Aggregate Planning, MPS, And MRP Of A Textile Production

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Abstract

The textile industry in Bangladesh, constituting the major share of the GDP, is mostly dependent on the strength of experience and cheap labor rate. However, it is facing challenges in small-scale production due to outdated technology and high operating costs. This particular sector, renowned for its global textile manufacturing role, particularly in ready-made garments, fabric manufacturing can benefit from aggregate planning. By aligning production with demand, optimizing resource utilization, and managing inventory effectively, following this strategy small textile companies can overcome operational shortcomings. To conduct the analysis process, the actual data utilized for examination encompassed a total of 517 product requirements. ABC analysis was done based on four months' requirements to identify products that generate the majority of sales. This strategic approach led to the selection of 12 products, collectively contributing to 60% of the total requirements. MRP focuses on a select 12 products. While these products vary, the raw materials exhibit less diversity, with six types common to all. These raw materials are procured either locally or internationally. This study aims to explore the inclusion of aggregate planning in the textile industries of Bangladesh, evaluating its potential to significantly reduce costs and enhance overall production and material resource planning.

Keywords
Textile, Yarn, Dyeing, MRP, MPS, Aggregate Planning, Optimization, Cost minimization.

1. Introduction
The textile industry in Bangladesh stands as a cornerstone of the country's economy, renowned for its significant contributions to employment, export earnings, and industrial growth. It's one of the largest contributors to Bangladesh's GDP (28.1%) (Leadership and Democracy Lab - Western University, n.d.) and has played a pivotal role

in transforming the nation into a global textile manufacturing hub. The industry encompasses a wide range of activities, from yarn production to fabric manufacturing, dyeing, printing, and garment production. Bangladesh is well-known for its ready-made garments (RMG) sector, which has experienced exponential growth, making it one of the world's major exporters of clothing.

Small-scale textile production faces a multitude of challenges, ranging from operational deficiencies and outdated technological infrastructure to high production costs and inefficient systems. These companies often grapple with limited resources, leading to lower production capacities and operational inefficiencies. Outdated machinery and a lack of access to modern technological advance ments hinder productivity, while higher per-unit production costs impact their competitiveness. Inefficient computer systems further exacerbate the problem by impeding data management, inventory control, and process optimization. Moreover, inadequate time management due to streamlined processes affects production timelines and overall output (Niño-Gaona & Baeza-Serrato, 2017).
Aggregate planning plays a pivotal role in addressing the challenges faced by small-scale textile production. By strategically aligning production levels with demand, aggregate planning can significantly improve the overall situation for these companies. It enables a more efficient allocation of resources, optimizing workforce utilization, and managing inventory levels. Through effective aggregate planning, small textile companies can better synchronize their production schedules, reducing operational deficiencies and maximizing the utilization of available resources. This planning process helps streamline production, thus reducing costs and improving efficiency. Moreover, by forecasting demand and adjusting production accordingly, these companies can minimize inventory overheads, prevent shortages, and enhance overall time management.

The company's supply chain encompasses two distinct production processes and the procurement of raw materials. This project focuses on aggregating the production requirements for the two processes and determining the Material Requirements Planning (MRP) for the raw materials. Specifically, the project centers on the final stage of production, which involves the dyeing process. To facilitate this, an aggregate plan will be developed for the preceding production process, namely knitting, based on the dyeing requirements. Yarn, a crucial raw material, is utilized in the knitting process to manufacture greige fabric. Subsequently, after the dyeing process, the final product is produced. This integrated approach aims to streamline the production processes, ensuring a more efficient allocation of resources, optimizing the use of raw materials, and enhancing the overall effectiveness of the supply chain.

