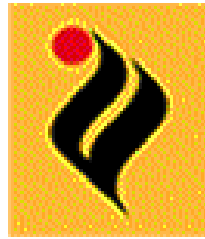


# SUPPLY CHAIN AND LOGISTICS STUDY

At MAHINDRA SWARAJ

1/10/2013



Submitted by:

AMIT ANAND (400907031)

Under the Guidance of

Er. GAURAV GOYAL



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### **Group Members -:**

Amit Anand

Apeksha Agarwal

Karanveer Singh

Tejveer Singh

Vishesh Bector

Vivek Kumar

Arjun Singh

Jatinder

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## **Introduction**

Mahindra Swaraj, the farm equipment division of Mahindra & Mahindra, builds and sources tractors that are sold worldwide across six continents. Mahindra is also among the top three tractor manufacturers in the world. It has a huge consumer base in India, China and America and a growing base in Australasia. The company builds more tractors in India than any other manufacturer, and has the capacity to build 150,000 tractors a year. In 1963, M&M formed a joint venture with International Harvester to manufacture tractors carrying the Mahindra nameplate for the Indian market. Armed with engineering, tooling and manufacturing know-how gained from this relationship, M&M developed its first tractor, the B-275. Mahindra Tractors with sales of nearly 85,000 units annually is one of the largest tractor companies in the world, and is number one in sales in India - the largest tractor market in the world.

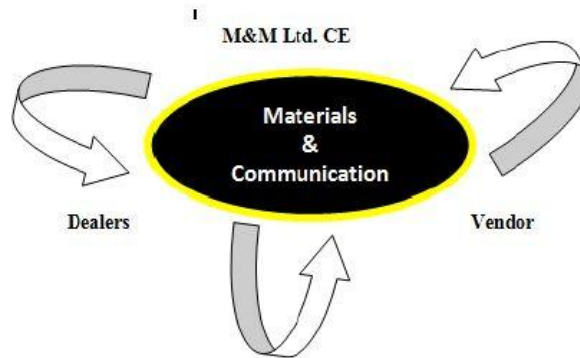
In India, it has a plant in following places :

- Baroda, Gujarat -Mahindra Gujarat
- Chappercheri - Swaraj plant
- Jaipur, Rajasthan
- Mumbai, Maharashtra
- Tamil Nadu
- Nagpur, Maharashtra
- Rudrapur, Uttaranchal
- Zaherabad, Andhra Pradesh
- nashik, Maharashtra



This project is about the study conducted at Mahindra Swaraj division on the logistics and supply chain management. The aim of this study is:-

- The **Right Parts**
- In **Right Quantity**
- In the **Right Place**
- At the **Right Time**



Supply Chain Management (SCM) is a system that used by an organization to organize the process of planning, implementing and controlling the operations of supply chain as efficiently as possible. Supply chain management spans all movements and storage raw materials, work-in-process inventory and finished goods from point-of origin to point-of-consumption. In order to reduce the number of defective parts, cut labor costs and improve efficiency, SCM is the tool that is used.

Normally, SCM will achieve one of the goals which are adding value chain. Value chain means the function within a company that add value to the products or service that the organization sells to customer and for which it receives payment.

### **Project Background**

Supply Chain Management is an important system that needs to apply in industry. In order to practice the knowledge practically, case study need to be done to let theory can be applied. Nowadays, many companies collaborated through a network of production units, so as to provide customer with the desired products. SCM, which are more precisely addressed in this thesis generally refer to a set of networked organizations working together to source, produce and distribute products and service to the customer.

In order to assemble world class tractors, PUNJAB TRACTORS LTD., was collaborated with MAHINDRA & MAHINDRA.

This collaboration applied SCM for the purpose of producing automotive to the maximum efficiency. There are several departments in the plant. Each department does their own job to achieve one objective which is produce good automotives. Each department needs to contact efficiently and uses SCM as the contact medium. Good contact between departments in a good manner lets the plant work smoothly.

### **Scopes of the Study**

This study is aimed at some exposure to Logistics & Supply Chain Management practices taking place in the industry and developing our knowledge and skills in the area of operation research. This study is directed at different levels of supply chain i.e. vendor level, manufacturing level,

dealer/distributor level. It also gives us a chance to understand how the companies implement computer integrated manufacturing systems(SAP-ERP etc) to achieve a competitive edge.

