, ineffective monitoring and controlling, disorganized production layout, lack of team based work, insufficient light and air etc. are common drawbacks in most of the RMG factories in Bangladesh which need to be minimized by taking necessary steps.

2 Literature Review

In 2006, Lam and Postle have reviewed the concept of supply chain management in textile and apparel supply chain management in Bangladesh. They argued that Bangladesh apparel industry is generally not aware of the concept of supply chain management and industrial benchmark for both manufacturing and retailing industries in Bangladesh [3]. There are three critical times in the fashion and apparel industry: Time-to-Market; Time–to–Serve; Time–to-React [4]. Islam (2013) analyzed that apparel supply chain matters such as new orders, raw materials supply, production processes and logistics related to finished goods delivery by using efficient supply chain process and also mentioned that Bangladesh garment industry improvement is desired in reducing the supply time required to produce and fulfill the orders placed by foreign companies [5]. Kumar (2006) focuses; Garments workers are concerned with long working hours or double consecutive shifts, personally unsafe work environment, poor working conditions, wage and gender discrimination. Indeed, employers treat the RMG workers as slaves, exploiting workers to increase their profit margins and keep their industry competitive in the face of increasing international competition [6]. Morshed (2007) advocates the key role of Cambodian labor unions in the clothing sector and as mediators between workers and factory owners to settle disputes and discuss wages [7]. Lack of workers' awareness about their rights limits the adherence to committees and unions because of the fear of being discriminated by their supervisors; moreover, workers are subjected to verbal and physical abuse and to penalties for mistakes or failure to achieve production targets [8].

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International Journal of Scientific & Engineering Research, Volume 7, Issue 10, October-2016
ISSN 2229-5518

3 Research Methodology

"Methodology" implies more than simply the methods one intend to use to collect data. It is often necessary to include a consideration of the concepts and theories which underlie the methods. Mainly the Descriptive Explore approach has been used in the exploratory phase of the research, in-depth interviews have been conducted with the Suppliers / Manufacturers (as well as Owners) and the relevant bodies and association in order to obtain the influential variables and to get a clear perspective of SCM and lead time management in the garment sector. A conceptual model has been developed based on the literature on strategic SCM skills, performance, supplier integration etc. which was tested using Structural Equation Modeling afer justifying by thorugh investigation. The findings from this study indicate that there is significant evidence to support the conjectured model in which strategic supply management skills, supplier integration and the perceived status of supply management have a direct impact on supply management performance. In quantitive approach, a case study and data collection was done in a RMG factory, namded "X", to reduce the idle time by introducing an improved line balancing layout. Again, best fitted forecasting method was determind by analyzing and comparing different methods for demand forecasting in another RMG factory named "Y" and also to determine the production time with production efficiency.

4 Data Analysis And Results

4.1 Cell Layout

From factory "X", necessary data has been collected from the existing line layout for different operation in the process of making a "Ladie's T-Shirt", where, the first process was named as "A" which took 9 seconds to finish and the layout finished at "K" process and the duration was also 9 seconds. The sum of the total operation is 118.2 seconds where cycle time is 30 seconds.

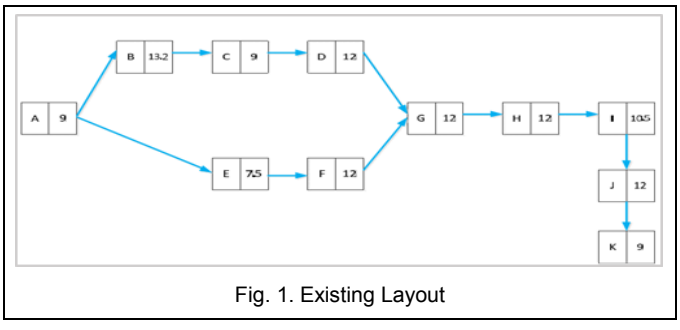

Fig. 1. Existing Layout

Now, in Table 1, from total elected time, that process in time, p_i was chosen which was close to cycle time is shown. Here h_i is the idle time.

