CHAPTER III

SUPPLY CHAIN MANAGEMENT PRACTICES IN THE WORLD

3.1 INTRODUCTION

Observe leaf cutter ants. At the control of their queen, the ants march in lockstep, cut leaves from forest trees in a perfectly ordered line, carry the right number of tasty leaves in their mandibles back to the colony and their discriminating queen. Therefore, humans have no such inborn sense of how to move products from their source to end users.

Producer all over the world are nervously maddening to get better efficiencies in their operations for facing global economy. Falling customer demand, tighter credit, increasing input prices and the economic doubt are forcing companies to re-evaluate their business plans especially with respect to investments in new capacities, markets and products. At the same time, there is a renewed focus on making current assets work harder and maximize the return on the investments. However, achieving operational efficiencies requires reduced costs, high utilization mandates, strict inventory control and rationalizing capacity or manpower. There is no rejection of the usefulness of these steps, but the key is to ensure every bit of the supply chain is performing towards meeting a single objective i.e. right product at the right place in the right quantity at the right time. This requires all operational entities within the enterprise to be integrated through business processes and technological enablers.

The fast changing situation in the retail sector does call for a new outlook and some strategic changes. Of course, change is not easy, even at the best of
times. At the worst of times, change is complex and alarming, but also necessary. Structural change through department reorganization, corporate rationalizes, or merger- is particularly difficult and frightening because the company must choose who among its employees has the greater skill to perform each specific task. The present study is the sincere effort towards the ‘supply chain management practices’ in the Nasik District.

In any manufacturing company, material flow observed into three phases. First is flow of raw material from suppliers into the manufacturing facility. Secondly, flow of material within the manufacturing facility as they are processed. Thirdly flow of finished goods from the manufacturing facility to the end customers. It is to be receptive to the global competition; Organizations must be able to manage the complete flow of material from the suppliers, through manufacturing, until the product reaches to the customers.

As a result, organizations must be involved in the management of suppliers who provide direct and indirect material inputs, must increase the manufacturing competitiveness, and must effectively manage the network of distribution systems responsible for delivery of the product to end customers. From this realization emerged the concept of supply chain.

3.1.1 SUPPLY CHAIN

The supply chain is the functioning process included all activities connected with the flow and exchange of goods from the raw materials stage (extraction) to the finish product of end users. During this functioning process, the linked information flows also plays an important role to the fulfilling of supply chain. Material and information flows both up and down the supply chain.
The supply chain includes new product development, systems management, and operations. The various operation like assembly, purchasing, production scheduling, order processing, inventory management, transportation, warehousing, and customer service are have the self important in the process. In the supply-chains of operations are required a series of linked suppliers and customers with every customer. These customers base is in turn a supplier to the next downstream organization until a finished product reaches the ultimate end user.

3.1.2 LINK OF SUPPLY CHAIN

A supply chain is a system of organizations, people, technology, activities, information and resources involved in moving a product or service from supplier to customer. Supply chain activities transform natural resources, raw materials and components into a finished product that is delivered to the end customers. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable. Supply chain is link value chain.¹

i) **Value Chain:** The value chain, also known as value chain analysis, is a concept from business management that was first described and popularized by Michael Porter in his 1985 best-seller.²

ii) **ERP:** An enterprise resource planning (ERP) system is an integrated computer-based application used to manage internal and external resources, including tangible assets, financial resources, materials, and human resources. Its purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. Built on a centralized database and normally utilizing a common computing platform, ERP
systems consolidate all business operations into a uniform and enterprise-wide system environment.

iii) **Sales:** A sale is the pinnacle activity involved in the selling of products or services in return for money or other compensation. It is an act of completion of a commercial activity.

iv) **Operational planning:** Operational planning guides the Department in setting priorities and accomplishing what needs to be done to fulfill our mission. It assists DPR management in implementing, monitoring, and budgeting program activities within and across reporting units. (A reporting unit is a branch within a division or an office within the Executive Office.) In this way, operational planning ensures that program activities are best positioned to achieve strategic results.

### 3.2 SUPPLY CHAIN MANAGEMENT (SCM)

It is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers. Supply chain management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point of origin to point of consumption (supply chain).

Another definition is provided by the APICS Dictionary when it defines SCM as the "design, planning, execution, control and monitoring of supply chain activities with the objective of creating net value, building a competitive infrastructure, leveraging worldwide logistics, synchronizing supply with demand and measuring performance globally."
Supply chain management is the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole.

A customer focused definition is given by Hines "Supply chain strategies require a total systems view of the linkages in the chain that work together efficiently to create customer satisfaction at the end point of delivery to the consumer. As a consequence costs must be lowered throughout the chain by driving out unnecessary costs and focusing attention on adding value. Throughput efficiency must be increased, bottlenecks removed and performance measurement must focus on total systems efficiency and equitable reward distribution to those in the supply chain adding value. The supply chain system must be responsive to customer requirements."

According to global supply chain forum, Supply chain management is the integration of key business processes across the supply chain for the purpose of creating value for customers and stakeholders. According to the Council of Supply Chain Management Professionals (CSCMP), supply chain management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes the crucial components of coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies. More recently, the loosely coupled, self-organizing network of businesses that cooperate to provide product and service offerings has been called the Extended Enterprise.
3.2.1 FIVE ELEMENTS OF SUPPLY CHAIN

Suppliers, Customers and Producers are being linked in the Supply chain by sales, operative planning, forecasting with ERP and supply planning.

i) **Sales:** The first element of the supply chain is sales. The provider of the goods or services - completes a sale in response to an acquisition or to an appropriation or to a request. There follows the passing of title (property or ownership) in the item, and the application and due settlement of a price, the obligation for which arises due to the seller's requirement to pass ownership. Ideally, a seller agrees upon a price at which he willingly parts with ownership of or any claim upon the item. The purchaser, though a party to the sale does not execute the sale, only the seller does that. To be precise the sale completes prior to the payment and gives rise to the obligation of payment. If the seller completes the first two above stages (consent and passing ownership) of the sale prior to settlement of the price, the sale remains valid and gives rise to an obligation to pay.

ii) **Operations planning:** The first and second elements of the supply chain is Sales and Operations planning (SOP) which fundamentally is bringing together sales and marketing function with the company’s operations. It ensuring both is working towards a common sales target that has been decided to be feasible under the given operational constraints.

iii) **Collaborative Planning, Forecasting and Replenishment:** The third element of the supply chain is Collaborative Planning, Forecasting and Replenishment (CPFR) comes in picture which enables accurate demand forecasting by make possible information sharing between the manufacturer,
retailer, and other involved parties. Simultaneous manufacturing that helps companies to develop products by involving all internal and external stakeholders leading to more efficient concept to start on cycles. These initiatives need permitting technologies in terms of data and specialized tools.

iv) **Enterprise Resource Planning:** The fourth element brings us triangular flow and that extended ERP, which is essentially, is an ERP core with peripheral specialized solutions for important supply chain functions.

v) **Supply Planning:** Supply planning is the fifth element of supply chain, which is about optimizing procurement and records. Supply chain planning (SCP) is the component of supply chain management (SCM) involved with predicting future requirements to balance supply and demand.

Sales and operation team are the most essential elements of a supply chain for any organization. While one represents, promotes, identifies and captures the demand for the organization’s products or services in the market place, the other co-ordinates the supply of the company’s products or services committed to its customers. Both are central to a company’s objectives of higher profits and revenues at lowest possible costs. However, these objectives take a severe beating due to the lack of co-ordination between the sales and the production. This lack of coordination has far reaching effects throughout the supply chain. An essential requirement of having an integrated supply chain is to provide visibility across the different functions and enable a seamless flow of material, information and funds across its boundaries. A lack of co-ordination between the demand and supply leads to a fragmented supply chain. A Sales and Operations planning process is the answer to remove this disconnects and forms an essential element for an integrated Supply Chain.
3.2.2 OBSERVATION OF SUPPLY CHAIN SYSTEM

System of supply chain generally observed in following two ways:

(i) The supply-chain process chart is the list of steps in the supply process together with the body selected to carry out each step in the process. The supply-chain process chart begins at the point when the customer has a product, which he wants supplied and ends when that product arrives at its final destination.

(ii) The product cost sheet a breakdown of costs for each material and step. Drivers of supply chain performance based on a framework for structuring. These are Facilities, Inventory, Transportation, Information and search out the obstacles to achieving productivity of the manufacturing unit.

3.2.3 IMPORTANCE OF LOGISTICS IN SUPPLY CHAIN SYSTEM

Logistics has key importance to the operation of supply chain. It is also calling as physical distribution of supply. In this operation mainly we focuses on the physical movement and storage of goods and materials. Logistics is the part of the supply chain process. It will require proper plans. Plans must be implements smoothly. Operation requires careful controls with the efficient and effective forward. Mean while reverse flow and storage of goods have various services with related information between the point of origin and the point of consumption. Evaluation is the important function in the logistics. Such as transportation selections, packaging options, inventory management for different channels, develop and manage networks of warehouses when needed. Same time require to manage the physical flow of materials into and out of the organization.
Therefore, importance of logistics has increased and much related in the broader scope of Supply Chain Managements. The importance of logistics in the operation of supply chain is clear with the help of following fig. no. 3.1.

**Fig.no.3.1**
Importance of logistics in the operation of supply chain

3.2.4 **DRIVERS OF SUPPLY CHAIN PERFORMANCE**

Following are the drivers of supply chain performance.

(i) **Facilities:** These can be observed in the places where inventory is stored, assembled, or fabricated as well as production sites and storage sites.
(ii) **Inventory:** It accounts a record of a business' current assets, including property owned, merchandise on hand, and the value of work in progress and work completed but not sold of the industries requires the study by taking care about the raw materials; work in process (WIP), finished goods within a supply chain. It also check whether the inventory policies of the industries is creating the hurdles in the production or other aspects of the industries time to time.

(iii) **Transportation:** It is the regulatory key of the function of the industries. Transportation for moving inventory from point to point in a supply chain and combinations of transportation modes and routes for the projection of industries function and

(iv) **Information:** It is the superlative driver of supply chain. Information data and it’s analysis regarding inventory, transportation, facilities throughout the supply chain and potentially the biggest driver of supply chain Performance.

Supply chain management is increases productivity but it requires mastery of purchasing, materials management, transportation, customs regulations, foreign exchange, and information technology among various other aspects. Supply chain strategies assist to gain competitive advantage in increasing the productivity of industries. However, the skills have more value or more relevance. A person devotes a working lifetime gaining experience; knowledge to develop a specific set of skills, only to be told those skills is no longer relevant. Therefore, he or she is no longer relevant. We are used to thinking of systemic changes as something affecting blue-collar workers replaced by automated machinery, or clerical and lower management employees replaced by computers.
We do not think of total change effecting on senior management because they are more educated, evidently more difficult to replace. They are the ones who usually decide who is no longer relevant and who should be phased out. However, once in a very long while, the systemic problems become so fundamental that senior managers- the judges of survival are the ones who must be replaced. At that point those running the company must make a decision either change the system and fire their colleagues who lack the ability to adapt, or see their company die.

3.2.5 EXTENDED ENTERPRISE AND SUPPLY CHAIN MANAGEMENT

Extended Enterprise is a more descriptive term than supply chain, in that it permits the notion of different types and degrees and performance of connectivity. Connections may be by contract, as in partnerships or alliances or trade agreements, or by open market exchange or participation in public tariffs. How the Extended Enterprise is organized and structured with its policies and mechanisms for the exchange of information, goods, services and money is described by the Enterprise Architecture.