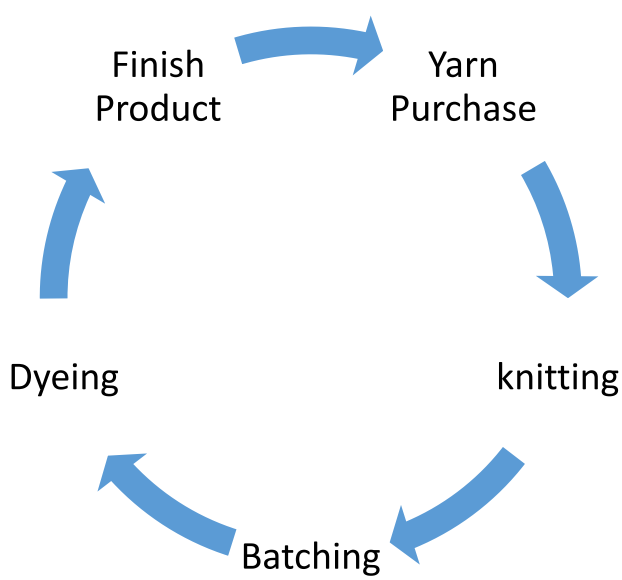

Figure 1. Production processes in scope.

2. Literature Review

The phenomenal growth of the garment industry in Bangladesh is widely known, due in no small part to the popular book by Easterly (2002) and an earlier paper by Rhee (1990). The industry now ranks among the largest garment exporters in the world. It accounts for 75% of the country's export earnings and provides ample job opportunities for females (Mottaleb et al., 2011) with this immense potential, the growth of this industry is facing bottlenecks in terms of inventory management, stock management, and production planning reliability. In this study, data from a small textile factory has been collected. Despite being a small textile factory, the owner's mindset is futuristic, and he aims for digitalization to reduce the loss that occurs yearly. From observation major obstacles are capacity constraints, lack of process optimization, lack of inventory management, and inadequate resources.

To deal with the issues this study focuses on studying the data and implementing aggregate planning to see the difference. Aggregate production planning (APP) is concerned with determining the optimum production and workforce levels for each period over the medium-term planning horizon. It aims to set overall production levels for each product family to meet fluctuating demand shortly (Cheraghalikhani et al., 2019). Based on the input data and objective functions, the structure of the APP model can be categorized into six main structural groups.

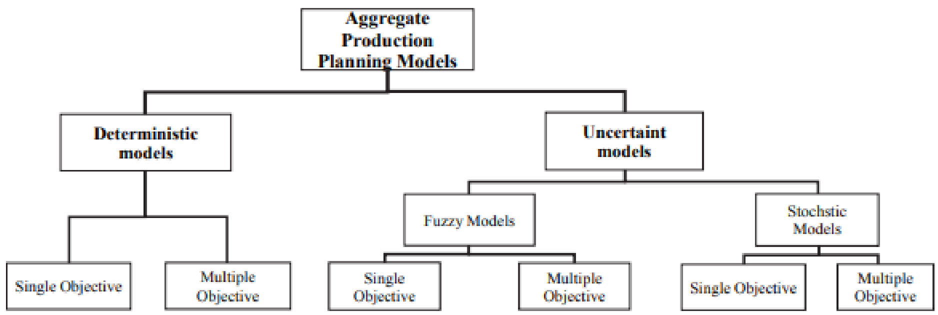

Figure 2. Structural groups for APP Models.

In this study, we will mostly focus on Structural group 1: Deterministic models with a single objective. Any APP model includes several parameters such as market demand, production costs, inventory costs, labor costs, subcontracting costs, production rate, backorder cost, subcontracting restriction, product capacity, product sales revenue, maximum labor level, maximum capital level, etc. These parameters are used in objective functions and constraints of the APP models. In deterministic models, all of these parameters are assumed to be known before planning. Deterministic models are divided into two subdivisions including single-objective and multiple-objective models. In real-world situations, APP problems normally involve multiple, conflicting, and incommensurable imprecise objective functions (Liang, 2007).

