AN EMPIRICAL STUDY OF PLANNING OF SUPPLY CHAIN MANAGEMENT (SCM) IN A KNIT COMPOSITE FACTORY

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ABSTRACT: Muhammad Mufidul Islam and Minhaz Ahmed, an empirical study of planning of supply chain management (scm) in a knit composite factory

The Purpose of the study is to show an empirical planning to maintain supply in the whole knit composite supply network. We have shown the importance of input and output balance in the raw materials that if we want a certain amount of output in a process than what should be the amount of inputs in each process considering its process loss% and that amount of raw material should be delivered to that particular machine. Moreover supply chain management has a strong relationship with machine arrangements, personnel management and last but not the least obviously inventory management. We have a plan here for manufacturing 100000 pieces T-shirt what should be the proper supply of raw materials to complete the order and within a possible lead time of 90 days

Key words: supply chain planning, textile supply chain management, lead time, input and output balance of raw materials.

INTRODUCTION

Supply chain management (SCM) is the management of the flow of goods and services. It includes the movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption (wiki/Supply chain management).
Here we have shown an empirical flow of SCM from a composite modern industry in Bangladesh.

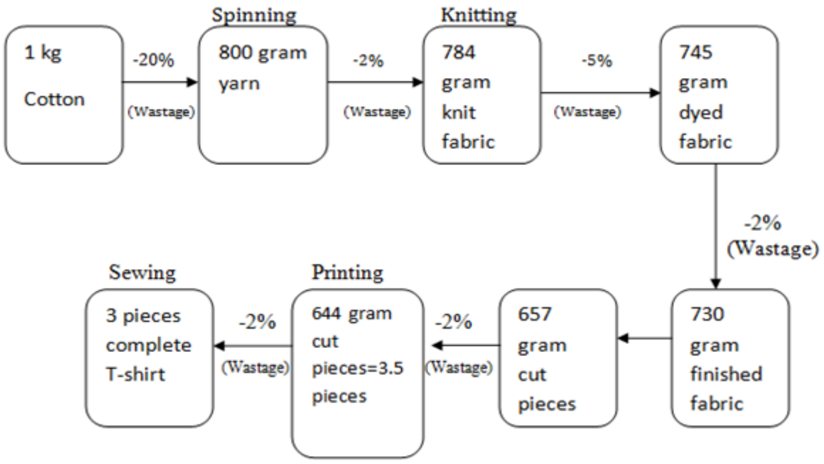

Figure-1: Flow diagram of supply of raw material

The Textile industry is a long chain including raw materials production, complement production, clothing production and so on. SCM concept is made possible as a conventional management tool for all manufactures are to strive to improve their product quality, to reduce their product and service cost and to shorten their product delivery and response time in a highly competitive market. The effective SCM of textile industry

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include lower inventories, lower costs, higher productivity, greater productivity, greater agility, shorter lead times, higher profits and greater customer loyalty. Supply Chain Management (SCM) is the coordinated set of techniques to plan and execute all steps in the global network used to acquire raw materials from vendors, transform them into finished goods, and deliver both goods and services to customers. It includes chain-wide information sharing, planning, resource synchronization and global performance measurements. The Textile industry is a long chain including raw materials production, complement production, clothing production and so on. SCM concept is made possible as a conventional management tool for all manufactures are to strive to improve their product quality, to reduce their product and service cost and to shorten their product delivery and response time in a highly competitive market.

Garmenting process consists of various stages including: Designing where various designs and their different variants based on the market trends, customer needs and demand forecasting are created. Companies either have their own designers or outsource from the various designer houses.
Garment industry confronts a major issue of very high lead time despite of its short life cycle and
volatile demand. Buying cycle for the garment products start generally in a year advance and the garment companies place and process their manufacturing orders for the garment products from 6 months to one year ahead of the coming seasons when the product is actually required and will be available in the stores for the sales (Mohammad Ali, September,2012).