The notion of the Extended Enterprise has taken on more importance as companies have become more specialized and inter-connected, trade has become more global, processes have become more standardized and information has become ubiquitous. The standardization of business processes has permitted companies to purchase as services many of the activities that previously had been provided directly by the company. By outsourcing certain business functions that had been previously self-provided, such as transportation, warehousing, procurement, public relations, information technology, companies have been able to concentrate their resources on those investments and activities that provide
them the greatest rate of return. The remaining "core competencies" determine the company's unique value proposition.

3.2.6 LEVELS OF SUPPLY CHAIN MANAGEMENT

Following are the three levels of Supply Chain Management:

i) **Strategic level**

SCM is operative by strategic network of optimization, including the number, location and size of warehousing, distribution centers and facilities. Strategic partnerships with suppliers, distributors, and customers, creating communication channels for critical information and operational improvements such as cross docking, direct shipping, and third-party logistics. Product life cycle management, so that new and existing products can be optimally integrated into the supply chain and capacity management activities. It is information technology chain operations. It is also where-to-make and make-buy decisions. Similarly line up overall organizational strategy with supply strategy. It is for long term and needs resource commitment.

ii) **Tactical level**

Tactical part will be understood by sourcing contracts and other purchasing decisions. Increasing Industrial productivity is depending on decisions, including contracting, scheduling, and planning process definition. Inventory decisions, including quantity, location, and quality of inventory. Connectivity through Transportation strategy, including frequency, routes, and contracting are backbone. Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise in the system is essentials and focus on customer demand.
iii) **Operational level**

It is the third level of SCM. Daily production and distribution planning include all nodes of the supply chain. Demand planning and forecasting, coordinates the demand forecast of all customers and sharing the forecast with all suppliers. Sourcing and planning, includes current inventory and forecast demand in collaboration with all suppliers. Inbound operations, includes transportation from suppliers and receiving inventory. Production operations, includes the consumption of materials and flow of finished goods. Outbound operations, includes all fulfillment activities, warehousing and transportation to customers.

Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other customers. From production level to supply level accounting all transit damage cases and arrange to settlement at customer level by maintaining company loss through insurance company.

In broader context, the study examines the types of activities involved in SCM decisions, the dynamics of the traditional SCM, the complementarities of technology in achieving effective management of operations through allow of electronic data interchange (EDI) and quick response (QR) disciplines to implement Just-in-Time (JIT) management techniques; and integrated SC and inventory control as it relates to capacity imbalances and transaction costs.

Evolutionary part of supply chain studies reveals that the challenges and complexities of companies face in the business and how they are configuring their supply chains to meet them. The issues must observe range from managing complexity in global logistics, to strategy formulation and implementation for the best practice in industries. These best practices relate to strategy, documentation,
planning and more often than not, simply discipline. Tom Peter searched for an excellence model identified the following eight attributes that characterized the excellent, innovative companies in their study:

(1) A bias for action, it means that although companies approach to decision making may be analytical. Companies approach emphasizes to the importance of experiments. It is believed that too many detailed analyses may be barriers against problem solving. Thus, their approaches to solve problems and challenges are often experimental. The deal with immediately or in a relatively short time is continuously functioning. Cross Functional team through establishment also handling evolutionary work. In this process external partners like customers or suppliers may participate.

(2) Close to the customer, which means that the successful companies really listen to the voice of the customer and also use the voices as input for continuous improvements and new product and service development?

(3) Autonomy and entrepreneurship having meaning that all employees – not only people in R & D – are expected to be creative and innovative in their daily jobs.

(4) Productivity through people, which means that people are expected to come up with ideas for waste reductions and productivity growth by providing the proper framework, i.e. respect, involvement and empowerment.

(5) Hands-on, value driven, which means that the company’s philosophy, vision and values are seen as the main guideline and to be far more important than technological or economic resources for the daily activities and challenges.

(6) Stick to the knitting, which means that the excellent companies stay close to the business they know.

(7) Simple form, lean staff, which means that the underlying structural forms and systems in the excellent companies are elegantly simple and top-level staffs are lean.
(8) Simultaneous loose-tight properties, which means that the excellent companies are both centralized and decentralized. On the one hand, for example, they have pushed autonomy down to the shop floor or product development teams, and on the other hand, they are fanatic centralists around the few core values they hold dear.

Supply chain management can confuse to those who are unfamiliar with the concepts and terminology.

**Product Development:** Senior Management has to define a strategic direction when considering the products, which the company should manufacture and offer to their customers. As product cycles mature or products sales decline, management has to make strategic decisions to develop and introduce new versions of existing products into the marketplace, rationalize the current product offering or whether develop a new range of products and services. These strategic decisions may include the need to acquire another company or sell existing businesses. However, when making these strategic product development decisions, the overall objectives of the company should be the determining factor.

**Customers:** At the strategic level, a company has to identify the customers for its products and services. When company management makes strategic decisions on the products to manufacture, they need to identify the key customer segments then where company marketing and advertising will be targeted.

**Manufacturing:** At the strategic level, manufacturing decisions define the manufacturing infrastructure and technology that is required. Based on high level forecasting and sales estimates, the company management has to make strategic decisions on how products will be manufactured. The decisions can require new manufacturing facilities to be built or to increase production at existing facilities. However, if the overall company objectives include moving manufacturing overseas, then the decisions may lean towards using subcontracting and third
party logistics. As environmental issues influence corporate policy to a greater extent, this may influence strategic supply chain decisions with regards to manufacturing.

**Suppliers:** Company management has to decide on the strategic supply chain policies with regards to suppliers. Reducing the purchasing spend for a company can directly relate to an increase in profit and strategically there are a number of decisions that can be made to obtain that result. Leveraging the total company’s purchases over many businesses can allow company management to select strategic global suppliers who offer the greatest discounts. But these decisions have to correspond with the overall company objectives. If a company has adopted policies on quality, then strategic decisions on suppliers will have to fall within the overall company objective.

**Logistics:** As well as strategic decisions on manufacturing locations, the logistics function is key to the success of the supply chain. Order fulfillment is an important part of the supply chain and company management need to make strategic decisions on the logistics network. The design and operation of the network has a significant influence on the performance of the supply chain. Strategic decisions are required on warehouses, distribution centers which transportation modes should be used. If the overall company objectives identify the use of more third parties subcontracting, the company may strategically decide to use third party logistics companies in the supply chain.

Strategic decisions determine the overall direction of company’s supply chain. They should be made in conjunction with the company’s overall objectives and not biased towards any particular product or regional location. These high level decisions can be refined, as required, to the specific needs of the company at the lower levels which allow for tactical and operational supply chain decisions to be made.
3.3 SUPPLY CHAIN MANAGEMENT (SCM) PRACTICES

SCM is the integration of all the activities in the supply chain to achieve a sustainable competitive advantage. Supply Chain can broadly classify of involve of three networks – Supplier, Company, and Distribution. The supplier network consists of all organizations that provide inputs, either directly or indirectly, to the focal company (i.e., the purchaser). Focal company’s network is involved in the exchange of input material to the output material. The distributive network consists of all downstream organizations from the central company that ensure that the right quantity of goods delivery to the appropriate customer location in a timely manner.

In the 1980s, the term Supply Chain Management (SCM) was developed to articulate the need to incorporate the key business processes, from end user through original suppliers. Innovative suppliers being those provide products, services and information that add value for customers and other stakeholders. The basic idea behind the SCM is that companies and corporations involve themselves in a supply chain by exchanging information regarding market fluctuations and production capabilities.

If all applicable information is accessible to any applicable company, every company in the supply chain has the option to and can seek to help optimizing the entire supply chain rather than sub optimize based on a local interest. This will lead to better planned overall production and distribution which can cut costs and give a more attractive final product leading to better sales and better overall results for the companies involved.
In addition, SCM successfully leads to a new kind of competition on the global market where competition is no longer of the company versus company form but rather takes on a supply chain versus supply chain form.

Most of the agro based manufacturers of Nasik district depend on supply of raw material from numerous components of farmers. The primary objective of supply chain management is to fulfill customers’ demand through the most efficient use of resources, including distribution capacity, inventory and labor. In theory, from a systems point of view, a supply chain seeks to match demand with supply and do so with the minimal inventory. Various aspects of optimizing the supply chain include liaising with suppliers to eliminate bottlenecks; sourcing strategically to strike a balance between lowest material cost and transportation. Implementing JIT (Just In Time) techniques to optimize manufacturing flow; maintaining the right mix and location of factories and warehouses to serve customer markets. It is also using location/allocation, vehicle routing analysis, dynamic programming and, of course, traditional logistics optimization to maximize the efficiency of the distribution side.

There is a confusion over the terms supply chain and logistics in the Nasik district. It is now generally accepted that the term Logistics applies to activities within one company/organization. Few companies mainly involving in distribution of product whereas the term supply chain also encompasses manufacturing and procurement. Therefore it has a much broader focus as it involves multiple enterprises, including suppliers, manufacturers and retailers, working together to meet a customer need for a product or service.

In the 1990s several companies chose to outsource the logistics aspect of supply chain management by partnering with a 3PL, Third-party logistics
Companies also outsource production to contract manufacturers. An unusual food supply chain operated by illiterate Dabbawalas in Mumbai is noted for being extremely reliable without using any computers or modern technology. It has been verified to be a six sigma supply chain. For example, in Automobile and Auto components of the study region, we have sub-industry called supply chain management. Every importer/retailer has a seemingly indispensable sourcing department responsible for supply chain management. Some very large and highly successful companies' entire reason for being is supply chain management. However, this is one area where fundamental systemic change must take place, because the supply chain concept is deeply and eternally defective. The purpose of supply chain management is to deliver the product in the shortest period of time and at the lowest cost.

The reality is that, in today's industry the supply chain system substantially increases both delivery time and product costs. The problem is neither the structure of the department nor the skill-sets of its members. In fact the better the sourcing department structure, the more experienced its members and the greater their supply-chain management skills, the longer the delivery time and the higher the product cost. The supply chain system has become dysfunctional and in one sense, all professionals know this.

3.3.1 STRATEGIC SUPPLY CHAIN MANAGEMENT

Strategic supply chain management decisions are made at an enterprise level that determines benefits and efficiencies of the supply chain. The study involve links examine these strategic decisions and how they affect a company's supply chain. Senior managers formulate strategy to maximize shareholder value; supply-chain planners run optimization models to minimize costs. Combining
scenario planning with supply-chain planning achieves the best of both worlds, which leads to long-term competitive advantage.

Every company that has a global supply chain should consider introducing its strategic left hand to its operational right hand. Strategic supply-chain planning that combines aspects of business-strategy formulation with aspects of tactical supply-chain planning can make each far more valuable to the planning effort than either would be alone. Strategic supply-chain planning is the Pegasus of strategy. It can fly, but it also needs to keep its feet on the ground.

Although companies having long-term supply-chain-related decisions of alternative sources of supply, new geographic markets or new products, various levels of management use different approaches, often in isolation. Senior managers make such decisions as part of formulating business strategy. Supply-chain planners, as an extension of their tactical supply-chain planning. Supply chain management depends on the company strategy and planning. It influences enterprise applications. Product lifecycle, Procurements, Asset management is important task in SCM. Logistics is backbone of SCM.