The overview of an MRP system is shown in the below figure,

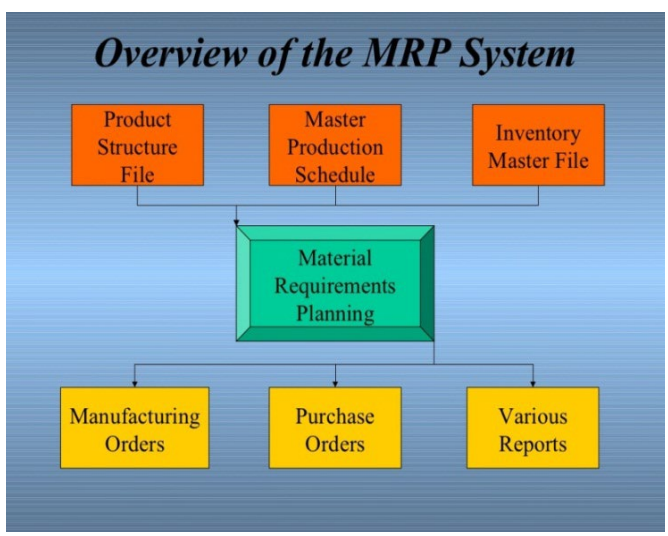

Figure 3. Material requirements planning (MRP) systems.

MRP Inputs: (a) Product Structure File (b) Master Production Schedule (C) Inventory Master File
(d) Manufacturing Orders (e) Purchase Orders (f) various Reports. In this study MRP will be used to find out the gross requirement, lot Sizes, net requirement Plan, planned order of a particular part in a particular period of time.

It is essential to discuss the manufacturing process of knitting and dyeing in this study as this study incorporates these two processes and aims to reduce the overall cost and to formulate the MPS tables based on different materials. In this case, 20% of the revenue stream occurs from first few materials (in terms of both knitting and dyeing.). The concept of pareto analysis has been applied here to decide the material importance, as the key materials that bring the most of revenue are focused on. Optimizing these material dyeing and knitting causes will help to optimize the majority of the cost. A similar study can be found by Chandna and Chandra, 2009. They did a study on forging operation that produces cylinder crankshafts, which are used in buses and trucks. They used Pareto diagrams to find and identify critical areas and forging defects of the crankshaft. In their study, the corrective measures reduce the rejection rate from 2.43% to 0.21%. Khekalei et al., 2010. In this study same idea is used to optimize the process cost focusing on the major revenue-bringing materials.

The MRP study has been conducted, and MRP has been a prominent tool that is being used in the textile industry of Bangladesh. But the obstacle is the right usage of the tool. Even though in most of industries the tool has been implemented and a database system has been established as well, due to the lack of proper maintenance the desired result is yet to be realized. MRP does not need to run head-to-head in competition with any other system on their area of strength. However, even in a repetitive environment, MRP can be made much more competitive by adjusting the usage errors that are now incorporated into the MRP (Plenert, 1999). Since this study's purpose is to implement APP and MRP to optimize the process, the objective function will be related to cost minimization. Within this study, Master production schedule (MPS) will also be discussed.

3. Mathematical Model

A mathematical model has been devised to optimize the collaboration between two production units, namely dyeing and knitting. The primary objective is to determine the most cost-effective solution for the overall production process. The relevant parameters and the objective function are outlined below for enhanced clarity:

Parameters

Production costs for Dyeing (c1)	= $ 1.0 /unit
Production costs for Knitting (c2)	= $ 0.5 /unit
Holding costs for Dyeing (i1)	= % 0.15
Holding costs for Knitting (i2)	= % 0.15
Subcontracting costs for Dyeing (b1)	= $ 4 /unit
Subcontracting costs for Knitting (b2)	= $ 2 /unit
Dyeing Production capacity /day	= 25,000 units/day
Knitting Production capacity /day	= 36,000 units/day
Starting stock for Dyeing	= 61,469 units
Starting stock for Knitting	= 80,257 units
Final stock required for Dyeing (t=4)	= 60,000 units
Final stock required for Knitting(t=4)	= 80,000 units

Demands for Dyeing (D1t) =

804,005 + %6 redye
639,149 + %7 redye
742,919 + %8 redye
885,347 + %8 redye

for t = 1, … , 4

Demands Knitting Dt =

804005
639149
742919
885347

for t = 1, … , 4

Decision Variables
For t = 1, ..., 4 (June to September)