**Drivers of supply chain in the company**

**Logistic Department** at Mahindra Swaraj is responsible to manage receiving raw material, storage and do delivery in the manner that is asked by the two departments which is Body Shop and Production Line.

**Body Shop** is the department that is responsible to assemble each part of tractor body part to make a complete tractor framework.

**Production Line** does the job to produce a complete tractor. Their responsible is to receive tractor framework from Body Shop and trim part from Logistic Department. After Production Line finishes the job, tractor is ready to be sent to the market.

**MANUFACTURING**

The flow of process and person In charge of Logistic Department responsible of unpacking trim section and body section of Mahindra Swaraj is as in Table

Department	Section	Type of Document
Logistic	Unpacking Trim	Process Flow

*Process Flow and Person in Charge of Unpacking Trim*

**Person in Charge**

Operator and Forklift Driver

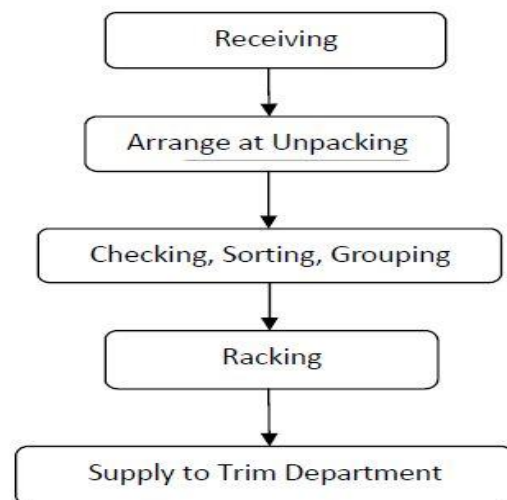
Forklift Driver

Operator

Operator

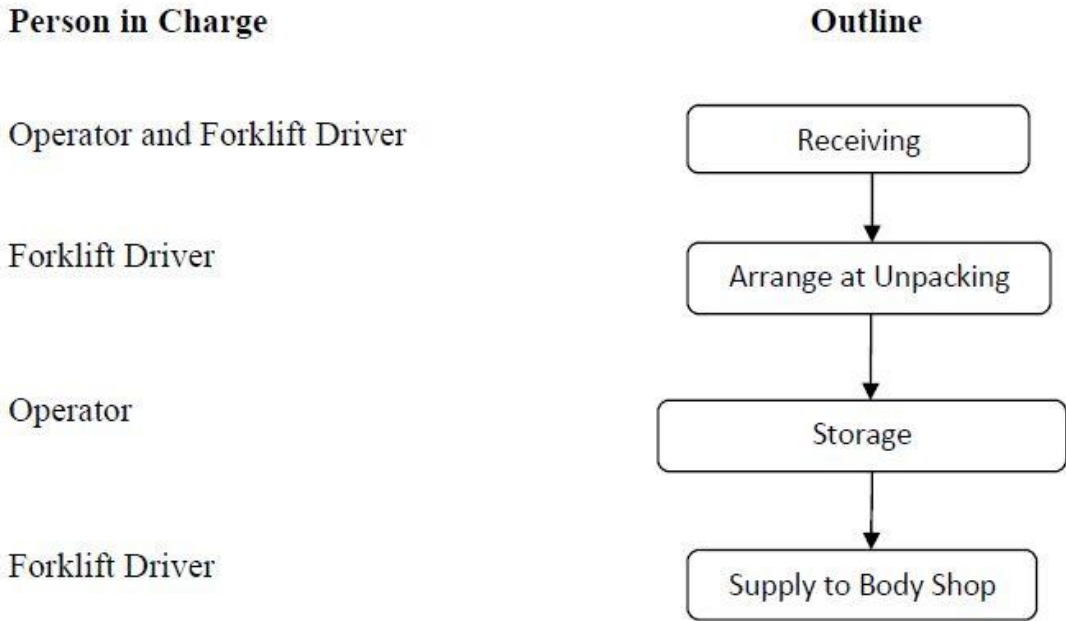
Operator

**Outline**



Department	Section	Type of Document
Logistic	Body	Process Flow

*Process Flow and Person in Charge of Body Parts*



**Few Findings of the Study**

In order to fulfill the demand that is asked by the Production Line, analysis of the strength of Logistic dept. needs to be done. The findings show that-:

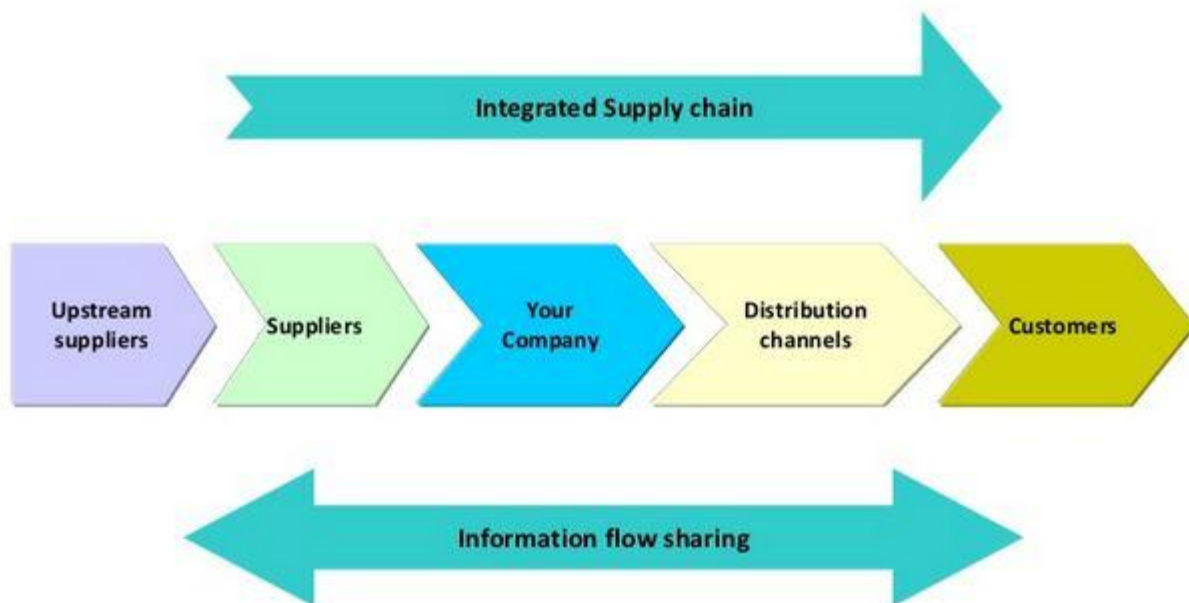
1. Logistic Department can't guarantee to supply the demand that is asked by the Production Line if the demand is increasing suddenly in any number.
2. Logistic Department does not have its capability data on supply trim part to Production Line.
3. Logistic Department have problem to identify the correct number of man and machine needed by that department.

MAHINDRA SWARAJ is a system that implements Just in Time (JIT). JIT is a concept that focuses on utilizing SCM.

## ASSEMBLY LINES

- There are approximately 1900 components and sub assemblies in each product. About 250 components are varied to produce the 11 different product combinations.
- All the components that might be required at a particular work station are positioned behind the assembly workers.
- There are different sections on the assembly lines for engine assembly, engine mounting, chassis dropping, internal fitting, fuelling etc.