How should companies ensure the relevant supply-chain details? They can do so through early communication between senior managers and supply-chain planners, which shorten strategy-implementation time while letting each group. Senior managers formulating strategy to maximize shareholder value; supply-chain planners running optimization models to minimize total supply-chain costs.\textsuperscript{xiv} These include product development, customers, manufacturing, vendors and logistics.\textsuperscript{\textsuperscript{xv}} Overall functions of strategic management are increasing the productivity of industries.
3.3.2 TOTAL QUALITY MANAGEMENT\textsuperscript{xvi}

It is an approach that seeks to improve quality and performance which will meet or exceed customer expectations. This can be achieved by integrating all quality-related functions and processes throughout the company. TQM looks at the overall quality measures used by a company including managing quality design and development, quality control and maintenance, quality improvement, and quality assurance. TQM takes into account all quality measures taken at all levels and involving all company employees. TQM influences on quality and performance. It is shown in the fig.no.3.2.

**Fig.no.3.2**
TQM and its effect on quality and performance

In late 1980s, companies have launched Total Quality Management (TQM) programs in the world. It is an attempt to retain or regain competitiveness in order to achieve customer satisfaction in the face of increasing
competition from around the world. TQM is an integrative philosophy of management for continuously improving the quality of products and processes.

TQM functions on the premise that the quality of the products and processes is the responsibility of everyone who is involved with the creation or consumption of the products or services offered by the organization. In other words, TQM capitalizes on the involvement of management, workforce, suppliers, and even customers, in order to meet or exceed customer expectations. Considering the practices of TQM as discussed in six empirical studies, Cua, McKone, and Schroeder (2001) identified the nine common TQM practices as cross-functional product design, process management, supplier quality management, customer involvement, information and feedback, committed leadership, strategic planning, cross-functional training, and employee involvement.

All the process includes in the TQM. Using TQM framework as a guide with expert consultation can help implementation environment and help to achieve quality and productivity goals of the industries.

3.3.3 TOTAL PRODUCTIVE MAINTENANCE

In TPM, the machine operator is thoroughly trained to perform much of the simple maintenance and fault-finding. Eventually, by working in "Zero Defects" teams that include a technical expert as well as operators, they can learn many more tasks - sometimes all those within the scope of an operator. Tradesmen are also trained at doing the more skilled tasks to help ensure process reliability.
This should be fully documented, Autonomous Maintenance ensures appropriate and effective efforts are expended after the machine becomes wholly the domain of one person or team. Safety is paramount, so training must be appropriate. Operators are often capable of high standards of technical ability; this is improved through the use of "best practice" procedures and proper training of these procedures.

In any modern manufacturing facility the equipment used, requires a level of maintenance to ensure that the manufacturing process is not disrupted and the production plan can be achieved. World class organizations spend time and resources on maintaining their equipment using a preventative maintenance plan. This study looks at the processes included in Total Productive Maintenance (TPM).

In any modern manufacturing facility the equipment used requires a level of maintenance to ensure that the manufacturing process is not disrupted and the production plan can be achieved. In some industries, especially those using continuous production, the plant would shut down for annual maintenance, where equipment is repaired and critical components replaced. World class organizations spend time and resources on maintaining their equipment as it is more effective to have a preventative maintenance plan than repair or replace equipment when it fails.

There are a number of plant maintenance processes that are employed by successful organizations.

a) **Corrective Maintenance:** This type of maintenance procedure is used in companies that do not employ a preventative maintenance program. In its simplest form, a company will not perform maintenance on a piece of equipment until a failure occurs. When this happens the plant maintenance department will
then perform work on the item to either repair it so that it can be placed back into service or replace the piece of equipment if it cannot be repaired or requires maintenance that would cause significant delays to the production schedule.

b) **Preventive Maintenance:** Companies that use a preventative maintenance will plan regular maintenance inspections so that any issues that may occur with a piece of equipment can be identified before a critical failure occurs. Preventative maintenance also ensures that critical parts are replaced before they fail and consumable items, such as oil and lubricants, are changed regularly.

c) **Predictive Maintenance:** Some companies use predictive maintenance to maintain their equipment. Predictive maintenance helps companies determine the condition of their equipment so that they can predict when maintenance should be performed. This method can be a considerable cost saving over preventive maintenance as it allows maintenance departments to perform work on equipment only when they believe it is needed rather than on a set schedule. This procedure is also known as condition-based maintenance as a company can employ conditioning monitoring which uses non-destructive testing, such as infrared, vibration analysis and sound analysis.

Depending on the industry, production processes and size of the business, the type of plant maintenance used can vary from company to company. But, Total Productive Maintenance (TPM) has become increasingly popular. TPM is a manufacturing led initiative that emphasizes the continuous improvement philosophy and the importance of production and maintenance staff working together.

As customer satisfaction becomes the primary differentiator, companies are increasingly sensitive to meeting customer’s delivery dates. Adhering to the production schedule is extremely important and maintenance of equipment has
become an integral part of the manufacturing process. By ensuring production and maintenance staff work together, the company should find that equipment issues are reported earlier and production delays are avoided.

**Fig.no.3.3**

Companies that have introduced TPM have seen a number of benefits including a better understanding of the performance of their equipment, improved co-operation between manufacturing and plant maintenance staff, reduced maintenance costs and extended life of manufacturing equipment. Above fig.no.3.3 shows the eight pillars of TPM.

**Benefits of TPM**

1. Increase productivity and OPE (Overall Plant Efficiency) by 1.5 or 2 times.
2. Rectify customer complaints.
3. Reduce the manufacturing cost by 30%.
4. Satisfy the customer’s needs by 100 % (Delivering the right quantity at the right time, in the required quality.)
5. Reduce accidents. Higher confidence level amongst the employees.
6. Keep the work place clean, neat and attractive.
7. Favorable change in the attitude of the operators.
8. Achieve goals by working as team.
9. Horizontal deployment of a new concept in all areas of the organization.
10. Share knowledge and experience.
11. The workers get a feeling of owning the machine.

All the above details tell us the direct relationship to increase productivity of industries.

3.3.4 LEAN SUPPLY CHAIN MANAGEMENT

Lean supply chain management is not exclusively for those companies who manufacture products, but by businesses who want to streamline their processes by eliminating waste and non-value added activities. Companies have a number of areas in their supply chain where waste can be identified as time, costs or inventory. To create a leaner supply chain companies must examine each area of the supply chain. Acquire some things in many businesses have complex purchasing operations. Large companies often have corporate purchasing groups as well as local purchasing. This can lead to vendors being given multiple contracts leading to variations in prices depending on location. Companies that practice lean supply chain management reduce their procurement function so that each vendor has one point of contact, one contract and offers one price for all locations. Businesses are looking to new technologies to assist them in improving procurement processes. These include internet based purchasing that allows requisitioners to purchase items from vendor’s catalogs containing companywide contract prices. Changes in payment options to vendors can also streamline processes. Companies that use a two-way match, which is payment on receipt
rather than payment on invoice, will reduce resources in their purchasing department as well as improve supplier relationships. Following are the different elements of lean SCM.

**a) Manufacturing:** Lean supply chain management gained popularity in the manufacturing area where significant improvement can be achieved. Manufacturing processes can be improved to reduce waste and resources while maintaining operational performance. Companies those have adopted lean supply chain practices have examined each of their routings, bill of materials and equipment to identify the area where improvements can be achieved.

**b) Overall Equipment Effectiveness:** Companies that have implemented Total Productive Maintenance (TPM), often do this as a part of an implementation of other manufacturing improvement procedures such as Six Sigma. When businesses want to evaluate the relative success of their TPM procedures they often use a set of measurements. This article examines the series of metrics that are part of the Overall Equipment Effectiveness.

The overall equipment effectiveness is a series of metrics that can be used to measure the utilization of a manufacturing operation or piece of equipment. The metrics can be used daily to identify how equipment is performing. It can be used as a goal that a company wishes to achieve. When a company looks at equipment effectiveness, there are six areas where waste can occur; equipment failures, setup and adjustments, idling, scrap and rework, reduced speed operation and startup losses.

**c) Equipment Failures:** These are unexpected failures that occur without warning and cause production to be halted. This can seriously affect the production schedule and customer deliveries. If the failure cannot be remedied quickly, a new piece of equipment may need to be purchased which can cause financial hardship to a small or medium sized company.
d) **Setup and Adjustments:** Equipment downtime also occurs when machines are broken down at the end of production run and new tools are setup for the next production run. Although this downtime is usually included in the production schedule, any additional time required in the setup due to adjustments may not and this can delay the production schedule.

e) **Idling:** A production schedule expects equipment to run at its optimum speed. A machine can have its speed reduced if there are minor issues that can be corrected by the machine’s operator. It is important for an operator to realize when a machine is operating below its optimum level as it can have a detrimental effect on the production schedule.

f) **Scrap and Rework:** If a machine is not operating at its optimum level it can produce items that are below the acceptable quality standard and will need to be scrapped or reworked. Not only is this a waste of time and resources, it can significantly affect the production schedule and customer delivery dates.

g) **Reduced Speed Operation:** The speed of a piece of equipment is defined by the manufacturer and companies expect that the documented speed is the speed that the machine will operate at. However, unless a company actually calibrates the equipment and verifies that it is operating at the manufacturer’s specification then there is a possibility that the machine is operating below standard.

h) **Startup Losses:** When equipment is setup there may be some issues with the initial items produced. For example, in chemical manufacturing, initial batches may not be of a suitable quality. Although this setup loss may be included in the production schedule, it does mean a loss of time and resources that could be minimized.

There are three factors that are used in the calculation of Overall Equipment Effectiveness. These are the availability rate, the performance rate, and the quality rate.
I) **Availability Rate** The availability rate is the time the equipment is really running, versus the time it could have been running. A reduced availability rate is an indication of equipment failures and issues around setup and adjustments.

II) **Performance Rate** The performance rate is the quantity of material produced during the running time, versus the quantity of material that could have been produced when taking into account the manufacturers documented speed of the equipment. A low performance rate can be seen as a result of idling, minor stoppages and reduced speed operation.

III) **Quality Rate** The quality rate is the amount of acceptable material versus the total amount of material that is manufactured. A low quality rate is an indication of startup losses and the amount of scrap material.

When a company first uses OEE metrics they can see the efficiency of their equipment. They then have the information from which they can set improvement goals for their plant. By improving the availability, performance and quality rates a company can reduce their expenditure on maintenance and raw materials as well as improve their manufacturing capability and customer delivery times.

Depending on the sub-specialties involved, industrial engineering may also be known as operations management, management science, and operations research, systems engineering, or manufacturing engineering, usually depending on the viewpoint or motives of the user. Recruiters or educational establishments use the names to differentiate themselves from others. While the term originally applied to manufacturing, the use of "industrial" in "industrial engineering" can be somewhat misleading, since it has grown to encompass any methodical or
quantitative approach to optimizing how a process, system, or organization operates. Some engineering universities and educational agencies around the world have changed the term “industrial” to the broader term “production”, leading to the typical extensions noted above.