X1t = Dyeing Production of in month t
X2t = Knitting Production of in month t
H1t = Dyeing Inventory held for at the end of month t
H2t = Knitting Inventory held for at the end of month t
S1t = Amount subcontracted for Dyeing in month t
S2t = Amount subcontracted for Knitting month t

Objective Function

to minimize total cost
(No labor cost and No production cost is considered in the question)

- Cost of Production
- Cost of Inventory
- Cost of Sub-contracting

Model:

$$\begin{aligned} Min\,Z = &\ \mathrm{c1}.X1_1 + \mathrm{c1}.X1_2 + \mathrm{c1}.X1_3 + \mathrm{c1}.X1_4 \\ &+ \mathrm{c2}.X2_1 + \mathrm{c2}.X2_2 + \mathrm{c2}.X2_3 + \mathrm{c2}.X2_4 \\ &+ \mathrm{i1}.H1_1 + \mathrm{i1}.H1_2 + \mathrm{i1}.H1_3 + \mathrm{i1}.H1_4 \\ &+ \mathrm{i2}.H2_1 + \mathrm{i2}.H2_2 + \mathrm{i2}.H2_3 + \mathrm{i2}.H2_4 \\ &+ \mathrm{b1}.S1_1 + b1.S2_2 + \mathrm{b1}.S1_3 + \mathrm{b1}.S1_4 \\ &+ \mathrm{b2}.S2_1 + \mathrm{b2}.S2_2 + \mathrm{b2}.S2_3 + \mathrm{b2}.S2_4 \end{aligned}$$

S.t.

Inventory & production flow constraints

$X1_t + S1_t + H1_{t-1} - H1_t - D2_t = 0$ for t = 1, …, 4 (June to September)
$X2_t + S2_t + H2_{t-1} - H2_t - D2_t = 0$ for t = 1, …, 4 (June to September)
$H1_0 = 61469$
$H2_0 = 80257$
$\boldsymbol{H1_4 = 60000}$
$\boldsymbol{H2_4 = 80000}$

Capacity constraints

$X1_1 - 30 * 25000 \leq 0$ (June capacity)
$X1_2 - 31 * 25000 \leq 0$ (July capacity)
$X1_3 - 31 * 25000 \leq 0$ (Aug capacity)
$X1_4 - 30 * 25000 \leq 0$ (Sept capacity)
$X2_1 - 30 * 36000 \leq 0$ (June capacity)
$X2_2 - 31 * 36000 \leq 0$ (July capacity)
$X2_3 - 31 * 36000 \leq 0$ (Aug capacity)
$X2_4 - 30 * 36000 \leq 0$ (Sept capacity)

$X1_t, X2_t, H1_t, H2_t, S1_t, S2_t \geq 0$

4. Results and Discussion

The aggregate planning is executed through Excel Solver, incorporating three distinct conditions. Initially, the solution is derived to meet the specified final inventory requirements for both production units. The second condition ensures parity between the inventories in the aggregate planning and the actual data. Lastly, the third solution is crafted to achieve a scenario where no inventory remains for the production units. This methodical approach enables a comprehensive exploration of various planning scenarios, enhancing the versatility and robustness of the analysis.

Table 1**.** Aggregate planning with meeting last inventory requirements.

DEC VARs	**X_1t**	**X_2t**	**H_1t**	**H_2t**	**S_1t**	**S_2t**
			61469	80257		
June	790776.75	750000.00	0.00	26251.58	0.00	0.00
July	683888.94	775000.00	0.00	162103.04	0.00	0.00
August	802352.65	775000.00	0.00	194183.92	0.00	0.00
September	1016174.97	750000.00	60000.00	80000.00	0.00	21163.28
Total	**3293193.30**	**3050000.00**	**60000.00**	**462538.54**	**0.00**	**21163.28**

The aggregate planning solution presents a total cost of $4,861,303.66, in contrast to the actual production cost of $5,021,069.76. This reflects a notable 3.18% improvement, equivalent to approximately $159,766.09. The effectiveness of the aggregate planning solution is underscored by its ability to generate cost savings, providing a practical and financially advantageous alternative to the actual production cost.