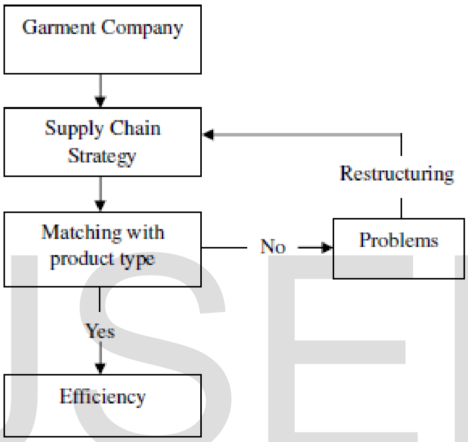
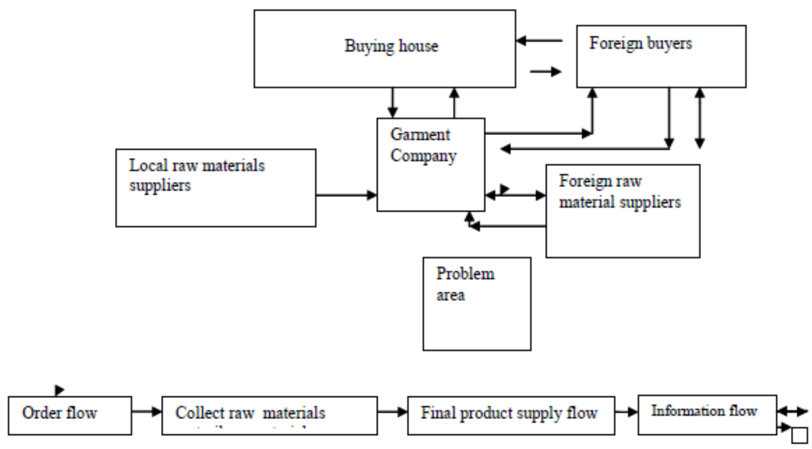


Figure 2: Strategic Supply Chain Framework

Supply chain management (SCM) has become a common tool for ensuring success of business organizations. A supply chain is an integrated manufacturing process wherein raw materials are converted into final products, then delivered to customers. The performance behavior of conjoined supply chains arises in web-based retail. Five performance measures, belonging to three performance measure classes, are used to study the performance effects of various operational factors on conjoined supply chains. The study is accomplished via experimental design and simulation analysis, and the results suggest the effects of the various factors on supply chain performance and identify the nature of the relationships among these factors and overall supply chain performance. A framework to promote a better understanding of the importance of SCM performance measurement and metrics was developed by using the current literatures and the results of an empirical study of selected British companies .To compete successfully in the global free trade market, the manufacturers must be adequately equipped with the latest knowledge of scientific management in minimizing lead time and other management deficiencies. All out support is required for this sector and it needs to build up the backward linkage industry to reduce the dependence on imported raw materials and to minimize lead-time. That is the supply chain performance should be enriched (Khan Md. Ariful Haque, 2005)

Basically they are performing cutting, making and trimming (CMT) activities. The RMG industry is highly dependent on imported raw material. About 90% of woven fabrics and 60% of knit fabrics are imported to make garments for export. That’s why this sector needs to maintain a long supply chain (backward and forward). Besides rudimentary application of ICT and inefficient port management limits its ability to respond quickly to market change, which is very essential in the fashion market. Therefore this industry takes maximum lead time to process an order. In BD the lead time for apparel export varies between 90-120 days, whereas the time for Sri Lanka is about 19-45 days, China 40-50 days and for India 50-70 days for similar products. Lam and Postle have reviewed the concept of supply chain management in textile and apparel supply chain management in Bangladesh.

The evolution of supply chain management occurred during the 1990s; at this time, collaboration between manufacturers and suppliers had been established in order to enhance traditional approaches in supply management functions. At the same time, retailers as well as wholesalers had integrated their logistics operations as well so as to achieve greater competitive advantages .In general there are five major elements in the apparels supply chain comprised of the processing raw materials into fiber , shipping thread and weaving fabric assembling finished products (often far away from point of sales) to goods to destination (often through in the traders and retail sales (in departments stores chains shops or boutique) . Harrison state that there are six processes in the simple apparels supplying china, design, raw materials purchases, manufacturing distribution retails sales (Mohammad Safiqul Islam)



Source: Nuruzzaman, 2007
Figure2: Business structure and raw materials collection process

From the above theory it is clear that the total lead time is customer lead time. Therefore we can Write that; Customer Supply time = [{Information supply time} + {Order lead time}] Total supply time = [{Information lead time} + {(manufacturing lead time) + (shipping time for import fabrics) + (Shipping time for export final product)}.

In this case they take help from local office or local agent. Therefore their average lead time is in between 90-120 days. At present the company is doing business successfully with "Corona" maintaining a minimum lead time. It is also possible to reduce 30 days in sample approval process by adopting normal sample approval process performed by other buyers or by encouraging the buyers to open a local office in Bangladesh. Considering the equation of lead time and putting value in that equation three types of buyer of this company can be analyzed (Mohammad Safiqul Islam).