3.3.5 MATERIAL REQUIREMENT PLANNING\textsuperscript{xx} (MRP-I)

Material Requirements Planning (MRP-I) and Manufacturing Resource Planning (MRP-II) are predecessors of Enterprise Resource Planning (ERP), a business information integration system. The development of these manufacturing coordination and integration methods and tools made today’s ERP systems possible. The vision for MRP and MRPII is to centralize and integrate business information which help in decision making for production line managers and increase the efficiency of the production line overall. In the 1980s, manufacturers developed systems for calculating the resource requirements of a production run based on sales forecasts. In order to calculate the raw materials needed to produce products and to schedule the purchase of those materials along with the machine and labour time needed, production managers recognized that they would need to use computer and software technology to manage the information. Material Requirements Planning (MRP-I) was an early iteration of the integrated information systems vision. MRP information systems helped managers to determine the quantity and timing of raw materials purchases. Information systems that would assist managers with other parts of the manufacturing process, MRP-II, followed. While MRP-I is primarily concerned with materials, MRP-II is concerned with the integration of all aspects of the manufacturing process, including materials, finance and human relations.
Like today’s ERP systems, MRP-II is designed to integrate a lot of information by way of a centralized database. However, the hardware, software, and relational database technology of the 1980s was not advanced enough to provide the speed and capacity to run these systems in real-time, and the cost of these systems was prohibitive for most businesses. Nonetheless, the vision had been established, and shifts in the underlying business processes along with rapid advances in technology led to the more affordable enterprise and application integration systems that big businesses and many medium and smaller businesses use today.

Material Requirements Planning (MRP-I) is software based production planning and inventory control system used to manage manufacturing processes. An MRP system is intended to simultaneously meet three objectives:

- Ensure materials and products are available for production and delivery to customers.
- Maintain the lowest possible level of inventory.
- Plan manufacturing activities, delivery schedules and purchasing activities.

MRP is concerned primarily with manufacturing materials while MRPII is concerned with the coordination of the entire manufacturing production, including materials, finance, and human relations. The goal of MRPII is to provide consistent data to all players in the manufacturing process as the product moves through the production line.

Paper-based information systems and non-integrated computer systems that provide paper or disk outputs result in many information errors, including missing data, redundant data, numerical errors that result from being incorrectly keyed into the system, incorrect calculations based on numerical errors, and bad
decisions based on incorrect or old data. In addition, some data is unreliable in non-integrated systems because the same data is categorized differently in the individual databases used by different functional areas.

MRPII systems begin with MRP, Material Requirements Planning. MRP allows for the input of sales forecasts from sales and marketing. These forecasts determine the raw materials demand. MRP and MRPII systems draw on a Master Production Schedule, the breakdown of specific plans for each product on a line. While MRP allows for the coordination of raw materials purchasing, MRPII facilitates the development of a detailed production schedule that accounts for machine and labour capacity, scheduling the production runs according to the arrival of materials. An MRPII output is a final labour and machine schedule. Data about the cost of production, including machine time, labor time and materials used, as well as final production numbers, is provided from the MRPII system to accounting and finance.

**The scope of MRP:** Manufacturing organizations, whatever their products, face the same daily practical problem - that customers want products to be available in a shorter time than it takes to make them. This means that some level of planning is required. Companies need to control the types and quantities of materials they purchase, plan which products are to be produced and in what quantities and ensure that they are able to meet current and future customer demand, all at the lowest possible cost. Making a bad decision in any of these areas will make the company lose money. A few examples are given below:

- If a company purchases insufficient quantities of an item used in manufacturing, or the wrong item, they may be unable to meet contracts to supply products by the agreed date.
• If a company purchases excessive quantities of an item, money is being wasted - the excess quantity ties up cash while it remains as stock and may never even be used at all. This is a particularly severe problem for food manufacturers and companies with very short product life cycles.
• Beginning production of an order at the wrong time can cause customer deadlines to be missed.

It provides answers for several questions like What items are required?, How many are required?, When are they required?

MRP can be applied both to items that are purchased from outside suppliers and to sub-assemblies, produced internally.

The input data includes:
• The end item being created. This is sometimes called Independent Demand or Level “0” on BOM (Bill of materials).
• How much is required at a time.
• When the quantities are required to meet demand.
• Shelf life of stored materials.
• Inventory status records include records of net materials available for use already in stock (on hand) and materials on order from suppliers.
• Bills of materials which deals with details of the materials, components and subassemblies required to make each product.
• Planning Data which includes all the restraints and directions to produce the end items. This includes such items as: Routings, Labour and Machine Standards, Quality and Testing Standards, Pull/Work Cell and Push commands, Lot sizing techniques (i.e. Fixed Lot Size, Lot-For-Lot and Economic Order Quantity), Scrap Percentages, and other inputs.

The output data includes two outputs and a variety of messages/reports:
• The first output is the "Recommended Production Schedule" which lays out a detailed schedule of the required minimum start and completion dates, with quantities, for each step of the Routing and Bill of Material required satisfying the demand from the MPS.

• The second output is the "Recommended Purchasing Schedule". This lays out both the dates that the purchased items should be received into the facility and the dates that the Purchase orders or Blanket Order Release should occur to match the production schedules.

Messages and Reports:

• Purchase orders include an order to a supplier to provide materials.

• Reschedule notices recommends cancelling, increasing, delaying or speeding up existing orders.

Note that the outputs are recommended. Due to a variety of changing conditions in companies, since the last MRP / ERP system Re-Generation, the recommended outputs need to be reviewed by trained people to group orders for benefits in set-up or freight savings. These actions are beyond the linear calculations of the MRP computer software.

MRP/ERP Systems were first introduced by George Plossl and Joseph Orlicky in the late 1960s. Oliver Wight contributed the evolution to MRP II, to include more than the factory production and material needs. ERP evolved with the change in hardware / software capability and "Interface" interpretations between software.

The major problem with MRP systems is the integrity of the data. If there are any errors in the inventory data, the bill of materials (BOM) data, or the master production schedule, then the outputted data will also be incorrect. Most vendors of this type of system recommend at least 99% data integrity for the system to give useful results.
Another major problem with MRP systems is the requirement that the user specify how long it will take a factory to make a product from its component parts (assuming they are all available). Additionally, the system design also assumes that this "lead time" in manufacturing will be the same each time the item is made, without regard to quantity being made, or other items being made simultaneously in the factory.

A manufacturer may have factories in different cities or even countries. It is no good for an MRP system to say that we do not need to order some material because we have plenty thousands of miles away. The overall ERP system needs to be able to organize inventory and needs by individual factory, and intercommunicate needs in order to enable each factory to redistribute components in order to serve the overall enterprise.

This means that other systems in the enterprise need to work properly both before implementing an MRP system, and into the future. For example systems like variety reduction and engineering which makes sure that product comes out right first time (without defects) must be in place.

Production may be in progress for some part, whose design gets changed, with customer orders in the system for both the old design, and the new one, concurrently. The overall ERP system needs to have a system of coding parts such that the MRP will correctly calculate needs and tracking for both versions. Parts must be booked into and out of stores more regularly than the MRP calculations take place. Note, these other systems can well be manual systems, but must interface to the MRP. For example, a 'walk around' stock take done just prior to the MRP calculations can be a practical solution for a small inventory. It is a production planning and inventory control system used to manage manufacturing processes for improving the overall productivity of organization.
Manufacturing Resource Planning (MRP II) is defined by APICS (American Production and Inventory Control Society, Estd. 1957) as a method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning in rupees, and has a simulation capability to answer "what-if" questions and extension of closed-loop MRP.

This is not exclusively a software function, but a marriage of people skills, dedication to data base accuracy, and computer resources. It is a total company management concept for using human resources more productively.

MRP II integrates many areas of the manufacturing enterprise into a single entity for planning and control purposes, from board level to operative and from five-year plan to individual shop-floor operation. It builds on closed-loop Material Requirements Planning (MRP) by adopting the feedback principle but extending it to additional areas of the enterprise, primarily manufacturing-related.

**Key functions and Features:** MRP II is not a proprietary software system and can thus take many forms. It is almost impossible to visualize an MRP II system that does not use a computer, but an MRP II system can be based on purchased / licensed or in-house software.

The MRP-II system is useful for:

- Master Production Scheduling (MPS)
- Item Master Data (Technical Data)
- Bill of Materials (BOM) (Technical Data)
- Production Resources Data (Manufacturing Technical Data)
- Inventories and Orders (Inventory Control)
- Purchasing Management
• Material Requirement Planning (MRP)
• Shop Floor Control (SFC)
• Capacity planning or Capacity Requirements Planning (CRP)
• Standard Costing (Cost Control)
• Cost Reporting / Management (Cost Control)
• Distribution Resource Planning (DRP)

Together with ancillary systems such as:

• Business Planning
• Lot Traceability
• Contract Management
• Tool Management
• Engineering Change Control
• Configuration Management
• Shop Floor Data Collection
• Sales Analysis and Forecasting
• Finite Capacity Scheduling

Related systems such as:

• General Ledger
• Accounts Payable (Purchase Ledger)
• Accounts Receivable (Sales Ledger)
• Sales Order Management
• Distribution Requirements Planning (DRP)
• [Automated] Warehouse Management
• Project Management
• Technical Records
• Estimating
• Computer-aided design/Computer-aided manufacturing (CAD/CAM)
The MRP II system integrates these modules together so that they use common data and freely exchange information, in a model of how a manufacturing enterprise should and can operate. The MRP II approach is therefore very different from the “point solution” approach, where individual systems are deployed to help a company plan, control or manage a specific activity. MRP II is fully integrated or at least fully interfaced.

**MRP II systems can provide:**

- Better control of inventories
- Improved scheduling
- Productive relationships with suppliers
- Improved design control
- Better quality and quality control
- Reduced working capital for inventory
- Improved cash flow through quicker deliveries
- Accurate inventory records
- Timely and valid cost and profitability information

The Material Requirements Planning application provides the required information to develop priorities, meet commitments, and plan production/purchasing. Therefore, MRP-II impacts on the productivity of the industries.

### 3.3.7 ENTERPRISE RESOURCE PLANNING (ERP)

The term "Enterprise resource planning" originally derived from manufacturing resource planning (MRP II) that followed material requirements planning (MRP). MRP evolved into ERP when "routings" became a major part of
the software architecture and a company's capacity planning activity also became a part of the standard software activity.

ERP systems typically handle the manufacturing, logistics, distribution, inventory, shipping, invoicing, and accounting for a company. ERP software can aid in the control of many business activities, including sales, marketing, delivery, billing, production, inventory management, quality management, and human resource management.

An Enterprise Resource Planning (ERP) system is an integrated computer-based application used to manage internal and external resources, including tangible assets, financial resources, materials, and human resources. Its purpose is to facilitate the flow of information between all business functions inside the boundaries of the organization and manage the connections to outside stakeholders. Built on a centralized database and normally utilizing a common computing platform, ERP systems consolidate all business operations into a uniform and enterprise-wide system environment.

An ERP system can either reside on a centralized server or be distributed across modular hardware and software units that provide "services" and communicate on a local area network. The distributed design allows a business to assemble modules from different vendors without the need for the placement of multiple copies of complex and expensive computer systems in areas which will not use their full capacity.

The initialize ERP was first employed by research and analysis company Gartner Group in 1990 as an extension of MRP (Material Requirements Planning; later Manufacturing Resource Planning) and CIM (Computer Integrated
Manufacturing), and whilst not supplanting these terms, it has come to represent a larger whole. It came into use, as the creators of MRP software started to develop software applications beyond the manufacturing arena. However, this does not mean that ERP packages have typically been developed from a manufacturing core. Many of the major players started their development of an integrated package from other directions, such as accounting, maintenance and human resources management. ERP systems now attempt to cover all core functions of an enterprise, regardless of the organization's business or charter. These systems can now be found in non-manufacturing businesses, non-profit organizations and governments.