Table 2**.** Aggregate planning with same inventory with actual

DEC VARs	**X_1t**	**X_2t**	**H_1t**	**H_2t**	**S_1t**	**S_2t**
			61469	80257		
June	790776.75	750000.00	0.00	26251.58	0.00	0.00
July	683888.94	775000.00	0.00	162103.04	0.00	0.00
August	802352.65	775000.00	0.00	194183.92	0.00	0.00
September	970942.16	750000.00	14767.18	140516.72	0.00	81680.00
Total	**3247960.49**	**3050000.00**	**14767.18**	**523055.26**	**0.00**	**81680.00**

Opting for a solution that maintains the same final inventory as the actual production yields a commendable 1.67% improvement, equivalent to $83,942. While this solution showcases notable progress, it's crucial to weigh its benefits against other factors. Balancing considerations such as practicality and overall effectiveness will aid in determining the most optimal solution for aggregate planning.

Table 3**.** Aggregate plan solution with no inventory

DEC VARs	**X_1t**	**X_2t**	**H_1t**	**H_2t**	**S_1t**	**S_2t**
			61469	80257		
June	790776.75	723748.42	0.00	0.00	0.00	0.00

July	683888.94	742414.86	0.00	103266.32	0.00	0.00
August	802352.65	775000.00	0.00	135347.20	0.00	0.00
September	956174.97	750000.00	0.00	0.00	0.00	0.00
Total	**3233193.30**	**2991163.28**	**0.00**	**238613.51**	**0.00**	**0.00**

The final solution demonstrates a noteworthy 5.81% enhancement, equivalent to $291,936.89. While this solution stands out as the most practical option, it's essential to recognize that concluding a production period without any remaining inventory may not be ideal. Additionally, considering the improved required inventory, the optimal choice is to adopt the first solution for aggregate planning, striking a balance between practicality and maintaining a sufficient inventory level at the end of the period.

4.1 MPS of the product requirements

To streamline the analysis process, the actual data utilized for examination encompassed a total of 517 product requirements. Given the extensive nature of reporting individual MPS for each product, an ABC analysis was conducted based on four months' requirements to identify high-impact products. This strategic approach led to the selection of 12 products, collectively contributing to 60% of the total requirements, for the creation of the Master Production Schedules (MPS), only 3 of them were reported here and the rest of them are given in the excel file.

Table 4. ABC analysis of the products based on their forecasting or requirements.

Fab Type	**Fab Composition**	**June**	**July**	**August**	**September**	**%**	**Cumulative %**
Lycra Single Jersey	95% BCI Cotton 5% Spandex	137526	85688	73556	85578	12%	12%
1X1 Rib	100% Organic Cotton	61234	56756	70751	115013	10%	22%
Lycra Single Jersey	97% BCI Cotton 3% Spandex	40625	33125	109576	118612	10%	32%
Single Jersey	75% Organic Cotton 25% Recycle Cotton	51515	30210	37838	30076	5%	37%
Single Jersey	100% BCI Cotton	39501	16702	37503	19870	4%	41%
1X1 L-Rib	97% Organic Cotton 3% Spandex	27835	27968	30339	45925	4%	45%
1X1 Rib	75% Organic Cotton 25% Recycle Cotton	27583	24127	18777	24445	3%	48%
Lycra Single Jersey	90% BCI Cotton 10% Spandex	24764	15331	24340	3935	2%	50%
Single Jersey	100% Cotton	23953	16498	32076	28286	3%	54%
Single Jersey	100% AUS Cotton	23266	15859	1700	2926	1%	55%
Lycra Single Jersey	95% Organic Cotton 5% Spandex	22779	19729	18291	30095	3%	58%
2X2 L-Rib	95% Organic Cotton 5% Spandex	16713	12936	12696	29372	2%	60%

Separate Master Production Schedules (MPS) are devised for the dyeing and knitting units, considering their distinct data and inventory levels. Among the total of 12 products, the initial three products collectively constitute 32% of the overall requirements, and their respective MPS details are furnished in the project report.