## Typical Supply Chain-:



The typical benefits of an excellent supply chain are

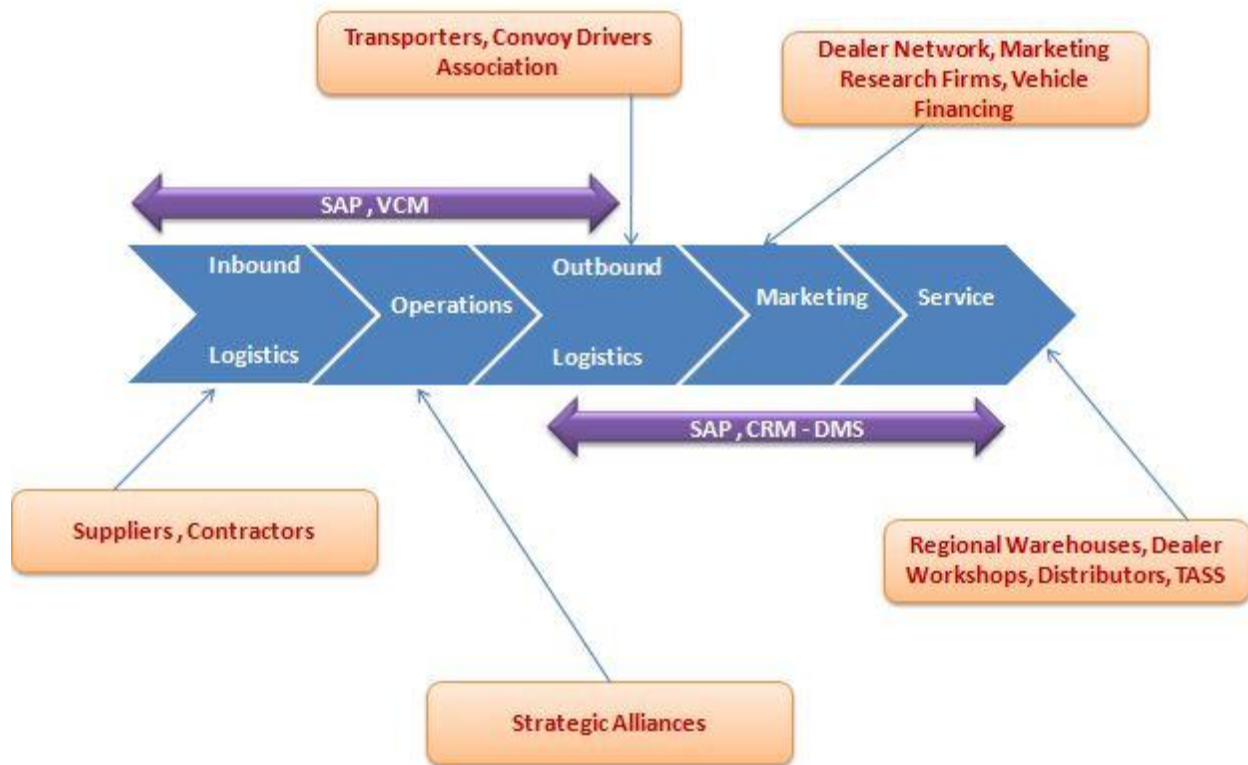
- Reduction in total logistics costs as a percentage of revenue (material acquisition, order management, inventory costs and finance/IT support)
- Reductions in order-fulfillment lead time.
- Reduction in inventory.
- Improvement in meeting commitment dates.

## Transportation Decisions

- Customer service levels and geographic location play vital roles in such decisions. Since transportation is more than 30 percent of the logistics costs, operating efficiently makes good economic sense.

- Shipment sizes (consolidated bulk shipments versus Lot-for-Lot), routing and scheduling of equipment are key in effective management of the firm's transport strategy.

### Supply Chain at MAHINDRA SWARAJ



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Demand is generated in Mahindra Swaraj in two ways. Firstly, the annual business planning of Mahindra Swaraj conducts a market survey studying the trend of market and the requirement of the customers.

Also, they look for their competitors' latest launches and prices. If a new product is launched by the competitor, the marketing department sends its details to the R&D department for consideration of the possibilities of design and development of a similar kind of product to be launched in competition. On the basis of this rigorous study they create their annual production target of all the vehicles. This annual plan also incorporates their annual growth rate target.

This whole planning is done by the top management to provide a long term growth for the company. Secondly, the order from the dealers to Mahindra Swaraj is also added in the production schedule as it arrives.

This production target is forwarded to PPC (Production Planning & Control) department which divides it into monthly, weekly and then daily production plan. This plans' information is then provided to the Production department and the Materials department. Now, as the material department has the responsibility to manage regular purchases, costing, material control and

supply for spares, so it manages inventory of all materials. For this, Materials department send production plans to the vendors and tells them how much they should produce and maintain as inventory. Now, the vendor supplies the raw material (as machined parts, castings, etc.) to the stores where it undergoes quality check and then kept as inventory. The production department utilizes this inventory for production. In doing so, they maintain continuous interaction with the materials department in case they felt short of any material and have to change the daily plan and need some other material. The material department then consults the vendors and look for the available options. The finished product then stored in the warehouse and then distributed by the distribution department to the dealers.

### **Inbound Logistics**

- Long term contract with service provider's – transporters and agents.
- Personnel at regional offices for overseeing the smooth transit of goods.
- Transparency and monitoring through deployment of IT – all transactions through SAP.
- DTL supplies for critical high value items.
- Efficient storage facilities – easy storage and retrieval.

### **Outbound Logistics**

- Stockyards, all across the country.
- Long term contracts with transporters – higher volume of business to transporters ensures competitive price.
- Regional Sales Office and Vehicle Dispatch Section linked through SAP.
- Efficient security system for prevention of any kind of pilferage.