To be considered as an ERP system, a software package should have the following traits:

- An integrated system that operates in (next to) real time, without relying on periodic batch updates.
- A common database that is accessed by all applications, preventing redundant data and multiple data definitions.
- A consistent look and feel throughout each module (sales, manufacturing, accounting etc.).
- The ability to access the system without specialist integration by the Information System (or IT) department.

Following are the components/modules of ERP

1) **Transactional Backbone**

- Financials
- Distribution
- Human Resources
- Product lifecycle management

2) **Advanced Applications**

- Customer Relationship Management (CRM)
- Supply chain management software
- Purchasing
- Manufacturing
Distribution
- Warehouse Management System

3) Management Portal/Dashboard
4) Decision Support System

These modules can exist in a system or can be utilized in an ad-hoc fashion like:

1) **Commercial applications:** These applications are Manufacturing Engineering, bills of material, work orders, scheduling, capacity, workflow management, quality control, cost management, manufacturing process, manufacturing projects, manufacturing flow Supply chain management Order to cash, inventory, order entry, purchasing, product configurator, supply chain planning, supplier scheduling, inspection of goods, claim processing, commission calculation.

ERP systems are often incorrectly called back office systems, indicating that customers and the general public are not directly involved. This is contrasted with front office systems like customer relationship management (CRM) systems that deal directly with the customers, or the e-Business systems such as e-Commerce, e-Government, e-Telecom, and e-Finance, or supplier relationship management (SRM) systems.

ERP systems are cross-functional and enterprise-wide. All functional departments that are involved in operations or production are integrated in one system. In addition to areas such as manufacturing, warehousing, logistics, and information technology, this typically includes accounting, human resources, marketing and strategic management.

ERP II, a term coined in the early 2000s, is often used to describe what would be the next generation of ERP software. This new generation of software
is web-based and allows both employees and external resources (such as suppliers and customers) real-time access to the system's data.

Businesses have a wide scope of applications and processes throughout their functional units, producing ERP software systems that are typically complex and usually impose significant changes on staff work practices. Implementing ERP software is typically too complex for in-house developers, lacking the required skills, so it is desirable and advisable to hire outside consultants who are professionally trained to implement these systems. This is typically the most cost-effective way. There are three types of services that may be employed - Consulting, Customization, and Support. The length of time to implement an ERP system depends on the size of the business, the number of modules, the extent of customization, the scope of the change, and the willingness of the customer to take ownership for the project.

ERP systems are modular, so they don't all need be implemented at once. Implementation can be divided into various stages, or phase-ins. The typical project is about 14 months and requires around 150 consultants. A small project (e.g. a company of less than 100 staff) can be planned and delivered within 3–9 months; however, a large, multi-site or multi-country implementation can take years. The length of the implementations is closely tied to the amount of customization desired.

2) Data Migration: Data migration is one of the most important activities in determining the success of an ERP implementation. Since many decisions must be made before migration, a significant amount of planning must occur. Unfortunately, data migration is the last activity before the production phase of an ERP implementation, and therefore receives minimal attention due to time
constraints. The following are steps of a data migration strategy that can help with the success of an ERP implementation:

a) Identify the data to be migrated determines the timing of data migration, Generate the data templates, Freeze the tools for data migration, Decide on migration-related setups, Decide on data archiving.
b) ERP systems centralize the data in one place has the benefits like: Eliminates the problem of synchronizing changes between multiple systems - consolidation of finance, marketing and sales, human resource, and manufacturing applications, Permits control of business processes that cross functional boundaries, Provides top-down view of the enterprise (no "islands of information"), real time information is available to management anywhere, anytime to make proper decisions.
c) Reduces the risk of loss of sensitive data by consolidating multiple permissions and security models into a single structure.
d) Shorten production lead time and delivery time
e) Facilitating business learning, empowering, and building common visions

Enterprise resource planning (ERP) system, such as Microsoft Dynamics, can help to create an environment that boosts indirect labor productivity. Measuring the impact of applications on ERP end-user productivity is a one of the goals of every industry.

3.3.8 CAPACITY PLANNING

It is the process of determining the production capacity needed by an organization to meet changing demands for its products. In the context of capacity planning, "capacity" is the maximum amount of work that an organization is capable of completing in a given period of time. The phrase is also used in business for Capacity Management.
A discrepancy between the capacity of an organization and the demands of its customers results in inefficiency, either in under-utilized resources or unfulfilled customers. The goal of capacity planning is to minimize this discrepancy. Demand for an organization's capacity varies based on changes in production output, such as increasing or decreasing the production quantity of an existing product, or producing new products. Better utilization of existing capacity can be accomplished through improvements in overall equipment effectiveness (OEE). Capacity can be increased through introducing new techniques, equipment and materials, increasing the number of workers or machines, increasing the number of shifts, or acquiring additional production facilities. We can compute with the help of following formula.

\[
\text{Capacity} = (\text{number of machines or workers}) \times (\text{number of shifts}) \times (\text{utilization}) \times (\text{efficiency}).
\]

The broad classes of capacity planning are lead strategy, lag strategy, and match strategy.

- **Lead strategy** is adding capacity in anticipation of an increase in demand. Lead strategy is an aggressive strategy with the goal of luring customers away from the company's competitors. The possible disadvantage to this strategy is that it often results in excess inventory, which is costly and often wasteful.

- **Lag strategy** refers to adding capacity only after the organization is running at full capacity or beyond due to increase in demand (North Carolina State University, 2006). This is a more conservative strategy. It decreases the risk of waste, but it may result in the loss of possible customers.

- **Match strategy** is adding capacity in small amounts in response to changing demand in the market. This is a more moderate strategy.
Capacity planning is long-term decision that establishes a company's overall level of resources. It extends over time horizon long enough to obtain resources. Capacity decisions affect the production lead time, customer responsiveness, operating cost and company ability to compete. Inadequate capacity planning can lead to the loss of the customer and business. Excess capacity can drain the company's resources and prevent investments into more lucrative ventures. The question of when capacity should be increased and by how much is the critical decisions towards the increasing productivity of industries.

3.3.9 DISTRIBUTION REQUIREMENT PLANNING (DRP)

It is a method used in business administration for planning orders within a supply chain. DRP enables the user to set certain inventory control parameters (like a safety stock) and calculate the time-phased inventory requirements. This process is also commonly referred to as Distribution Requirements Planning.

**DRP uses following variables:**
- the on-hand inventory at the end of a period.
- the backordered demand at the end of a period.
- the required quantity of product needed at the beginning of a period.
- the constrained quantity of product available at the beginning of a period.
- the recommended order quantity at the beginning of a period.

**DRP needs the following information:**
- the demand in a future period.
- the scheduled receipts at the beginning of a period.
- the safety stock requirement for a period.
- the on-hand inventory at the beginning of a period.
A supply channel is composed of three structures. At one end of the channel is the manufacturer. The manufacturer focuses on the development and production of products and originates the distribution process. The terminal point in the channel is the retailer who sells goods and services directly to the customer for their personal, non-business use. In between the two lies a process called distribution, which is more difficult to define. One involved in the distribution process is labeled a "distributor."

The APICS Dictionary describes, “A distributor as a business that does not manufacture its own products but purchases and resells these products. Such a business usually maintains a finished goods inventory." The proliferation of alternative distribution forms, such as warehouse clubs, catalog sales, marketing channel specialists and mail order, have blurred functional distinctions and increased the difficulty of defining both the distribution process and the term distributor.

Distribution involves a number of activities centered around a physical flow of goods and information. At one time the term distribution applied only to the outbound side of supply chain management, but it now includes both inbound and outbound. Management of the inbound flow involves following elements:

- Material planning and control
- Purchasing
- Receiving
- Physical management of materials via warehousing and storage
- Materials handling

Management of the outbound flow involves following elements:

- Order processing
• Warehousing and storage
• Finished goods management
• Material handling and packaging
• Shipping
• Transportation

Distribution channels are formed to solve three critical distribution problems: Functional performance, Reduced complexity and Specialization. The central focus of distribution is to increase the efficiency of time, place, and delivery utility. When demand and product availability are immediate, the producer can perform the exchange and delivery functions itself. However, as the number of producers grows and the geographical dispersion of the customer base expands, the need for both internal and external intermediaries who can facilitate the flow of products, services, and information via a distribution process increases.

Distribution management also can decrease overall channel complexity through sorting and assistance in routinization. Sorting is the group of activities associated with transforming products acquired from manufacturers into the assortments and quantities demanded in the marketplace. Routinization refers to the policies and procedures providing common goals, channel arrangements, expectations, and mechanisms to facilitate efficient transactions. David F. Ross describes the techniques of classification of inventory as follows:

1. Sorting is the function of physically separating a heterogeneous group of items into homogeneous subgroups. This includes grading and grouping individual items into an inventory lot by quality or eliminating defects from the lot.
2. Accumulating is the function of combining homogeneous stocks of products into larger groups of supply.
3. Allocation is the function of breaking down large lots of products into smaller salable units.
4. Assorting is the function of mixing similar or functionally related items into assortments to meet customer demand. For example, putting items into kit form.

As the supply chain grows more complex, costs and inefficiencies multiply in the channel. In response, some channels add or contain partners that specialize in one or more of the elements of distribution, such as exchange or warehousing. Specialization then improves the channel by increasing the velocity of goods and value-added services and reducing costs associated with selling, transportation, carrying inventory, warehousing, order processing, and credit.

**Role of the distribution function**

There are a number of critical functions performed by the channel distributor. These functions are as follows:

1. Product acquisition.

2. Product movement. This implies significant effort spent on product movement up or down the supply channel.

3. Product transaction.

**The critical functions of distribution are given below:**
- Selling and promoting.
- Buying and building product assortments.
- Bulk breaking.
- Value-added processing.
• Transportation.
• Warehousing.
• Marketing information.

The need for more detailed distribution planning led to the emergence of distribution requirements planning (DRP) during the 1970s. DRP is a widely used and potentially powerful technique for helping outbound logistics systems manage and minimize inbound inventories. This concept extended the time-phase order point found in material requirements planning (MRP) logic to the management of channel inventory. By the 1980s DRP had become a standard approach for planning and controlling distribution logistics activities and had evolved into distribution resource planning. The concept now embraces all business functions in the supply channel, not just inventory and logistics, and is termed DRP II.

DRP is usually used with an MRP system, although most DRP models are more comprehensive than stand-alone. MRP models can schedule transportation. The underlying rationale for DRP is to more accurately forecast demand and then use that information to develop delivery schedules. This way, distribution companies can minimize inbound inventory by using MRP in conjunction with other schedules.

Key elements of DRP are as follows:
• Forecast demand for each stock-keeping unit (SKU)
• Current inventory level of the SKU
• Target safety stock
• Recommended replenishment quantity
• Replenishment lead time
The concept of DRP very closely mimics the logic of MRP. As with MRP, gross requirements consist of actual customer orders, forecasted demand, or some combination of both; scheduled receipts are the goods the distributor expects to receive from orders that already have been released, while goods that already are received and entered into inventory constitute the on-hand inventory balance. Subtracting scheduled receipts and on-hand inventory from gross requirements yields net requirements.

