Lead Time Reduction in Transportation of Packaging Materials and Production Scheduling and Region-wise Allocation at Nestle India Limited, Nanjangud

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Comments by the Faculty

Logistics and Supply Chain Management is now a dominant area of Operations Management and in particular all the activities that are not adding value but incur costs are under scanner to ascertain their role and contribution. Warehousing of materials and items is one such activity which was traditionally considered to be a non-value adding activity but has been now relooked and observed to be helping in improving the overall functioning of material retrieval and movement reducing internal lead time. This improves the efficiency of the operations and improves the overall turn around time. A study conducted at Nestle, India, clearly demonstrates how warehouse management can help in reducing the lead time.

The present study focusses on four aspects namely Packaging material inward and outward, Cycle time, Current aisle utilization, Pallet configuration. There are five aisles currently being utilized for storing the packaging materials. Out of the 5 Aisles viz. A, B, C, D, E and F, only A, B and C were considered for deployment of prioritized packaging materials. Each Aisle has 35 bins in total, with each bin having 3 floors for storing the pallets. Each floor of the bin can accommodate 6 pallets.

The following are the priority flows for arrangement of packaging materials in the Aisles A, B and C: A1 to A13, B1 to B13 & C1 to C13**.** The time taken by the fork lift operator to transport the Case Corrugated HALB shipper from Rack A1 to Bulk Area was monitored and the fork lift operator took 55 seconds as against 66 seconds when carrying the load, and 29 seconds to return as against 40 seconds. There was *26%* of reduction in total time taken in transporting the packaging material and returning to the aisle.

In the second part of the study, the focus is on production scheduling based on the changing demand pattern and developing an aggregate plan. Arriving at the right amount of supply for a sales channel or customer in a particular week is the most important strategy to drive the allocation plan. This is usually based on targets days/weeks of inventory that are derived keeping in view the sales plans, customer importance and delivery lead times. Setting allocation priorities is the next key parameter. The objective of this study was to make a decision model which in an optimal way aids in production and allocation of noodles' units to various distribution centers.

The current method of scheduling and allocation of noodles SKUs is based on historical data. The mathematical model developed aims at giving the production and allocation numbers in advance and accuracy at the beginning of the month enabling the production and supply chain departments to align their activities accordingly. This model takes into account the constraints on the run length, number of units, and capacity requirements. This helps in a smooth production plan and improves the bottom line of operations.

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Prologue:

The SIP carried out at Nestle India Limited comprises two parts: Part A - Lead time reduction in transportation of packaging materials in Coffee Warehouse and Part B - Production scheduling and region-wise allocation of Maggi Stock Keeping Units. Considering the nature of work the two parts are separately dealt with individual abstract, details, and discussion of results followed by conclusion.

Introduction

In any supply chain, the materials or items will undergo storage either in the beginning, or during transit, or at the end of the chain before reaching the next stage or the customer. Activities of the warehouse are aimed at keeping materials in good conditions for future use, (Addy-Tayie, 2012). Other objectives include optimum space utilization, improved material handling, efficient transportation and proper shelter for the materials and items procured or produced. All these actions are to be managed to make the warehouse worthwhile of its existence and justifiable of investment.

In the past, warehouses were referred to as cost centres and rarely adding value to the product, (Addy-Tayie, 2012). But the increasing need for transfer of products across cities, countries and continents, the growth in e-commerce, and increasing demands from end users, have brought a change about the perception of warehouses. They are considered as vital components within today's supply chain. The functions of warehousing include stockpiling, stock mixing, trans-loading, and contingency protection (Mentzer, 2006). Many warehouses have separate areas for bulk storage of large quantities, for order pick storage, and for smaller quantities or smaller units of measure. Order picking happens when products are retrieved from storage and inventory records are updated. The order picking area is replenished from bulk stock area as quantities are depleted upon filling the orders.

Transportation in Warehouses

Warehouses typically use several types or combinations of material handling equipment for different volumes and varieties of handling. Fork-lift trucks are the workhorses of most of the warehouses. They come in different sizes depending on their lift capacity and lift heights. Consequently, different fork-lift trucks are used in different warehouses depending on the mode of operation. Figure 1 depicts a typical forklift. Forklift trucks are designed mainly for lifting and transporting pallets. The effective storage of goods in warehouse normally involves the stacking of pallets, and their transportation or movement is made possible by fork-lift trucks.