TABLE 1
ELECTED TIME, PROCESS IN TIME AND IDLE TIME

Eligible	Elected	$\sum E_t$	p_i	h_i
A	A	0+9=9	9	21
B,E	B	0+13.2=13.2	22.2	7.8
C,E	C	13.2+9=22.2		
D,E	E	0+7.5=7.5	19.5	10.5
D,F	D	7.5+12=19.5		
F	F	0+12=12	24	6
G	G	12+12=24		
H	H	0+12=12	22.5	7.5
I	I	12+10.5=22.5		
J	J	0+12=12	21	9
K	K	12+9=21		

Now, the graphical representation of the layout along with idle time is shown below

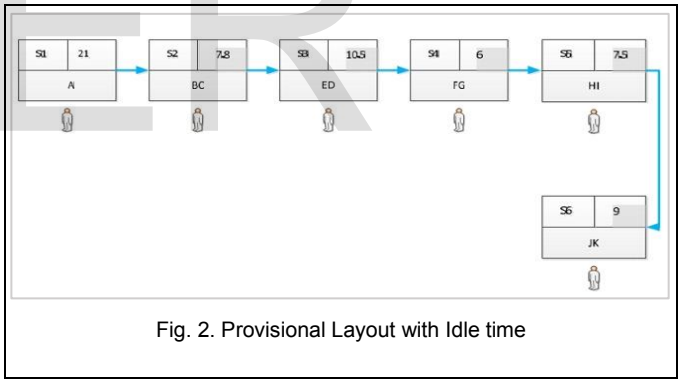

Fig. 2. Provisional Layout with Idle time

In this "L" shaped layout where total idle time is (21+7.8+10.5+6+7.5+9) or 61.8 second. To reduce the total idle time for profitable growth a layout has been proposed for where time is optimized and worker numbers are reduced. In the existing layout, no smoothness was present in operation processes.

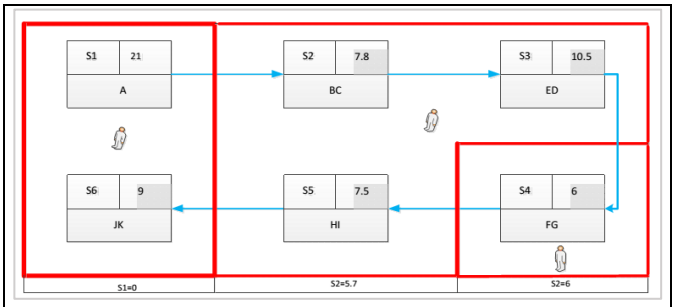

Fig. 3. Final Cell Layout

International Journal of Scientific & Engineering Research, Volume 7, Issue 10, October-2016
ISSN 2229-5518

Three cells can be seen in the proposed layout. At first cell when workers will complete their operation A then they will do operation J and K so there will be no idle time. At second cell, at first workers will do operation B and C, then they will do operation E and D and finally when operation in cell no. 3 will be completed then they will do operation H and I. At 3rd cell, workers will complete operation F and G. The idle times at second and third cell are 5.7 and 6 seconds respectively. So here total idle time is (0+5.7+6) or 11.7 second.

4.2 Forecasting Methods

The forecasting was done by using three methods: Moving average for 3 and 5 months, Weighted moving average for 3 months and Exponential smoothing with smoothing constant 0.1 and 0.3 in "Y" factory.

A moving average forecast uses a number of historical actual data values to generate a forecast. Mathematically. The simple moving average is expresses as-

$$\textbf{Moving average} = \frac{\sum \text{Demand in previous n periods}}{n}$$

Using data collected form the factory for 3 and 5 months, a graph has been plotted which can be seen in fig 4.