Logistic Partners for Dispatch are

- Blue Dart
- Professional
- Gati

### **Procurement**

- E procurement initiative.
- Global Sourcing Team – China , a key destination for sourcing essential items like tires, power steering units etc., Steel procured from Belarus
- Long term relationships with a stable and loyal pool of suppliers.
- Technology driven procurement – SAP and VCM.
- Strategic Sourcing for key components – FIP's, Steel etc.
- Localized supplier base at mfg. locations – low inventory levels

### **SUPPLY CHAIN-:**

## **DISTRIBUTORS OF MAHINDRA SWARAJ TRACTORS**

- MAHINDRA SWARAJ serves the domestic market through 76 regional distributors. Each regional distributor handles the needs of the retailers in its geographic region.
- The distributors provide the factory with forecasts of dealer requirements based on experience, discussions and season.
- The regional distributors in the areas of high demand often order more no. of tractors to the factory than what is actually forecasted by the dealers. This is done by them to prevent any stock outs and to be prepared for any adverse situation.
- In this case there are high risks at the distributors and dealer's end if the ordered tractor units are not sold. Though less risk is faced by the company as for them the tractor units are already been sold. But at the same time the standing inventory at the distributor's end and dealer's end do bring bad name to the company which tarnishes the goodwill of the company in the market.
- The forecasted pre purchased orders can be cancelled by the distributors at any time before the actual delivery has been done from the factory, at that point the pre purchased orders automatically became firm purchase orders that the distributors were obliged to sell.

## **MODE OF TANSPORTATION**

- Tractors are shipped by truckload & trains to the warehouses nationwide once a week.
- Deliveries normally take one to two days.
- During peak seasons, additional mid week deliveries were made in response to urgent orders from retailer warehouses.

## **WAREHOUSE & STORE OPERATION**

- The dealers mostly maintain their own regional warehouses.
- Shipments are timed to arrive at the stores at the start of the weekend
- It takes a day or two for the dealer warehouse to pick and move the tractors to the stores.
- The individual dealers don't have much space so they stock only what they expect to sell over a period of time, plus a safety margin. Therefore the stores rely on rapid order fulfillment from their regional warehouses.

## **BULL-WHIP EFFECT IN THE SUPPLY CHAIN**

- The demand at all ends be it dealers, distributors, manufacturers keeps on fluctuating due to various external and internal factors. The bullwhip effect is evident in a supply chain when demand increases and decreases.
- The effect is that these increases and decreases are exaggerated up the supply chain. The observation here is that retailer's orders to the distributors varied far more than the preceding customer demand and in return the distributor's order to the factory varied even more than the preceding retailer's demand.

- In order to tackle more demand Mahindra Swaraj orders more to their vendors.

## **FEW OF THE POTENTIAL CAUSES OF THE BULL WHIP EFFECT**

### **Demand forecast updating**

- The main reason for this problem is that the data are usually based on forecast orders and not actual customer demand. As most companies are untrusting, this leads to companies not wanting to share information about demand, which leads to information distortion throughout the supply chain.
- Various methods of forecasting such as exponential smoothing or moving average forecasting have been employed by the company to find the 'truest' demand. Unfortunately, any type of forecasting can cause the bullwhip effect

### **Order batching**

- Order batching refers to a company ordering a large quantity of a product in one week and not ordering any for many weeks. The main reason for a company ordering in batches is that it may prove to be less costly because of transportation costs or the company will receive a discount if a large quantity is ordered in one period.

### **Price variations/sales promotions**

- If the price of products changes dramatically, customers will purchase the product when it is cheapest. This may cause customers to buy in bulk, which also adds to the order-batching problem.
- Manufacturers and distributors occasionally have special promotions like price discounts, quantity discounts, coupons, rebates, etc. All these price promotions result in price fluctuations, and the customers' ordering patterns will not reflect the true demand pattern. One method of avoiding price fluctuations is by stabilizing prices.

## **RECOMMENDATIONS TO REDUCE THE BULL WHIP EFFECT**

### **Step 1**

Improve the flow of information along the supply chain. Improving communication and forecasting end-user needs greatly assists in reducing the bullwhip effect. In addition, look to day-to-day operations along the supply chain to observe trends and better predict customer demands. Supply chain managers should develop a forecasting system consisting of customer demands and supplier inventory, in concert with market fluctuations.

### **Step 2**

Reduce delays in the supply chain. Cutting order to delivery time also greatly decreases fluctuations along with Lessing inventory levels and operating costs.