The distributor's lot-sizing policy and receiving behavior, generate planned order receipts. Company may order only what they need for the next planning period or for a designated time period, known as Economic Order Quantity (EOQ). This involves a lot size based on a costing model. Alternatively, companies may be limited to multiples of a lot size simply because the supplying company packages or palletizes their goods in standard quantities. Also, some distributors may require some time interval between the arrival of goods on their docks and the entry of the goods into the inventory system. For example, a company may have a staging area where goods remain for an average time period while awaiting quality or quantity verification.

Hence, planned order receipt may be during the planning period when the goods are needed, or they may need to be received earlier depending on time requirements. Order release is then determined by offsetting the planned order receipt by the supplier's lead time.

If multiple warehouses or distributor inventories are present, the DRP system will attempt to balance their inventories by shifting available units between inventories based on parameters established by the user that indicate the
level at which inventories may interact with one another. Hence, DRP automatically helps to improve the productivity of organization.

3.3.10 REVERSE LOGISTICS

It stands for all operations related to the reuse of products and materials. It is "the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. More precisely, reverse logistics is the process of moving goods from their typical final destination for the purpose of capturing value, or proper disposal.

Remanufacturing and refurbishing activities also may be included in the reverse logistics." The reverse logistics process includes the management and the sale of surplus as well as returned equipment and machines from the hardware leasing business. Normally, logistics deal with events that bring the product towards the customer. In the case of reverse, the resource goes at least one step back in the supply chain. For instance, goods move from the customer to the distributor or to the manufacturer.

In today's marketplace, many retailers treat merchandise returns as individual, disjointed transactions. "The challenge for retailers and vendors is to process returns at a proficiency level that allows quick, efficient and cost-effective collection and return of merchandise. Customer requirements facilitate demand for a high standard of service that includes accuracy and timeliness. It’s the logistic company's responsibility to shorten the link from return origination to the time of resell." By following returns management best practices, retailers can
achieve a returns process that addresses both the operational and customer retention issues associated with merchandise returns. Further, because of the connection between reverse logistics and customer retention, it has become a key component within Service Lifecycle Management (SLM), a business strategy aimed at retaining customers by attending more coordination of a company's services data together to achieve greater efficiency in its operations.

**Fig.no.3.4**

Reverse logistics is more than just returns management; it is "activities related to returns avoidance, gate keeping, disposal and all other after-market supply chain issues". Returns management – increasingly being recognized as affecting competitive positioning – provides an important link between marketing and logistics. This Reverse logistics is clear with the help of fig.no.3.4.

The broad nature of its cross-functional impact suggests that companies would benefit by improving internal integration efforts. Third-party logistics providers see that up to 7% of an enterprise's gross sales are captured by return costs. Almost all reverse logistics contracts are customized to fit the size and type of company contracting. The 3PL's themselves realize 12% to 15%
profits on this business. The Improving the Quality and Productivity of Reverse Logistics Operations is common expression among Reverse Logistics.

3.3.11 THIRD-PARTY LOGISTICS (3PL)

A third-party logistics provider (abbreviated 3PL, or sometimes TPL) is a company that provides a one stop shop service to its customers of outsourced logistics services for part or all of their supply chain management functions.

Third party logistics providers typically specialize in integrated operation, warehousing and transportation services that can be scaled and customized to customer’s needs based on market conditions and the demands and delivery service requirements for their products and materials.

3PL provides transportation, warehousing, cross-docking, inventory management, packaging, and freight forwarding. Third-party logistics providers are freight forwarders. The courier company integrating and offering contracted logistics and transportation services

Hertz and Alfredsson describe four categories of 3PL providers xxvi:

- Standard 3PL provider: This is the most basic form of a 3PL provider. They would perform activities such as, pick and pack, warehousing, and distribution (business) – the most basic functions of logistics. For a majority of these companies, the 3PL function is not their main activity.

- Service developer: This type of 3PL provider will offer their customers advanced value-added services such as: tracking and tracing, cross-docking, specific packaging, or providing a unique security system. A solid Information Technology (IT) foundation and a focus on economies of scale and scope will enable this type of 3PL provider to perform these types of tasks.
The customer adapter: This type of 3PL provider comes in at the request of the customer and essentially takes over complete control of the company’s logistics activities. The 3PL provider improves the logistics dramatically, but do not develop a new service. The customer base for this type of 3PL provider is typically quite small.

The customer developer: This is the highest level that a 3PL provider can attain with respect to its processes and activities. This occurs when the 3PL provider integrates itself with the customer and takes over their entire logistics function. These providers will have few customers, but will perform extensive and detailed tasks for them.

Advancements in technology increases the supply chain visibility and inter-company communications have given rise to a relatively new model for third-party logistics operations – the “non-asset based logistics provider.” Non-asset based logistics providers perform functions such as consultation on packaging and transportation, freight quoting, financial settlement, auditing, tracking, customer service and issue resolution. However, they don’t employ any truck drivers or warehouse personnel, and they don’t own any physical freight distribution assets of their own – no trucks, no storage trailers, no pallets, and no warehousing. A non-assets based provider consists of a team of domain experts with accumulated freight industry expertise and information technology assets. They play a role similar to freight agents or brokers, but maintain a significantly greater degree of “hands on” involvement in the transportation of products, which helps to increase the efficiency and effectiveness of operation for better productivity.
3.3.12 JUST-IN-TIME (JIT)\textsuperscript{xxvii}

It is an inventory strategy that strives to improve a business return on investment by reducing in-process inventory and associated carrying costs. Just In Time production method is also called the Toyota Production System. To meet JIT objectives, the process relies on signals or Kanban between different points in the process, which tell production when to make the next part. Kanban are usually 'tickets' but can be simple visual signals, such as the presence or absence of a part on a shelf. Implemented correctly, JIT can improve a manufacturing organization's return on investment, quality, and efficiency. Quick notice of material reduces inventory at the center of JIT. This saves warehouse space and costs.

Just in time is a ‘pull’ system of production, so actual orders provide a signal for when a product should be manufactured. Demand-pull enables a company to produce only what is required, in the right quantity and at the right time.

This means that stock levels of raw materials, components, work in progress and finished goods can be kept to a minimum. This requires a carefully planned scheduling and flow of resources through the production process. Modern manufacturing companies use sophisticated production scheduling software to plan production for each period of time, which includes ordering the correct stock. Information is exchanged with suppliers and customers through EDI (Electronic Data Interchange) to help ensure that every detail is correct.
Advantages of JIT:

- Lower stock holding means a reduction in storage space which saves rent and insurance costs.
- As stock is only obtained when it is needed, less working capital is tied up in stock.
- There is less likelihood of stock perishing, becoming obsolete or out of date.
- Avoids the build-up of unsold finished product that can occur with sudden changes in demand.
- Less time is spent on checking and re-working the product of others as the emphasis is on getting the work right first time.
- Reduced setup time the flow of goods from warehouse to shelves improves.
- Employees with multiple skills are used more efficiently.
- Production scheduling and work hour consistency synchronized with demand.
- Increase emphasis on supplier relationships. Supplies come in at regular intervals throughout the production day.

Disadvantages of JIT:

- There is little room for mistakes as minimal stock is kept for re-working faulty product
- Production is very reliant on suppliers and if stock is not delivered on time, the whole production schedule can be delayed
- There is no spare finished product available to meet unexpected orders, because all products are made to meet actual orders.

Ultimately, JIT improves the productivity of organization with the help of above benefits.
3.3.13 SIX SIGMA \textsuperscript{xviii} (6'6)

It is a business management strategy originally developed by Motorola, USA in 1986. As of 2010, it is widely used in many sectors of industry, although its use is not without controversy. Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects or errors and minimizing variability in manufacturing and business processes. It uses a set of quality management methods, including statistical methods, and creates a special infrastructure of people within the organization such as "Black Belts", "Green Belts", etc. who are the experts in these methods. Each Six Sigma project carried out within an organization follows a defined sequence of steps and has quantified financial targets such as cost reduction or profit increase.

The term six sigma originated from terminology associated with manufacturing, specifically terms associated with statistical modeling of manufacturing processes. The maturity of a manufacturing process can be described by a sigma rating indicating its yield, or the percentage of defect-free products it creates. A six-sigma process is one in which 99.99966% of the products manufactured are statistically expected to be free of defects means 3.4 defects per million. Motorola set a goal of "six sigma" for all of its manufacturing operations, and this goal became a byword for the management and engineering practices used to achieve it.

Six Sigma originated as a set of practices designed to improve manufacturing processes and eliminate defects, but its application was subsequently extended to other types of business processes as well. In Six Sigma, a defect is defined as any process output that does not meet customer
specifications, or that could lead to creating an output that does not meet customer specifications.

Bill Smith first formulated the particulars of the methodology at Motorola in 1986. Six Sigma was heavily inspired by six preceding decades of quality improvement methodologies such as quality control, TQM, and Zero Defects based on the work of pioneers such as Shewhart, Deming, Juran, Ishikawa, Taguchi and others.

**Objectives of Six Sigma:**
- Continuous efforts to achieve stable and predictable process results (i.e., reduce process variation) are of vital importance to business success.
- Manufacturing and business processes have characteristics that can be measured, analyzed, improved and controlled.
- Achieving sustained quality improvement requires commitment from the entire organization, particularly from top-level management.

**Features of Six Sigma:**
- A clear focus on achieving measurable and quantifiable financial returns from any Six Sigma project.
- An increased emphasis on strong and passionate management leadership and support.
- A special infrastructure of "Champions," "Master Black Belts," "Black Belts," "Green Belts", etc. to lead and implement the Six Sigma approach.
- A clear commitment to making decisions on the basis of verifiable data, rather than assumptions and guesswork.
Six Sigma is a registered service mark and trademark of Motorola Inc. As of 2006 Motorola reported over US$17 billion in savings from Six Sigma. Other early adopters of Six Sigma who achieved well-publicized success include Honeywell (previously known as Alliedsignal) and General Electric, where Jack Welch introduced the method. By the late 1990s, about two-thirds of the Fortune 500 organizations had begun Six Sigma initiatives with the aim of reducing costs and improving quality and productivity.

**Methods of Six Sigma:**
Six Sigma projects follow two project methodologies inspired by Deming's Plan-Do-Check-Act Cycle. These methodologies, composed of five phases each, bear the acronyms DMAIC and DMADV.

- **DMAIC** is used for projects aimed at improving an existing business process. DMAIC is pronounced as "duh-may-ick".
- **DMADV** is used for projects aimed at creating new product or process designs. DMADV is pronounced as "duh-mad-vee".

**DMAIC**
The DMAIC project methodology has five phases:

- **Define** the problem, the voice of the customer, and the project goals, specifically.
- **Measure** key aspects of the current process and collect relevant data.
- **Analyze** the data to investigate and verify cause-and-effect relationships.
- **Improve** or optimize the current process based upon data analysis using techniques such as design of experiments, poka yoka or mistake proofing, and standard work to create a new, future state process.
- **Control** the future state process to ensure that any deviations from target are corrected before they result in defects. Implement control systems such as
statistical process control, production boards, and visual workplaces, and continuously monitor the process.

**DMADV or DFSS**

The DMADV project methodology, also known as DFSS ("Design For Six Sigma"), features five phases:

- **Define** design goals that are consistent with customer demands and the enterprise strategy.
- **Measure** and identify CTQs (characteristics that are Critical To Quality), product capabilities, production process capability, and risks.
- **Analyze** to develop and design alternatives, create a high-level design and evaluate design capability to select the best design.
- **Design** details, optimize the design, and plan for design verification.
- **Verify** the design, set up pilot runs, implement the production process and hand it over to the process owners.