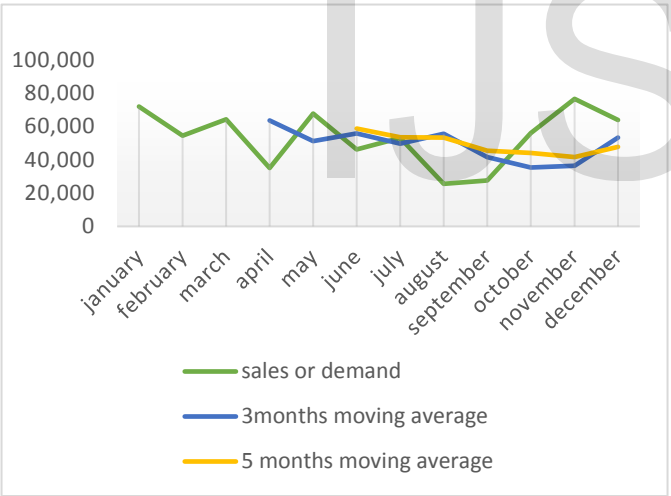

Fig. 4. Actual vs. Forecast demand (MA)

Weighted moving average is used when trend is present, here older data is usually less important and weights based on experience and intuition.

$$\textbf{Weighted moving average} = \frac{\sum (\text{Weight for period, } n_w) \times (\text{Demand in period, } n_d)}{\sum \text{weights}}$$

This method has been calculated for 3 months and a graph (fig 5) can be plotted using the collected data.

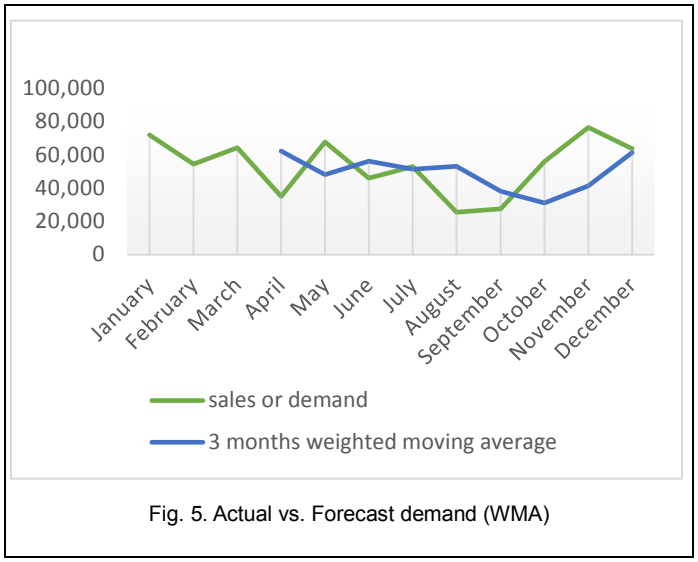

Fig. 5. Actual vs. Forecast demand (WMA)

In **Exponential smoothing,** the formula can be derived as,
New forecast = Last period's forecast + α (Last period's actual demand – Last period's forecast)

Or, $F_t = F_{t-1} + \alpha (A_{t-1} - F_{t-1})$
Here, α = Smoothing (or weighting) constant ($0 \le \alpha \le 1$)

Now, assuming α= 0.1 and Initial forecast = 75,000, a chart (fig 6) is created,

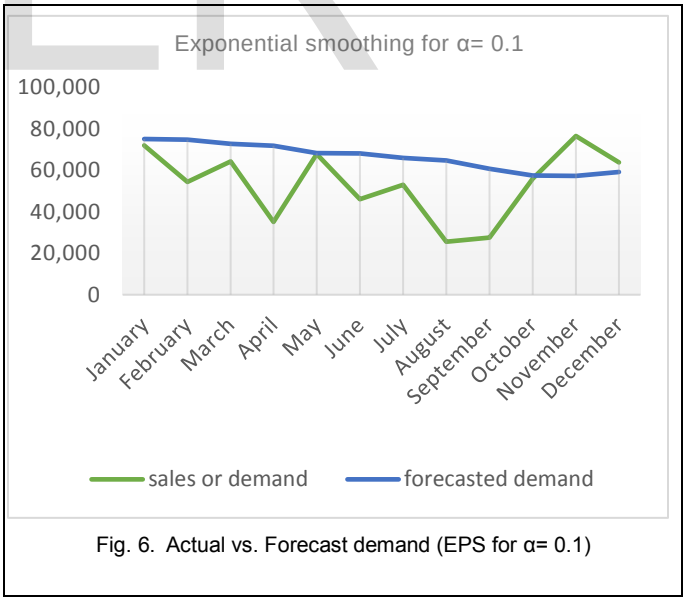

Fig. 6. Actual vs. Forecast demand (EPS for α= 0.1)