Supply chain management (SCM) is an approach that has evolved out of the integration of these considerations. SCM is defined as the integration of key business processes from end user through original suppliers that provide products, services, and information and hence add value for customers and other stakeholders (Lambert et al., 1998). The concepts of supply chain design and management have become a popular business paradigm in these days. This has intensified with the development of information and communication technologies that include electronic data interchange (EDI), the Internet and World Wide Web (WWW) to overcome the ever-increasing complexity of the systems driving buyer-supplier relationships. The complexity of SCM has also forced companies to improve online network communication systems. This signifies the importance of communication and the application of IT in SCM. Information sharing between members of a supply chain using EDI technology should be increased to reduce uncertainty and enhance shipment performance of suppliers and greatly improve the performance of the supply chain system.

The followings are some of the problems often cited in the literature both by the researchers and practitioners when developing an IT-integrated SCM: lack of integration between IT and business model, lack of proper strategic planning, poor IT infrastructure, insufficient application of IT in virtual enterprise, and inadequate implementation knowledge of IT in SCM. There is no comprehensive framework available on the application of IT for achieving and effective SCM (Ha Jin Hwang, December, 2011)

MATERIALS AND METHODS

Table-01: Order summery

Buyer	Order No.	Item or Article	Fabrics	Quantity	Delivery Date

		category			
LIDL	115394	Men Short Sleeve T-Shirt	S/J 180 GSM Yarn count:28	1,00,000	16 May 2015

Lead time: 90 days
Size Ratio:
S: M: L = 3: 4: 3
Cartoon ratio=1:12
Initial 8 days + Last 7 days = Total 15 days

From 70 days we should keep 15 days in hand for inventory, Final Q.C & others

So, Operation Days remaining= (90-15) days =75 days

To achieve the target within lead time we have to produce 1334 Pcs T-shirt per day.

Fabric Required:

$$\text{Fabric consumption} = \frac{(\text{Body Length} + \text{Sleeve Length} + 10\text{ cm}) \times (\frac{1}{2}\text{Chest} + 3\text{ cm}) \times 2 \times \text{GSM}}{10000000} + \text{Wastage}\%$$

$$\text{Fabric consumption} = \frac{(70 + 24 + 8) \times (46 + 3\text{ cm}) \times 2 \times 160}{10000000} + 15\%$$

=0.189 kg per piece

So, for the daily production of 1334 pc, we need

=0.189X1334 kg

=252 kg

Yarn required:

Daily yarn require: 252+3% wastage

=260 kg

=260/2.5

=104 cones (Because each cone contains 2.5 kg yarn)

Knitting Plan:

Table-02: Available Knitting M/C:

M/C No.	M/C Diameter (D)	M/C Gauge (G)	No. Of Needles	No. Of Feeders
01	38	25	2984	114
06	36	25	2827	108
07	34	24	2563	102
08	32	24	2412	96

09	40	25	3141	120
10	**30**	**24**	**2261**	**90**
39	21	25	1649	63
40	26	24	1960	78
41	20	25	1570	60

Per machine/hour production in (kg)

$$= \frac{\pi DGN \times No.of\ feeders \times Stitch\ Length(mm) \times 60 \times Efficiency}{25 \times 36 \times Yarn\ count \times 840 \times 2.2}$$

Here,

D=Diameter of knitting machine

G= Machine gauge

N= Rotation Per Minute (RPM)

$$= \frac{3.1416X30X24X30X90X2.6X60X.80}{25 \times 36 \times 28 \times 840 \times 2.2}$$

=16.36 kg per hour

So, for the daily production of 252 kg we need = (252/16) hour

=16 hours

To knit daily production of 252 kg we can use M/C no. **10**

Dyeing Plan:

Table-03: Available Dyeing M/C

M/C No.	Nozzle	Capacity per nozzle (kg)	Total capacity(kg)
01	4	200	800
02	3	200	600
03	3	200	600
04	**2**	**200**	**400**
05	3	200	600
06	1	200	200
07	10	200	2000
08	3×2	200	1200
09	4×2	200	1600
10	6×2	200	2400

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To dye 252 kg fabric daily we can use M/C no. **04**

Dyeing Time:

12 hours required to dye this single batch i.e 252 kg

To achieve the daily target we have to dye at least 252 kg fabric daily to meet the requirement of sewing floor without any delay.

Finishing plan:

For slitting 252 kg fabric = 2 hr required
For stenter 252 kg fabric =3.5 hr required
For compacting 252 kg fabric = 4 hr require
To inspect 252 kg fabric = 2.5 hr required

Total time for finishing =12 hr
So, total 24 hr require for Dyeing & Finishing of single batch (252 kg)
24 hr or 1 day takes to go this 252 kg fabric batch from dyeing & finishing section to cutting section.