Figure 1. Typical fork lift truck

Types of Fork-Lift Trucks

Different types of forklifts are as follows:

- Counterbalanced fork-lift trucks.
- Reach Trucks
- Narrow aisle Truck
- Hand pallet truck
- Powered pallet truck
- Multi-riser picking truck
- Articulated fork truck.

About Nestle

Nestlé is the world's leading Nutrition, Health and Wellness Company that continues to delight consumers and create economic value for society. Its mission of "Good Food, Good Life" is to provide consumers with the best tasting, most nutritious choices in a wide range of food and beverage categories and eating occasions, from morning to night.

Nestlé India's first production facility, set up in 1961 at Moga (Punjab), was followed soon after by its second plant, set up at Choladi (Tamil Nadu), in 1967. Consequently, Nestlé India set up factories in Nanjangud (Karnataka), in 1989, and Samalkha (Haryana), in 1993. This was succeeded by the commissioning of two more factories - at Ponda and Bicholim, Goa, in 1995 and 1997 respectively. The seventh factory was set up at Pantnagar, Uttarakhand, in 2006. The 8th Factory was set up at Tahliwal, Himachal Pradesh, in 2012.

Use of Fork-Lifts at Nestle

The Nestlé supply chain management department at Nanjangud, India, uses fork-lifts for in-house transportation of raw materials, packaging materials, work-In-progress inventory as well as finished goods. The Fork-lifts move along a defined path and are operated on an average for about 8 hours in a day. The Fork-lifts carry pallets from warehouse to production area or the

co-packer transportation area depending on the stage of the production the goods are in. Nestle has outsourced a part of its packaging activity its co-packers who are located around Nanjangud. Also, Fork-lifts are involved in carrying load from trucks which return from co-packer units and place the packaged finished goods at the quality check area.

Problem Statement

There was an inherent delay in the overall process of transporting the packaging material from point A to point B within the warehouse and Supply Chain Management department at Nestlé Factory, Nanjangud and there was an opportunity to reduce the overall time taken to transport the packaging units by efficiently arranging the Packaging materials. The objective was to reduce the lead time for transportation of packaging materials to the production/staging area.

Methodology

After spending sometime on understanding the problem, the relevant data to be collected was identified and previous months' data was collected. In order to understand the layout of the Coffee warehouse, many visits were made and the sections for placement of packaging material were prioritized.

The following information was prepared for data analysis:

- Packaging material inward and outward
- Cycle time
- Current aisle utilization
- Pallet configuration

After the aforementioned data was collected and organized, data analysis was done and the following data was compiled for inference and recommendation:

- Inward palletization
- Outward palletization
- Average daily movement of pallets for each packaging material

Ranking of packaging inventory was the next task and the following lists were prepared:

- Pallet movement
- Pallet utilization

Post data analysis the following factors were decided as the ones which would help in virtual aisle utilization and arrangement of packaging material:

- Inward pallet movement
- Outward pallet movement
- Movement of pallets on the basis of Standard cycle time

Sampling

Inward and Outward palletization data from the month of September ’13 till March ’14 was taken into consideration. The pallet utilization figures for the month of March ’14 was considered.

Following information was used:

1. List of packaging materials
2. Inward palletization
3. Outward palletization
4. Standard Cycle Time of Packaging materials

Prioritization

As directed by the Nestlé SCM team, “Case Corrugated” packaging material was given priority for rearrangement, as this type of packaging material was the one which had the highest movement. Also, only three Aisles viz. A, B and C were to be considered for this particular study.

Summary of Findings

Overall ranking of Packaging materials in terms of Pallet utilization

1. Jar Glass Dawn Dia 67mmxHeight107mm
2. Case Corrugated 485x285x385mm
3. Jar Glass Asean NESCAFE CLASSIC 25g N1
4. Pallet Plastic PP 1100 x1100x150mm
5. Jar Glass Dawn NESC CLASSIC 100g Local
6. Clsr Plas NESECLAS 50g Wad new artwork
7. Case Corrugated Type R 485x285x210mm
8. Case Corrugated Type U with Z - Type partition
9. Case Corrugated common HALB shipper
10. Case Corrugated Type A 475x380x185mm SIPM

Overall ranking of Packaging materials in terms of Pallet movement

1. Case Corrugated 485x285x385mm
2. Jar Glass Dawn Dia 67mmxHeight107mm
3. Jar Glass Dawn NESC CLASSIC 100g Local
4. Case Corrugated 380x315x255mm