One key innovation of Six Sigma involves the "professionalizing" of quality management functions.

Six Sigma identifies several key roles for its successful implementation.

- **Executive Leadership**: It includes the CEO and other members of top management. They are responsible for setting up a vision for Six Sigma implementation. They also empower the other role holders with the freedom and resources to explore new ideas for breakthrough improvements.
- **Champions**: It takes responsibility for Six Sigma implementation across the organization in an integrated manner. The Executive Leadership draws them from upper management. Champions also act as mentors to Black Belts.
- **Master Black Belts**: These are identified by champions, act as in-house coaches on Six Sigma. They devote 100% of their time to Six Sigma. They assist champions and guide Black Belts and Green Belts. Apart from
statistical tasks, they spend their time on ensuring consistent application of Six Sigma across various functions and departments.

- Black Belts: These operate under Master Black Belts to apply Six Sigma methodology to specific projects. They devote 100% of their time to Six Sigma. They primarily focus on Six Sigma project execution, whereas Champions and Master Black Belts focus on identifying projects/functions for Six Sigma.
- Green Belts: These are the employees who take up Six Sigma implementation along with their other job responsibilities, operating under the guidance of Black Belts.

Some organizations use additional belt colours, such as Yellow Belts, for employees that have basic training in Six Sigma tools. Ultimately, Six Sigma operates with the help of above techniques and improves the productivity of overall organization.

### 3.3.14 FIVE S (5S)

It is the name of a workplace organization methodology that uses a list of five Japanese words which are Seiri, Seiton, Seiso, Seiketsu and Shitsuke. They all start with the letter "S". The list describes how items are stored and how the new order is maintained. The decision-making process usually comes from a dialogue about standardization which builds a clear understanding among employees of how work should be done. It also instills ownership of the process in each employee. Following fig.no.3.5 clarifies five S.
**Definition of Five S** practice “It is a technique used to establish and maintain a quality environment in a company by improving its’ organization”.

**Objectives of Five S:**

a) Find the root causes of the problem and overcome it.

b) Improve housekeeping Make every individual responsible for housekeeping.

c) Beautify by simple means Productivity improvement by saving time, space etc.

d) Keep human beings at the centre at the time of formulating policies of organization.

e) Maintain healthy relations among different levels of organization.
Benefits of Five S:

a) Improves self-organization
b) Improves overall appearance of company
c) Improves efficiency of workplace

There are 5 primary phases of 5S:

i) SEIRI  ii) SEITON  iii) SEISO  iv) SEIKETSU and v) SHITSUKE.

Additionally, there are two other phases sometimes included, safety and security.

i) SEIRI - Sort out:

This means sorting and organizing the items as critical, important, frequently used items, useless or items that are not need as of now as well as on the basis of similar characters of items. Unwanted items can be salvaged. Critical items should be kept for use nearby and items that are not be used in near future, should be stored in some place. For this step, the worth of the item should be decided based on utility and not cost. As a result of this step, the search time is reduced.

ii) SEITON - Organize:

The concept here is that "Each item has a place and only one place". The items should be placed back after usage at the same place. To identify items easily, name plates and colored tags has to be used. Vertical racks can be used for this purpose, and heavy items occupy the bottom position in the racks.

iii) SEISO - Shine the workplace:

This involves cleaning the work place free of burrs, grease, oil, waste, scrap etc. No loosely hanging wires or oil leakage from machines. At the time of
cleaning, one more thing is important which to count the material for knowing the present status.

**iv) SEIKETSU - Standardization:**

Employees have to discuss together and decide on standards for keeping the work place / Machines / pathways neat and clean. These standards are implemented for whole organization and are tested / inspected randomly.

**v) SHITSUKE - Self discipline:**

Considering 5S as a way of life and bring about self-discipline among the employees of the organization. This includes wearing badges, following work procedures, punctuality, dedication to the organization etc.

Therefore, 5’S is useful tool for keeping healthy environment in organization for sound efficiency and effectiveness, which affects on productivity.

**3.3.15 KAIZEN**

"Kai" means change, and "Zen" means good (for the better). Basically kaizen is for small improvements, but carried out on a continual basis and involve all people in the organization. Kaizen is opposite to big spectacular innovations. Kaizen requires little investment. The principle behind is that "a very large number of small improvements are more effective in an organizational environment than a few improvements of large value. This pillar is aimed at reducing losses in the workplace that affect our efficiencies. By using a detailed and thorough procedure we eliminate losses in a systematic method using various Kaizen tools. These activities are not limited to production areas and can be implemented in administrative areas as well.
a) **Kaizen Policy includes:**

1. Practice concepts of zero losses in every sphere of activity.
2. Relentless pursuit to achieve cost reduction targets in all resources.
3. Relentless pursuit to improve overall plant equipment effectiveness.
4. Extensive use of PM analysis as a tool for eliminating losses.
5. Focus of easy handling of operators.

b) **Kaizen Target includes:**

Achieve and sustain zero loses with respect to minor stops, measurement and adjustments, defects and unavoidable downtimes. It also aims to achieve 30% manufacturing cost reduction.

c) **Tools used in Kaizen:**

1. PM analysis
2. Why - Why analysis
3. Summary of losses
4. Kaizen register

The objective of TPM is maximization of equipment effectiveness. TPM aims at maximization of machine utilization and not merely machine availability maximization. As one of the pillars of TPM activities, Kaizen pursues efficient equipment, operator and material and energy utilization that is extremes of productivity and aims at achieving substantial effects. Kaizen activities try to thoroughly eliminate 16 major losses for improving the productivity of organization.

d) **KAIZEN helps to minimize following losses assist to improve productivity.**

Failure losses - Breakdown loss, Setup / adjustment losses, Cutting blade loss, Start up loss, Minor stoppage / Idling loss, Speed loss - operating at low speeds,

3.3.16 BARCODE

A barcode is an optical machine-readable representation of data, which shows certain data on certain products. Originally, barcodes represented data in the widths (lines) and the spacing of parallel lines, and may be referred to as linear or 1D (1 dimensional) barcodes or symbologies. They also come in patterns of squares, dots, hexagons and other geometric patterns within images termed 2D (2 dimensional) matrix codes or symbologies. Although 2D systems use symbols other than bars, they are generally referred to as barcodes as well. Barcodes can be read by optical scanners called barcode readers, or scanned from an image by special software.

The first use of barcodes was to label railroad cars, but they were not commercially successful until they were used to automate supermarket checkout systems, a task in which they have become almost universal. Their use has spread to many other roles as well, tasks that are generically referred to as Auto ID Data (AIDC). Other systems are attempting to make inroads in the AIDC market, but the simplicity, universality and low cost of barcodes has limited the role of these other systems. It costs 0.5¢ (U.S.) to implement a barcode, while passive RFID still costs about 7¢ to 30¢ per tag as well as saved time, which converts into productive time.
3.3.17 BENCHMARKING

It is the process of comparing one's business processes and performance metrics to industry bests and/or best practices from other industries. Dimensions typically measured are quality, time and cost. Improvements from learning mean doing things better, faster, and cheaper.

Benchmarking involves management identifying the best companies in their industry, or any other industry where similar processes exist, and comparing the results and processes of those studied (the "targets") to one's own results and processes to learn how well the targets perform and, more importantly, how they do it.

The term benchmarking was first used by cobblers to measure people's feet for shoes. They would place someone's foot on a "bench" and mark it out to make the pattern for the shoes. Benchmarking is most used to measure performance using a specific indicator (cost per unit of measure, productivity per unit of measure, cycle time of x per unit of measure or defects per unit of measure) resulting in a metric of performance that is then compared to others.

It is a process used in management and particularly strategic management, in which organizations evaluate various aspects of their processes in relation to best practice companies' processes, usually within a peer group defined for the purposes of comparison. This then allows organizations to develop plans on how to make improvements or adapt specific best practices, usually with the aim of increasing some aspect of performance. Benchmarking may be a one-off event, but is often treated as a continuous process in which organizations continually seek to improve their practices.
a) Uses of Benchmarking

In 2008, a comprehensive survey on benchmarking was commissioned by The Global Benchmarking Network, a network of benchmarking centers representing 22 countries. Over 450 organizations responded from over 40 countries. The results showed that: Mission and Vision Statements and Customer (Client) Surveys are the most used (by 77% of organizations) of 20 improvement tools, followed by SWOT analysis (72%), and Informal Benchmarking (68%). Performance Benchmarking was used by (49%) and Best Practice Benchmarking by (39%).

The tools that are likely to increase in popularity the most over the next three years are Performance Benchmarking, Informal Benchmarking, SWOT, and Best Practice Benchmarking. Over 60% of organizations that are not currently using these tools indicated they are likely to use them in the next three years.

b) Types of benchmarking

i) Process benchmarking – In process benchmarking, the initiating company focuses its observation and investigation of business processes with a goal of identifying and observing the best practices from one or more benchmark companies. Activity analysis will be required where the objective is to benchmark cost and efficiency; increasingly applied to back-office processes where outsourcing may be a consideration.

ii) Financial benchmarking – This benchmarking performs a financial analysis and comparing the results in an effort to assess your overall competitiveness and productivity.

iii) Benchmarking from an investor perspective- It extends the benchmarking universe and also compares to peer companies that can be considered alternative investment opportunities from the perspective of an investor.
iv) **Performance benchmarking** – It allows the initiator company to assess their competitive position by comparing products and services with those of target companies.

v) **Product benchmarking** – It is the process of designing new products or upgrades to current ones. This process can sometimes involve reverse engineering which is taking apart competitors products to find strengths and weaknesses.

vi) **Strategic benchmarking** – It involves observing how others compete. This type is usually not industry specific, meaning it is best to look at other industries.

vii) **Functional benchmarking** – In financial benchmarking, a company will focus its benchmarking on a single function to improve the operation of that particular function. Complex functions such as Human Resources, Finance and Accounting and Information and Communication Technology are unlikely to be directly comparable in cost and efficiency terms and may need to be disaggregated into processes to make valid comparison.

viii) **Best-in-class benchmarking** - It involves studying the leading competitor or the company that best carries out a specific function.

ix) **Operational benchmarking** – It embraces everything from staffing and productivity to office flow and analysis of procedures performed.

x) **Energy benchmarking** – It develops an accurate model of a building's energy consumption with the purpose of measuring reductions in usage.

These indicated that the productivity of organization can increase with the help of using above proper method.
3.3.18 ELECTRONIC DATA INTERCHANGE (EDI)

It is the structured transmission of data between organizations by electronic means. It is used to transfer electronic documents or business data from one computer system to another computer system, i.e. from one trading partner to another trading partner without human intervention.

It is more than mere e-mail; for instance, organizations might replace bills of lading and even cheques with appropriate EDI messages. The National Institute of Standards and Technology in a 1996 publication defines electronic data interchange as "the computer-to-computer interchange of strictly formatted messages that represent documents other than monetary instruments. EDI implies a sequence of messages between two parties, either of whom may serve as originator or recipient. The formatted data representing the documents may be transmitted from originator to recipient via telecommunications or physically transported on electronic storage media." It goes on further to say that "In EDI, the usual processing of received messages is by computer only. Human intervention in the processing of a received message is typically intended only for error conditions, for quality review, and for special situations. For example, the transmission of binary or textual data is not EDI as defined here unless the data are treated as one or more data elements of an EDI message and are not normally intended for human interpretation as part of online data processing."