Again, for α= 0.3 and Initial forecast = 75,000, another graph (Fig 7) is plotted,

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ISSN 2229-5518

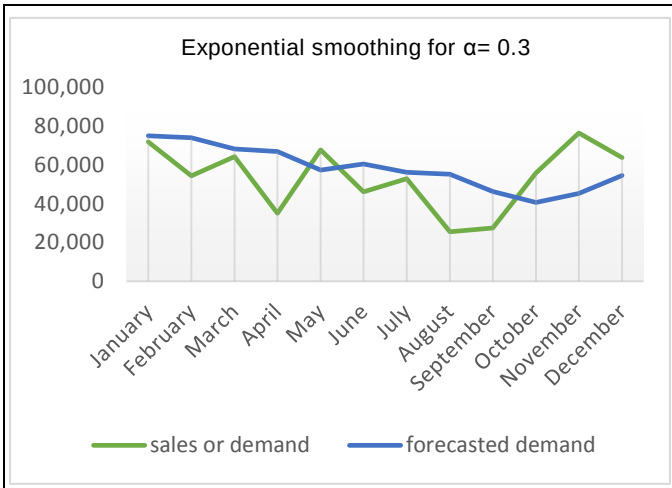

Fig. 7. Actual vs. Forecast demand (EPS for α= 0.3)

Here, in Table 2, the errors of moving average with 5 months are lower than other methods and two values of Smoothing constant (α) were considered. For α= 0.3 the errors are lower than for the errors of α= 0.1

TABLE 2
COMPARISON OF ERROR

		Mean Absolute Deviation	Mean Squared Error
Moving Average	For 3 months	14,435	369.295E+6
Moving Average	For 5 months	10,145	225E+6
Weighted Moving Average (3 months)		13,253	330E+6
Exponential Smoothing	For α= 0.1	16,803	460E+6
	For α= 0.3	15,897	357E+6

4.3 Target Achieved and Production Efficiency

In this research, the company's monthly target plan of garments items, achieved items, time and efficiency were also considered. After collecting the monthly basis data on target achieved, Standard Achieved hours, Clock hours, Efficiency were gathered with proper calculation and highlighted the actual fluctuations of efficiency, root level problems that hamper smooth productions, target achieved from January,'15 to May, '15 which is also a main concern in this study.

In Table 3, the information collected from the "Y" company is shown briefly,

TABLE 3
TARGET ACHIEVED AND PRODUCTION EFFIECIENCY

Month	Target Achieved (Average)	Standard Achieved Hour (Average)	Clock Hours (Average)	Efficiency % (Average)
January	765.7917	214.5058	442.8888	49.61%
February	903.2174	235.3826	425.7587	53.97%
March	1181.538	331.2258	473.1169	69.99%
April	1129.304	303.8165	446.4065	68.86%
May	731	223.4554	461.6446	49.43%

Using data from Table 3, two line graphs can be plotted for Target Achieved and Production Effiecieny (fig 8 & fig 9 respectively) from the month of January to May. The fluctuation in target Achieved and Efficiency month by month can be seen from the figures.