5. Jar Glass Dawn NESC CLASSIC100g Imported

6. Fitment Corrugated 280x237x380mm

7. Case Corrugated Type R 485x285x210mm

8. Case Corrugated common HALB shipper

9. Case Corrugated Type U with Z - Type partition

10. Case Corrugated Type A 475x380x185mm SIPM

Jar Glass Dawn 67mmx107mm used the maximum number of pallets which was 2695 pallets**. Case Corrugated 485x285x385mm** was the most moved packaging material with around 402 Pallets. While **Case Corrugated NESC Cappuccino 15g Instant pack** was the least moving of all Case Corrugated packaging materials. Also, three out of top ten most moved packaging materials are 'Jars' and which are as follows:

- Jar Glass Asean NESCAFE CLASSIC 25g N1
- Jar Glass Dawn Dia 67mmxHeight107mm
- Jar Glass Dawn NESC CLASSIC 100g Local

Arrangement of Packaging Materials

Configuration of Aisles

There are five aisles currently being utilized for storing the packaging materials. Out of the 5 Aisles viz. A, B, C, D, E and F, only A, B and C were considered for deployment of prioritized packaging materials. Each Aisle has 35 bins in total, with each bin having 3 floors for storing the pallets. Each floor of the bin can accommodate 6 pallets.

The following are the priority flows for arrangement of packaging materials in the Aisles A, B and C: **A1 to A13, B1 to B13 & C1 to C13**

Aisle A

Rack ID	Material Codes	Number of Pallets	Percentage Utilization of Rack	Material Type
A1	43446973	18	100%	Case Corrugated common HALB shipper
A2	43446973	18	100%	Case Corrugated common HALB shipper
A3	43446973	4	22%	Case Corrugated common HALB shipper
A4	43518743	18	100%	Case Corr 485x285x385mm
A5	43518743	8	44%	Case Corr 485x285x385mm
A6	43520175	18	100%	Case Corr 380x315x255mm
A7	43520175	4	22%	Case Corr 380x315x255mm
A8	43520175	0	0	Case Corr 380x315x255mm
A9	43520174	11	61%	Case Corr 485x385x185mm
A10	43520174	0	0	Case Corr 485x385x185mm
A11	43454422	7	39%	Case Corr Type U with Z - Type partition
A12	43454422	0	0	Case Corr Type U with Z - Type partition
A13	41080641	7	39%	Case Corrugated SUNRISE EXTRA 20kg Exp

Aisle B

Rack ID	Material Codes	Number of Pallets	Percentage Utilization of Rack	Material Description
B1	43520173	5	28%	Case Corr 485x320x350mm
B2	43024315	5	28%	Case Corrugated RICORY 20kg XJ
B3	43493785	1	6%	Case Corr Type R 485x285x210mm
B4	43341199	18	100%	Pallet Plastic PP 1100 x1100x150mm
B5	43341199	18	100%	Pallet Plastic PP 1100 x1100x150mm
B6	43341199	18	100%	Pallet Plastic PP 1100 x1100x150mm
B7	43341199	2	11%	Pallet Plastic PP 1100 x1100x150mm
B8	41081927	10	56%	Pallet Pinewood L1150x W1150x H150mm
B9	43166525	8	44%	Closure Plastic NESCAFE Sunrise 50g Jar
B10	43463303	2	11%	Clsr Plas NESECLAS 50g Wad new artwork
B11	43325728	2	11%	Carton Board NESCAFE CLAS BIB 500g N1
B12	43434512	1	6%	Carton Board NESC Cappuccino 5x15g

Aisle C

Rack ID	Material Codes	Number of Pallets	Percentage Utilization of Rack	Material Description
C1	43030666	18	100%	Jar Glass Dawn Dia 67mmxHeight107mm
C2	43337262	1	6%	Jar Glass Asean NESCAFE CLASSIC 25g N1

Conclusion

The packaging material which has the fastest movement, i.e. Case Corrugated HALB shipper was arranged in Rack A1 instead of its current place i.e. B10. The time taken by the fork lift operator to transport the Case Corrugated HALB shipper from Rack A1 to Bulk Area was monitored and the fork lift operator took 55 seconds as against 66 seconds when carrying the load, and 29 seconds to return as against 40 seconds.

There was ***26%*** of reduction in total time taken in transporting the packaging material and returning to the aisle. The cumulative reduction time taken by all the fork-lift operators for a particular time period can prove to be of significance to Nestle, when the time saved for in-house transportation translates to the increase of goods going out of the factory. This in turn will reflect on the availability of Nestle products in retail stores and, therefore may, lead to increase in sales, impacting the top-line.