### Step 3

Pay closer attention to point of sale purchases made by customers. Using your point of sale system to create reports that track customer preferences and ordering behavior. This helps to identify future trends as well as bettering communication along the supply chain.

### Step 4

Reduce your order sizes. In the retail industry, this refers to the economic order quantity.

### Step 5

Maintain price consistency. Another useful method for reducing the bullwhip effect is to maintain prices during market fluctuations to have an immediate impact on customer purchases.

### Step 6

Centralized information –: one of the most frequent suggestions for reducing the bullwhip effect is to centralized demand information within a supply chain that is to provide each stage of supply chain with complete information on the actual customer demand. If the demand information is centralized, each stage of supply chain can use the actual customer demand data to create more accurate forecasts, rather than relying on the orders received from the previous which can vary significantly more than the actual customer demand

### Step 6

All the functions of placing a demand at each level or stages of the supply chain should be given to one common person or group. This will reduce any discrepancies.

## VENDORS

### Development at Vendor's end -WHY?

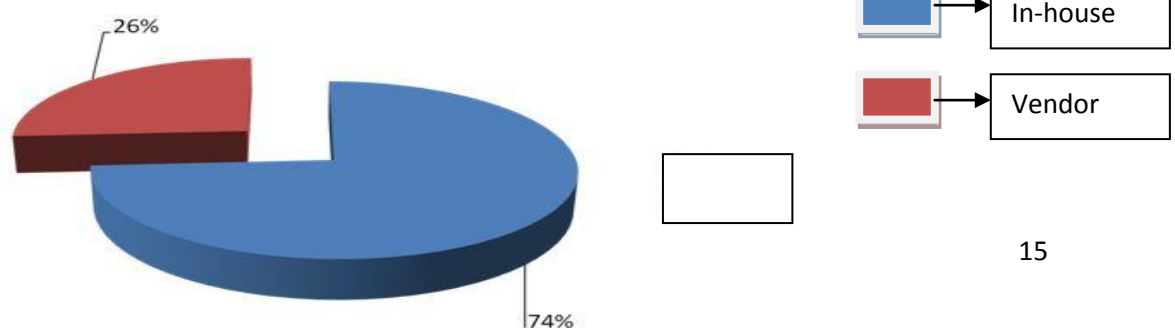
Before Going Further we shall now discuss the Secret behind the Mahindra Swaraj's excellent response to the challenges it face from the Present Competitive Market **by just improving the conditions at the vendor's end.**

The top Management at Mahindra Swaraj has always known the Secret that

**Vendor's Development = Mahindra Swaraj's Success**

Therefore, Right from the inception, Mahindra Swaraj has always tried to improve the condition at vendor's end. Moreover the Best Practices at Mahindra Swaraj has been applied to vendor's through MPS & Lean Projects.

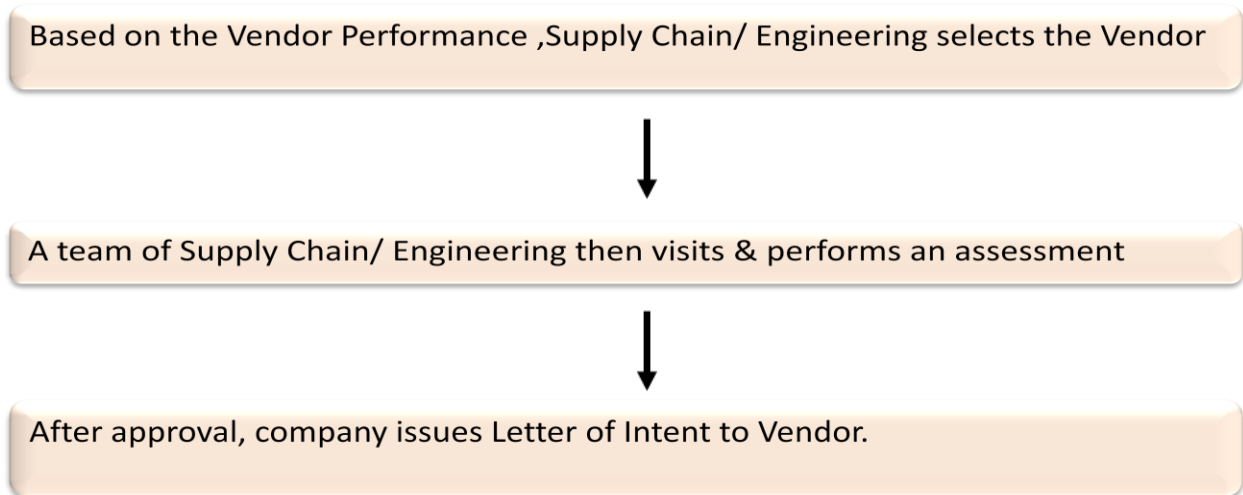
### Contribution of Vendors & In house Production



- To maintain quality Best In-House Practices are implemented at Vendor's End.