4.2 MPS Dyeing

Table 5. MPS dyeing for product 1

Product	**Lycra Single Jersey 95% BCI Cotton 5% Spandex**											
Initial Inventory	**June**				**July**				**August**			
30231												
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Forecast or Requirement	34381	34381	34381	34381	21422	21422	21422	21422	18389	18389	18389	18389
Customer Orders (Commited)	34381	34381	24067	17191	4284							
Projected on hand inventory	30231	30231	30231	30231	8809	8809	8809	8809	8809	8809	8809	8809
MPS	34381	34381	34381	34381	0	21422	21422	21422	18389	18389	18389	18389
ATS	30231	0	10314	17191		21422	21422	21422	18389	18389	18389	18389

Table 6. MPS dyeing product 2

Product	**1X1 Rib 100% Organic Cotton**											
Initial Inventory	**June**				**July**				**August**			
16561												
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Forecast or Requirement	15308	15308	15308	15308	14189	14189	14189	14189	17688	17688	17688	17688
Customer Orders (Commited)	15308	15308	10716	7654	2838							
Projected on hand inventory	16561	1253	1253	1253	1253	1253	1253	1253	1253	1253	1253	1253
MPS	15308	0	15308	15308	14189	14189	14189	14189	17688	17688	17688	17688
ATS	16561		4593	7654	11351	14189	14189	14189	17688	17688	17688	17688

Table 7. MPS dyeing product 3

Product	**Lycra Single Jersey 97% BCI Cotton 5% Spandex**											
Initial Inventory	**June**				**July**				**August**			
9458												
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Forecast or Requirement	10156	10156	10156	10156	8281	8281	8281	8281	27394	27394	27394	27394
Customer Orders (Commited)	10156	10156	7109	5078	1656							
Projected on hand inventory	9458	9458	9458	9458	1177	1177	1177	1177	1177	1177	1177	1177
MPS	10156	10156	10156	10156	0	8281	8281	8281	27394	27394	27394	27394
ATS	9458	0	3047	5078		8281	8281	8281	27394	27394	27394	27394

4.3 MPS Knitting

Table 8. MPS knitting product 1

Product	**Lycra Single Jersey 95% BCI Cotton 5% Spandex**											
Initial Inventory	**June**				**July**				**August**			
44352												
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Forecast or Requirement	34381	34381	34381	34381	21422	21422	21422	21422	18389	18389	18389	18389
Customer Orders (Commited)	34381	34381	27505	25442	7498	5784						
Projected on hand inventory	44352	9971	9971	9971	9971	9971	9971	9971	9971	9971	9971	9971
MPS	34381	0	34381	34381	21422	21422	21422	21422	18389	18389	18389	18389
ATS	44352		6876	8939	13924	15638	21422	21422	18389	18389	18389	18389

Table 9. MPS knitting product 2

Product	**1X1 Rib 100% Organic Cotton**											
Initial Inventory	**June**				**July**				**August**			
18523												
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Forecast or Requirement	15308	15308	15308	15308	14189	14189	14189	14189	17688	17688	17688	17688
Customer Orders (Commited)	15308	15308	12247	11328	4966	3831						
Projected on hand inventory	18523	3215	3215	3215	3215	3215	3215	3215	3215	3215	3215	3215
MPS	15308	0	15308	15308	14189	14189	14189	14189	17688	17688	17688	17688
ATS	18523		3062	3980	9223	10358	14189	14189	17688	17688	17688	17688

Table 10. MPS knitting product 3

Product	**Lycra Single Jersey 97% BCI Cotton 5% Spandex**											
Initial Inventory	**June**				**July**				**August**			
11172												
Week	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Forecast or Requirement	10156	10156	10156	10156	8281	8281	8281	8281	27394	27394	27394	27394
Customer Orders (Commited)	10156	10156	8125	7516	2898	2236						
Projected on hand inventory	11172	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016	1016
MPS	10156	0	10156	10156	8281	8281	8281	8281	27394	27394	27394	27394
ATS	11172		2031	2641	5383	6045	8281	8281	27394	27394	27394	27394

In the outlined Master Production Schedules (MPS), the weekly lot size is determined in accordance with monthly requirements. Given the nature of textile production, where output is closely tied to order quantities, the lot size is strategically chosen based on production needs and the specific quantity to be manufactured. This approach ensures alignment with order demands and facilitates efficient production planning.