Introduction

Production Allocation and Planning

The function of product allocation planning is that of a bridge between the planning and order fulfilment side processes. In the context of multiple sales channels, this function primarily ensures the right amount of supply is being allocated to the right distribution centres at the right time. (Arora, 2011)

Arriving at the right amount of supply for a sales channel or customer in a particular week is the most important strategy to drive the allocation plan. This is usually based on targets days/weeks of inventory that are derived keeping in view the sales plans, customer importance and delivery lead times. Setting allocation priorities is the next key parameter. Depending on the level of allocation plan being derived, these priorities are applied among various levels, for e.g.: various sales channels or geographies, or even at the customer level. The tool should start distributing supply to allocation sets in the order of priorities defined, so that the higher priority allocation sets get satisfied first.

Problem/Objective of the Study

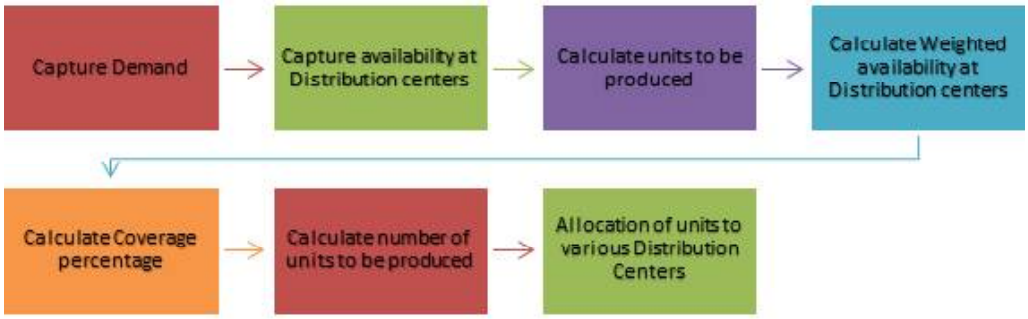
Presently, the SCM department decides on the number of units to be produced to meet the demand from various states using the past data. The allocation of produced Maggi units depends on various parameters. The objective of this study was to make a decision model which in an optimal way aids in production and allocation of Maggi units to various distribution centres.

Methodology

Understanding the outline of the process of production and allocation which is currently being followed by Nestlé was the first step before going into the details. An explanation of the constraints which the Nestlé production and SCM team faced while producing and allocating the units was given. Based on the information collected, it was decided to go ahead with Microsoft Excel as tool which could help in arriving at a calculation based model.

To create a model four states viz. Tamil Nadu, Kerala, Karnataka and Andhra Pradesh were chosen. The Maggi units considered for the model were 140 grams, 280 grams and 420 grams SKUs. Calculation of the optimal number of units to produce and allocate to the 4 distribution centres which cater to the states were taken into consideration. The month of May was taken into consideration. The model which was developed considering only one production line for the sake of simplicity to begin with. Macro functions of Microsoft excel were used to get the daily production and allocation figures.

The following process was followed:



The model

Introduction

The model takes certain figures as input from the user and gives the desired output. The calculation based model takes the following input from the user:

1. Sales plan figures for each SKU for each region
2. Current availability at distribution centres
3. Individual production capacity based on SKU

As output, the model would give the optimal number of units to be produced and allocated to each distribution centre.

Functioning of the Model

Basis the sales plan entered by the user and the stock in hand quantity at the beginning of a particular month, weighted availability is first calculated. This weighted availability is calculated for each region and its corresponding SKU. Sales plan/Demand is a constant figure and doesn't vary for a month while availability/stock in hand does and eventually changes the weighted availability as it changes. The weighted availability has not effect on prioritizing the production of SKUs whatsoever but plays a vital role in allocation of produced SKUs to various regions.

Coverage value (%) is basis which the production is prioritized/scheduled and this is done for each day of the month. Higher the availability to demand ratio, lower the priority of production.

Once the prioritization of production is done and the SKU production schedule for Day 1 is calculated, the number of units to be produced is passed on to the allocation part of the model as input. The allocation of the number of units to be produced is done basis the

weighted availability and through a 4 stage allocation process. At first the regions are sorted in descending order and in the 1st stage allocation, the region which has the least weighted availability is matched with the 3rd largest figure. The 2nd stage tries to match the 2nd and 3rd largest weighted availability values and so on until we arrive at the allocation figures for each of the regions.

The coverage values only on the days 1st,4th,7th,10th,13th,16th,19th,22nd,25th,28th and 31st of each month (or up to 30th as the case may be) are looked into for calculation purposes so as to incorporate the constraint of minimum production run.