At Mahindra Swaraj most of the products are produced in house except the plastic components, seats etc. So they have a relatively less no. of vendors

### **VENDOR SELECTION PROCEDURE**



### **CRITERIA FOR VENDOR SELECTION**

- Vendors Past Problem on Quality, Cost & Delivery.
- Vendor technological Capability in Designing, Manufacturing, Testing
- Management of company wrt to professionalism, Clarity in Org structure.
- Financial health
- Tool making capability
- Quality system in the Org.
- Proximity to enable JIT deliveries
- Loyalty
- The vender has an effective quality system and improvement program such as ISO/QS9000

As per the demand of the tractors from the distributors, MRP sheets are made and the subsequent demands for the components are placed to the vendors through e-mails. The inventory is filled up on the principal of JIT.

## SAP-SCM

Mahindra Swaraj employs a SAP-ERP system for consolidation of systems and strategic transformation across the company's diversified operational landscape. To effectively manage the entire supply chain and to meet and exceed customer expectations.

To transform the linear supply chain into a responsive supply network and quickly adapt to ever changing markets. It helps them to synchronise their planning, distribution, transportations and logistic

It also helps them maintain relationship with their vendors, customers and suppliers.

- Faster responsiveness to changes in supply and demand
  - Optimized inventory with greater forecast accuracy and market visibility
  - Increased perfect order fulfillment with integrated planning and logistics
  - Reduced operational expenses and transportation spend
  - Improved warehouse efficiency with automated processes and tighter controls
- 

### SAP SCM COMPONENTS

These components of SAP Supply Chain Management are designed to support supply chain processes throughout the company and its supply chain network.

- SAP Advanced Planning and Optimization (SAP APO)

APO offers a fully integrated palette of functions for planning and executing supply chain processes.

SAP APO is composed of Demand Planning, Supply Network Planning, Multi-level Supply and Demand Matching, Production Planning and Detailed Scheduling, Transportation Management, and Global Available-to-Promise

- SAP Forecasting and Replenishment (SAP F&R)

F&R optimizes the internal logistics of retail companies by improving the replenishment processes.

- SAP Event Management (SAP EM)

EM enables the coordination of planning and activities within the business and with partners by exchanging information across systems and monitoring critical situations.

- Supply Network Collaboration (SNC) - formerly SAP ICH

SNC optimizes collaboration with suppliers and customers by providing a common platform for controlling and monitoring the replenishment process for products.

- SAP Extended Warehouse Management (SAP EWM)

EWM offers flexible, automated support for processing various goods movements and for managing stocks in a warehouse complex. The system supports scheduled and efficient processing of all logistics processes within a warehouse.

### INFORMATION FLOW IN THE SCM

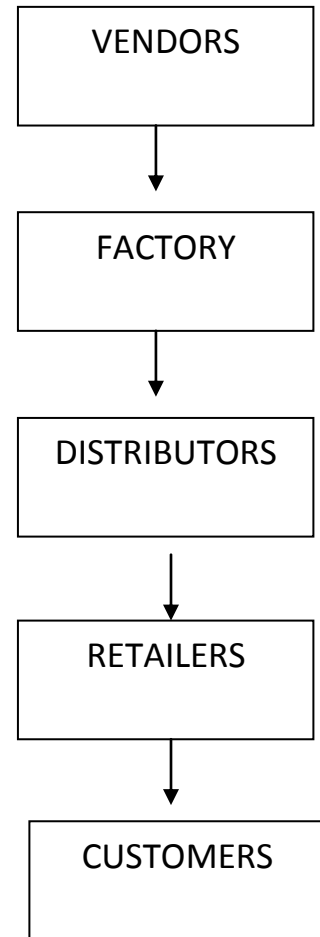
On the basis of forecasted demand the factory places order at the Vendors end.

The factory has the information i.e. communicated to it by the Distributors regarding the demand. It also has info about vendors

The distributors have the data that the retailer passes on to him. It is Connected to both the factory and the retailer.