Cutting plan:

Relaxation time = 4 hr

Spreading

3 kg fabric requires 1 lay

So, 252 kg fabric requires = $\frac{252}{3}$ lays=84 lays

So, cutting table- **01** has to be selected for 2 hours for cutting & another 1 hour for sorting, separating & bundling.

So by 252 kg we can make (252/0.189) T-shirts

=1334pices T-shirts.

So Total time for cutting required=4+3=7 hours required to deliver the entire panels of 1334 pcs T-Shirt from cutting floor to printing section to run a single sewing line.

Printing plan:

2 screen motive design=1 minute/piece

Machine head=2

Drying unit=1

Total Capacity per hour= (no of heads X60X efficiency %) /complete time to print a single piece

= (4X60X.8)/3

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=64 piece /minute

So to print these 1334 pcs we need (1X1334)/64=20hours

Quality check & another formalities = 4 hours

Total Time= 24 hours

Sewing Plan:

Target production= 1334pc per day

To sew 1334 pc per day accessories are required

Thread consumption:

To sew 1 T-Shirt thread required=120 m
For 1334 pc total thread required=1334X120 m
=160080 m
No. of cone required=160080/4000 m [1 cone=4000m]
=40 cones
Main label, Size label, Care label required=1334+5% Extra
=1400 pc

Per hr production= (1334/10) pcs
=134 pcs (Target)

So, target production /hr/line= $\frac{No.of\ workersx60xEfficiency}{\mathrm{SMV}}$

Here, SMV=Standard Minute Value =5(to complete a garment)

$\Rightarrow 134 = \frac{Ax60x.60}{5}$(efficiency =60%)

$\Rightarrow$ A=28 [let, no. of workers=A]

No. of workers = 28

So, a line is required with 28 workers in a row

So, No. of M/C=28

No. of helpers=5

If line is balanced by 28 M/C & 5 helpers then we get 134 pc per hr& 1334 pcs

Per day (10 hr single shift)

After getting this 1334 pc it will go to the finishing section for inspection.

Packaging plan:

For 2000 pc T-Shirt

Joker tag required=1334+5%
=1400 pc
Tag pin required=1334+5%
=1400 pc
Poly bag required=1334+5%
=1400pc
Cartoon required:
If cartoon ratio is=1:12
Then cartoon required= (1334/12) +5%
=117 pc (3ply paper)

Result & Discussions:

1. To complete a production of 100000 piece T-shirt in just 75 days we need daily **252** Kgs fabric for which we have to book a machine for**16** hours and we have to arrange **104** numbers of cones in JIT inventory for creeiling in the knit machines daily
2. Then this **252**kgs fabric should kept in batch for distribution per nozzle(126kgs) in a **400** kgs capacity dyeing machine
3. Then the fabric should send to finishing section and there should plan for a stenter for **3.5**hours, compactor for **4** hours and **2.5** hours for 4 point inspection system.
4. Then this **252** kgs fabric should send to cutting section & **4** hours for relaxation, and then**1**cutting sequences for **3** hours and **1** numbers of cutting tables with **84** lays for 160GSM fabric.
5. Then the cut pieces should be delivered to printing section for **24** hours **2**head numbers printing machine.
6. Then the **1334** numbers of cut pieces should be provided to **1**sewing line for **10** hours with **1400** pieces labels, **40** pieces cones of sewing threads, **1400** pieces of poly bag and **11** pieces of cartons of 3ply numbers.
7. Thus these processes should be continued and inspection should be continued in both online & off-line Quality Control (Q.C.) basis.

Conclusion:

The major impact of our research is maintaining proper flow of raw materials for converting garments without any gap in the chain. Because in a continuous chain, if it is broken at any point then the whole chain is destroyed. So, raw material input calculating with proper and accurate process loss% is obvious in a composite factory. But the main limitation is the lack of efficient workers in each sector. At last, the strong impact of our study is to apply our planning in modern garment industries in order to complete the products within the lead time.

References

wiki/Supply chain management

Supply Chain Management of Textile Industry:A Case Study on BangladeshSeptember,2012*International Journal of Supply Chain Management*35-40

Performance Evaluation of Bangladeshi Apparel and Textile Supply Chain Network, A Case Study2005*Unpublished Masters Thesis, GBS, Gothenburg University*1-9

Supply Chain Management on Apparel Order Process:A Case Study In Bangladesh Garment Industry*Asian Journal of Business and Management Sciences*60-72

An Intelligent Supply Chain Management System to Enhance Collaboration in Textile IndustryDecember, 2011*International Journal of u- and e- Service, Science and Technology* 47-62