The output of Day 1 i.e. to be allocated quantities become the input to calculate the stock in hand quantities for Day 2. Based on the invoicing numbers and the allocated quantities (previous day) the new figures for stock in hand are calculated and the process goes on till we reach the end of the month. The calculation done in the excel sheet are entirely formula based and are triggered by Microsoft Excel Macros.

Sample Calculation Steps

Region wise demand figures for the month under consideration

Region	140	280	420
Tamil Nadu	23279	24766	9143
Andhra Pradesh	8642	18328	10687
Karnataka	11296	16129	8173
Kerala	14358	11730	2012

Current availability at distribution centre (DC)

Region	140	280	420
Tamil Nadu	8641	1436	1803
Andhra Pradesh	4753	4932	9643
Karnataka	3953	5837	2006
Kerala	8822	816	605

Weighted availability at DC (Availability at DC/Total Availability of all SKUs at DC)

Region	140	280	420
Tamil Nadu	33.02%	11.03%	12.83%
Andhra Pradesh	18.16%	37.88%	68.60%
Karnataka	15.11%	44.83%	14.27%
Kerala	33.71%	6.27%	4.30%

Coverage values (Availability at DC/Demand)

SKUs	Coverage percentage
140	45%
280	18%
420	47%

SKU Prioritized for Production

Procedure of allocation of produced SKUs between regions (The four stage allocation process)

1st stage Allocation Table

Region	Coverage before allocation	1st Stage coverage	1st Stage quantity
Karnataka	44.83%	44.83%	0
Andhra Pradesh	37.88%	37.88%	0
Tamil Nadu	11.03%	11.03%	0
Kerala	6.27%	11.03%	395

2nd stage Allocation Table

Region	Coverage before allocation	2nd Stage coverage	2nd Stage quantity
Karnataka	44.83%	44.83%	0
Andhra Pradesh	37.88%	37.88%	0
Tamil Nadu	11.03%	37.88%	1553
Kerala	6.27%	37.88%	2122

3rd stage Allocation Table

Region	Coverage before allocation	3rd Stage coverage	3rd Stage quantity
Karnataka	44.83%	44.83%	0
Andhra Pradesh	37.88%	44.83%	255
Tamil Nadu	11.03%	44.83%	274
Kerala	6.27%	44.83%	294

4th stage Allocation Table

Region	Coverage before allocation	4th Stage coverage	4th Stage quantity
Karnataka	44.83%	49.63%	775
Andhra Pradesh	37.88%	49.63%	880
Tamil Nadu	11.03%	49.63%	1190
Kerala	**6.27%**	**49.63%**	**563**

Total Allocation

Region	Coverage before allocation	Final allocation
Karnataka	44.83%	775
Andhra Pradesh	37.88%	1135
Tamil Nadu	11.03%	3016
Kerala	**6.27%**	**3375**

Layout of the Excel Document

The Microsoft excel document has the following sheets namely:

- Demand-Supply (Result sheet)
  - Main Columns
    - Sales Plan
    - Stock in Hand
    - Invoice
    - Deployment
    - Final deployment
- WIP (Calculation sheet)
  - Main columns
    - Demand/Sales plan
    - Availability at Distribution centre
    - To be produced
    - Coverage values
    - Allocation stages
    - Weighted availability

Demand-Supply Sheet Depicting the Production Scheduling of SKUs Post-macro Run.

Final Deployment		
140	280	420
0	8300	0
0	8300	0
0	8300	0
8300	0	0
8300	0	0
8300	0	0
0	0	8300
0	0	8300
0	0	8300
0	8300	0
0	8300	0
0	8300	0
8300	0	0
8300	0	0
8300	0	0
0	8300	0
0	8300	0
0	8300	0
0	8300	0
0	8300	0
0	8300	0
8300	0	0
8300	0	0
8300	0	0

Conclusion

The current method of scheduling and allocation of Maggi SKUs is based on historical data. The mathematical model developed aims at giving the production and allocation numbers in advance and accuracy at the beginning of the month enabling the production and supply chain departments to align their activities accordingly. A detailed schedule like this can help the department reduce waste and allocate the required manpower and raw materials accordingly. The developed model may give figures for the most ideal situation but is incapable to incorporate the qualitative factors which the production or the supply chain department may face in their day to day operations. Having said that the model sure does aid in giving a bird's eye view on how the production scheduling and region wise allocation will be for the particular month.

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