4.5 MRP of the raw material (yarn) based on MPS

Given the complexity of managing numerous products, our MRP focuses on a select 12 products. While these products vary, the raw materials exhibit less diversity, with six types common to all. These raw materials are procured either locally or internationally, with sources including countries like India and China. Local materials boast a quicker delivery time of approximately 3 weeks, whereas foreign-sourced materials require a longer lead time of 4 to 5 weeks. In our MRP process, we account for both sources, aligning with available requirements and lead times, and release planned orders accordingly.

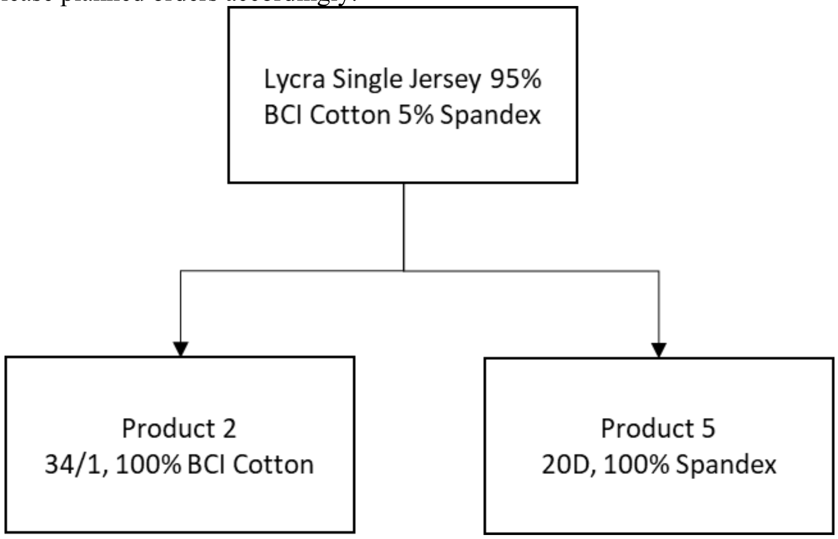

Figure 4. Sample bill of material

Table 11**.** MRP Product 1

Product	**34/1, 100% Organic Cotton**											
Period	1	2	3	4	5	6	7	8	9	10	11	12
Gross Requirement	46268	0	46268	46268	38917	38917	38917	38917	43019	43019	43019	43019
Scheduled Receipts												
Onhand from Prior period	98568	52300	52300	6031	0							
Net Requirements	0	0	0	40237	38917	38917	38917	38917	43019	43019	43019	43019
Time Phased net requirement	40237	38917	38917	38917	38917	43019	43019	43019	43019			
Panned order releases	40237	38917	38917	38917	38917	43019	43019	43019	43019			

Table 12**.** MRP product 2

Product	**34/1, 100% BCI cotton**											
Period	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Gross Requirement	57961	0	57961	57961	36009	36009	36009	36009	58894	58894	58894	58894
Scheduled Receipts		20000	20000	20000								
Onhand from Prior period	85000	47039	67039	29078	0							
Net Requirements	0	0	0	28883	36009	36009	36009	36009	58894	58894	58894	58894
Time Phased net requirement	28883	36009	36009	36009	36009	58894	58894	58894	58894			
Panned order releases	28883	36009	36009	36009	36009	58894	58894	58894	58894			