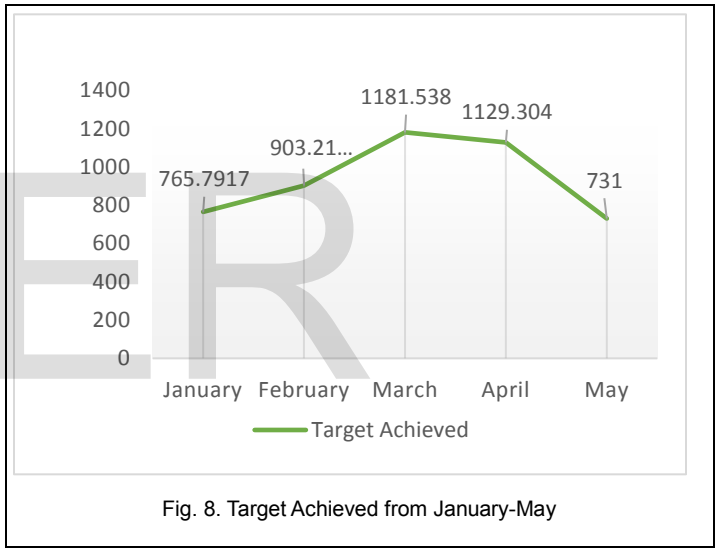

Fig. 8. Target Achieved from January-May

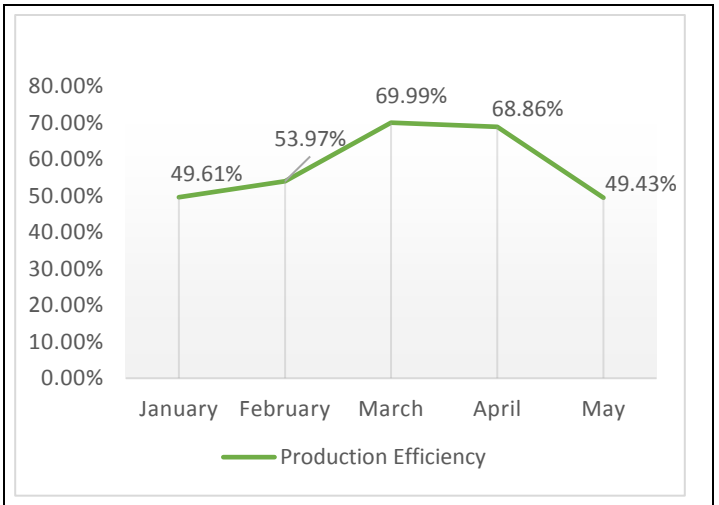

Fig. 9. Production Eficeiency from January-May

International Journal of Scientific & Engineering Research, Volume 7, Issue 10, October-2016
ISSN 2229-5518

Form Fig 8 and Fig 9 an upward trend can be observed from the month of January to March, where both Achieved Target and Production Effieceny were at their peak point. From March to April the trend remained almost steady in both charts but a sudden drop can be seen in the month of May. The maximum target was achieved in March, which is 1181.54 and the production effieciney was almost 70% which was also the highest production efficiency recorded.

5 Concluding Remarks

Supply Chain management (SCM) expresses managing the supply of 'inbound and outbound' goods and services in the most cost effectual and time responsive way. This can be done by designing a strategic route plan for the quickest possible pick-up and delivery regimen, from the appropriate suppliers, for all points throughout the congregation line, in order to achieve cost and time related efficiency levels in Bangladesh Garment Industry.

The Garment Industry (Apparel Industry) is an important and fundamental business sector in Bangladesh. For this ground, companies operating within this industry must then be able to initiate relevant business strategies that would assist sustainable growth of the clothing sector through Supply Chain Management (SCM). This resources that by modifying a few of the existing business actions of the Garment Companies, such as their Supply Chain Management (SCM) systems, unremitting advancement and expansion in the industry may be observed. This in turn may facilitate the formulation of a better Supply Chain Management (SCM) that would make a payment to the unremitting fruition of the Bangladesh Garment industry. By means of identifying the current supply chain management practices of some Bangladesh Garment Industries, business areas for upgrading can be acknowledgedA proposed layout was suggested for reducing idle time which was 66.7 seconds and made it 11.6 seconds through proposed layout. The indicators of 'Target achieved' and 'Production Efficiency' are also identified using the data collected from the company where the average Target achieved and Production Efficiency is 942.2 and 58.3% respectively daily. The lead time is minimized which directly affect the supply chain and makes it more efficient.

6 Future Areas to Research

Research on SAH for the proper process: Improvement in SAH (Standard Achieve Hour) will really increase the final output of any production.
Improvement on line balancing: An improved and balanced line increase productivity to a great length. Further work on Yamazumi or line balancing will help to optimize the process flow of any garments.
Visual Manufacturing system (VSM): Work on visual manufacturing system will really helpful to highlight the present conditions of the working flow.
Research on TPM: Already huge works are done on it, as it is the major obstacle for the disruption of normal process flow of operation. There can be more research on this topic for productivity improvement.
Focus on company nerve center: Delivery, Safety, Quality and Morale.
Study on loss time for time optimization: If loss time is managed to reduce, the total production time can be reduced.

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