The retailer has the data that the consumer passes on to him

Real demand data is obtained



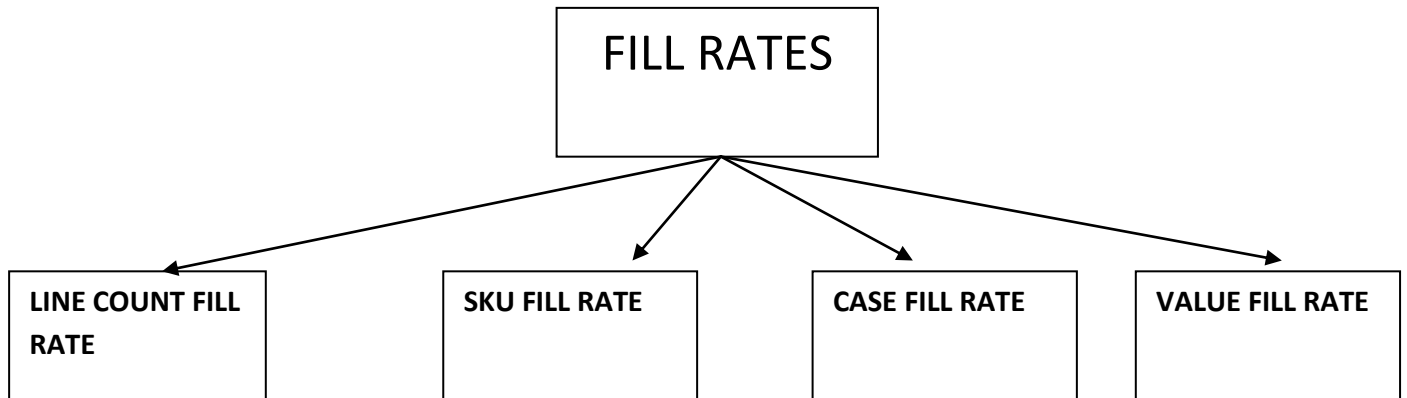
### FIRST FILL

- It calculates the service level between 2 parties.
- It is usually a measure of shipping performance expressed as a percentage of the total order.

$$\frac{\text{Number of Lines Completely Filled}}{\text{Total Lines Ordered}}$$

## FILL RATES

On our visit we learned a very important concept about the fill rate. Fill Rate calculates the service level between 2 parties. It is usually a measure of shipping performance expressed as a percentage of the total order.



### 1. LINE COUNT FILL RATE

The amount of order lines shipped on the initial shipment versus the amount of lines ordered. This measure may or may not take into consideration the requested delivery date

**Illustration** ABC Company orders 10 products (one order line each) on its Purchase Order #1234. The manufacturer ships out 7 line items on March 1 and the remaining 3 items on March 10. The Fill Rate for this Purchase Order is 70%. It is calculated once the initial shipment takes place.

**Calculation: Number of Order Lines Shipped on the Initial Order\* / Total Number of Order Lines Ordered (7/10 = 70%)**

### 2. SKU FILL RATE

The number of SKU's (Stock Keeping Units) ordered and shipped is taken into consideration. Above, we consider each Order Line to have an equal value (1). Here, we count the SKU's per Order Line.

#### **Illustration**

If on Line 1, the order was for 30 skus of product "AB" and on line 2, they ordered 10 skus of item "AC". If Line 1 ships on April 1 and line 2 on April 20, the SKU Fill Rate is 75%

**Calculation: Number of SKUs Shipped on the Initial Shipment / Total Number of SKUs Ordered (30/40 = 75%).**

### **3. CASE FILL RATE**

The amount of cases shipped on the initial shipment versus the amount of cases ordered.

**Illustrations** ABC Company orders 6 products that total 200 cases. The manufacturer ships out 140 cases on 3/1/11 and the remaining 60 cases on 3/10/11. The Fill Rate for this Purchase Order is 70%. It is calculated once the initial shipment takes place. The number of Order Lines is not considered in this calculation. This Fill Rate measure gives "weight" to the order lines that are shipped out.

**Calculation: Number of Cases Shipped on the Initial Order / Total Number of Cases Ordered . (140/200 = 70%)**

**4. VALUE FILL RATE** Same as above, except the order line value is used instead of cases.

**Calculation:** Value of Order Lines Shipped on the Initial Order / Total Value of the Order (INR 400/INR 500 = 80%).