Table 13. MRP product 3

Product	**34/1, 100% Cotton**											
Period	1	2	3	4	5	6	7	8	9	10	11	12
Gross Requirement	5988	0	5988	5988	4124	4124	4124	4124	8019	8019	8019	8019
Scheduled Receipts												
Onhand from Prior period	20000	14012	14012	8023	2035	0						
Net Requirements	0	0	0	0	2089	4124	4124	4124	8019	8019	8019	8019
Time Phased net requirement	0	2089	4124	4124	4124	8019	8019	8019	8019			
Panned order releases	0	2089	4124	4124	4124	8019	8019	8019	8019			

Table 14. MRP product 4

Product	**34/1, 100% AUS Cotton**											
Period	1	2	3	4	5	6	7	8	9	10	11	12
Gross Requirement	5816	0	5816	5816	3965	3965	3965	3965	0	0	0	425
Scheduled Receipts												
Onhand from Prior period	17449	11633	11633	5816	0	0						
Net Requirements	0	0	0	0	3965	3965	3965	3965	0	0	0	425
Time Phased net requirement	3965	3965	3965	3965	0	0	0	425				
Panned order releases	3965	3965	3965	3965	0	0	0	425				

Table 15. MRP product 5

Product	**20D, Spandex**											
Period	1	2	3	4	5	6	7	8	9	10	11	12
Gross Requirement	3345	0	3345	3345	2321	2321	2321	2321	2965	2965	2965	2965
Scheduled Receipts												
Onhand from Prior period	17689	14344	14344	10998	7653	5332	3011	691				
Net Requirements	0	0	0	0	0	0	0	1630	2965	2965	2965	2965
Time Phased net requirement	0	0	0	13489								

Panned order releases	0	0	0	13489								

Table 16**.** MRP product 6

Product	**34/1, Recycle Cotton**											
Period	1	2	3	4	5	6	7	8	9	10	11	12
Gross Requirement	4944	0	4944	4944	3396	3396	3396	3396	3538	3538	3538	3538
Scheduled Receipts												
Onhand from Prior period	9980	5036	5036	93								
Net Requirements	0	0	0	4851	3396	3396	3396	3396	3538	3538	3538	3538
Time Phased net requirement	4851	3396	3396	3396	3396	3538	3538	3538	3538			
Panned order releases	4851	3396	3396	3396	3396	3538	3538	3538	3538			

The Material Requirements Planning (MRP) calculations have been devised using a lot-for-lot approach for products 1 to 6. However, product 5 is uniquely handled by consolidating the last total amount. This strategic decision is driven by the consideration that the individual amounts are relatively small, and the production time for this product is extended. Furthermore, each order entails the opening of a Letter of Credit (LC), incurring additional costs. By combining the quantities, the process becomes more efficient and cost-effective.

The overarching MRP analysis underscores the potential benefits of adopting a hybrid sourcing strategy involving both local and foreign suppliers. The rationale behind this recommendation lies in the cost advantages associated with foreign sourcing. To implement this, it is suggested to procure the material requirements for July and August from foreign suppliers. This aligns with the notion that at the commencement of the planning period, a comprehensive MRP can be executed, allowing for meticulous planning and timely foreign orders.
In essence, a nuanced approach that combines lot-for-lot strategies with the consolidation of smaller quantities and a dual-sourcing strategy can enhance overall efficiency, reduce costs, and streamline the Material Requirements Planning process.

5. Conclusion
The textile industry faces increasing global competition, necessitating the implementation of effective strategies for cost minimization. To remain competitive on the world stage, textile companies must explore avenues to reduce costs while meeting customer demands promptly. This project aims to demonstrate the applicability of aggregate planning in the textile industries of Bangladesh, showcasing its potential to significantly reduce costs and enhance overall production and material resource planning.

The proposed solution suggests that by employing aggregate planning methods, textile industries can achieve substantial cost savings. This approach not only optimizes production but also enhances efficiency in material resource management. However, it is important to note that the model presented in this project may benefit from further refinement by incorporating additional variables and parameters to enhance accuracy and precision.
In future research endeavors, considerations should extend to exploring scheduling techniques to refine the planning process further. Updating the overall mathematical model can contribute to achieving superior results. As the industry evolves, continuous efforts to integrate advanced methodologies will be crucial for maintaining a competitive edge in the global textile market.

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