EDI can be formally defined as 'The transfer of structured data, by agreed message standards, from one computer system to another without human intervention'. Most other definitions used are variations on this theme. Even in this era of technologies such as XML web services, the Internet and the World
Wide Web, EDI may be the data format used by the vast majority of electronic commerce transactions in the world.

a) Sets of EDI standards include:

- The UN-recommended UN/EDIFACT is the only international standard and is predominant outside of North America.
- The US standard ANSI ASC X12 (X12) is predominant in North America.
- The TRADACOMS standard developed by the ANA (Article Numbering Association) is predominant in the UK retail industry.
- The ODETTE standard used within the European automotive industry.

b) Advantages of EDI over paper systems

EDI and other similar technologies save company money by providing alternative to or replacing information flows that require a great deal of human interaction and materials such as paper documents, meetings, faxes, etc. Even when paper documents are maintained in parallel with EDI exchange, e.g. printed shipping manifests, electronic exchange and the use of data from that exchange reduces the handling costs of sorting, distributing, organizing, and searching paper documents.

EDI and similar technologies allow a company to take advantage of the benefits of storing and manipulating data electronically without the cost of manual entry. Another advantage of EDI is reduced errors, such as shipping and billing errors, because EDI eliminates the need to rekey documents on the destination side. One very important advantage of EDI over paper documents is the speed in which the trading partner receives and incorporates the information into their system thus greatly reducing cycle times. For this reason, EDI can be an important component of just-in-time production systems.
3.3.19 RADIO FREQUENCY IDENTIFICATION (RFID)

It is a technology that uses communication via electromagnetic waves to exchange data between a terminal and an electronic tag attached to an object, for the purpose of identification and tracking. Some tags can be read from several meters away and beyond the line of sight of the reader. Radio-frequency identification involves interrogators (also known as readers), and tags (also known as labels).

Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions. The other is an antenna for receiving and transmitting the signal.

There are three types of RFID tags:

1) Passive RFID tags, which have no power source and require an external electromagnetic field to initiate a signal transmission.
2) Active RFID tags, which contain a battery and can transmit signals once an external source (Interrogator) has been successfully identified.
3) Battery Assisted Passive (BAP) RFID tags, which require an external source to wake up but have significant higher forward link capability providing greater range.

There are a variety of groups defining standards and regulating the use of RFID includes:
International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), ASTM International, DASH7 Alliance, EPC global. RFID has many applications; for example, it is used in enterprise supply
chain management to improve the efficiency of inventory tracking and management.

3.4 CASES OF SUPPLY CHAIN MANAGEMENT

Case no.1: Anand Group

Practices: Centralized purchase for high value items, E-procurement, Vendor development, Managed inventory.

The Anand group is one of the larger diversified conglomerates active in auto ancillaries. It has 33 plants in eight states and is present in the industrial clusters of Delhi, Pune, Chennai and Hosur - close to its key customers. It has the largest basket of products for the auto industry, and every vehicle in India carries some or the other part manufactured by Anand group.

Supply chain has just caught the attention of the group. The group companies are decentralized to a very large extent. They buy and sell their own materials. Procurement has also been independent and group-level synergies hadn’t been explored much. By 2003-04, the top management of the group had realized that SCM had to be looked into if they had to maintain any competitive advantage.

For a business in which 2/3rd of the sale price is material costs, focus on cost control for this issue was paramount. The first effort, says Arvind Nanda, the company’s strategy deployment and corporate materials VP in Delhi, was to consolidate key commodities to leverage scale of procurement. This meant a consolidation of supplier bases, so as to remove any duplication and unnecessary negotiations. The group formed the Corporate Materials division, which Mr Nanda heads, with the clear intention to facilitate buying. This division does not
actually enter into any pacts or deals, but identifies the right vendors across the
country, negotiates the pricing and other aspects and then hands over to the
individual group companies to take it forward – the actual logistics, inventory and
so on. “Procurement for key materials a centrally driven function,” says Nanda.
The A-class material would be controlled and bought for the companies by the
central group, while the B and C-class materials would be bought directly by the
individual group companies. The group also formed quality and commodity
councils to create awareness of usage and costs.

The other method that the group used was e-commerce. They use e-
sourcing via Baazi.com. The group requirements are put online for the
commodities, and registered vendors are asked to bid for supply. The event is
held on the Baazi portal. The group has held 15-20 such events in the past six
months, aggregating to a total of Rs 800 crore in purchasing. “This year”, says
Nanda, “we will buy worth Rs 1,000 crore on this portal.” He says savings of
around 7-8% on total procurement cost has already been realised.

Different companies in the group are at different levels of SCM maturity.
Take Purolator, one of the group companies engaged in making filters for auto
and other industries. Says Prakash Bhalekar, CEO, Purolator; “We have 50 turns
a year for finished goods, which ranks as one of the best in the industry.”
Purolator’s vendor base is all close to its plants. There’s also a strong focus on
vendor development, working with them for better quality, faster development
and pricing. The BaaN, ERP that the group uses today allows companies to see
data but not transact, which will change eventually. Vendor rationalization is also
underway, as the company finds the usual Pareto principle working. Bhalekar
describes a typical operation. There are 400 bins per shift. A schedule for
production is given to all concerned -- plant and vendors. There’s a three-day
rolling plan as well. The partnership manner has delivered almost 100% adherences to forecast for both the company and consequently its vendors as well. Trolleys carry material as per the requirement of production, no less, no more. This is quite similar to the manner in which his customers in automobiles work.

Critically, Purolator has developed its own APO (advanced planning tool) at a cost of Rs 10 lakh. This tool has deskill BaaN -- every production manager, not just the IT guy, can do his planning. The screens are user-friendly and uncluttered. The dispatches are published on the intranet, and dynamic changes to schedules are possible. Hourly dispatch Direct on Line (DOL) can be made and tracked. Inventory can be seen online as well, as APO integrates with BaaN. This intranet presently covers three-group companies -- Purolator, Spicer and Gabriel -- but more will go online soon. The group expects to spend up to Rs 20 lakh for new middleware and servers soon. There’s a challenge to connect all the companies, but it will have to be done.

**Gabriel** is another major company in the group. It has also started off with SCM sometime before the others did. For example, it has a firm production plan for the next day; and gives firm schedules to vendors. The material is collected by a milk run (3 trucks) and the preparation of trolleys to the line is done as per the deployment plan for the first two hours of production. There is also feedback for the vendors (who all use standard containers for supply) and a replenishment of the trolleys every two hours. The ‘bucket’, therefore, is two hours. **Just In Time** (JIT) is also being used at Gabriel. 225 lots a day come into the plant; and operations people, not planning, do the scheduling of the lots. There’s a contingency plan of vendor fallback for every activity as well, since the output of the station is balanced with the suppliers’ rate of production and disruption is expensive. Gabriel also does vendor-managed inventory – where the
subcontractor maintains Gabriel’s inventory on its shop floor. The vendor must submit a weekly stock statement as well. The ultimate idea is to use 20 vendors as preferred ones.

**Case no. 2: Larson and Turbo**

**Practices:** Inventory online, Real-time procurement and planning, Integrating systems

L and T is one of India’s largest industrial conglomerates with interests in segments as diverse as heavy engineering to IT and ERP. Not surprisingly, one of its major concerns is tracking inventory. L and T InfoTech, the IT division of L and T, is the implementers for several ERP packages, but they themselves internally applied the inventory tracking concepts to realize significant business benefits. One of the innovations -- or rather logical developments -- that L and T did was the L and T store. This initiative is part of their e-connect suite.

One of the add-ons to the SAP system that L and T use is E and Cstore.com, **inventory management software.** This has helped the division to manage the surplus material in all the sites. This has further helped the company to take up new projects in an expeditious manner. In itself, it’s not an unknown innovation, but L and T has a virtual store on it that makes it unique. Surplus material lying at the various project sites that L and T is working on is listed by the project managers on this site for sale or use in other projects and validated by the central stores in Powai. Subsequent projects can check on this site and ensure they don’t order material already with L and T somewhere in the country, not just the company stores. L and T has also used the site to sell surplus fully made machinery. They even sold a surplus turbine worth several million dollars to buyers in Africa via the site.
Today, L and T stores lists of all items for auction via its websites where anyone – not just L and T personnel -- can try their hand at buying pre-owned material. A look at their website lists an eclectic collection of material – from plates, beams, angles, valves, paint, elbows and so on. There is also the sale of pre-owned material, but unused. L and T puts up the whole gamut of documents - images, pictures, files, drawings and the ownership details. Users can click the item they wish to buy or bid for, and submit it via the website itself. This fits with the stated objective: “For executing E and C jobs for our prestigious customers on a fast track, we maintain an inventory of high class raw-materials, components and machines. We now make available the same inventory to all end users and E and C companies worldwide through this website. As a first step, we are introducing the feature of accessing our inventory online for any visitor of this website. From time to time we dispose off lots of slow moving items through a process of closed e-auction amongst a set of pre-qualified bidders.”

There’s SCM innovation on inventory on the shop floor as well at L and T. In the Heavy Engineering Department (HED) at Powai, Mumbai, electrodes are used in the manufacturing process and traditionally controlling quantity supplied was a problem. No one really bothered too much about these things. Today, the SCM focus has changed things. From a manual process, it’s now automated. Says M V Kotwal, senior VP, HED, L and T, “We set up kiosks in the shop floor linked to our BaaN, ERP system. These kiosks are touch screens. The worker has to input the project code, which gives the kind and number of electrodes required for that project. If the demand is as per schedule, the system gives the worker a number, which he takes to the stores and gets his electrode. The stores also input the same number, which already has all the details of the worker, consumption and project. All this is online with BaaN, so all the concerned departments track real-time the consumption of electrodes for that particular
project.” The company says this has cut excess inventory significantly and saved up to Rs 20-30 lakh in such inventory control alone.

On the scheduling front also, the division has had to adopt an external system, the Prima Vera Project planner to do the scheduling per se. However, the back-up data on the status of various items ordered by the project buyers, along with the Prima Vera reports, is the basis of schedule management. Overall there has been a 20% cycle time reduction in the division's project orders if one was to compare the before and after scenario. However, to be fair, the division accepts the fact that many environmental and business strategy factors have also played a part in reducing the cycle time for the orders.

An e-procurement package helping the company in procuring raw material, ALPS, a material tracking software and PDS, a plant design system are the other add-ons which help the division in its process management. SAP R/3 works in conjunction with the company’s EprocurePlus, the e-procurement package that addresses Supply Chain Management. E-Procure+ developed by L and T InfoTech to suit E and C business-specific procurement practices. In L and T’s business the supply chain is not repetitive. Each project order has different types of items with unique specifications. Consequently the division has a different set of supplies and suppliers. Maintaining inventories of standard items through on-line agreements with dedicated suppliers in the classical SCM sense is not possible in for the division.

The ERP system, SAP has synergies with the supply chain management software. The ERP system has an interface with e-Procure+. The division has backward integrated the ERP system with the Plant Design System (PDS). It has developed a connector between the P-BOMS (bill of materials). This enables
faster and authentic bills of material to be directly fed into the ERP system from the PDS. This end-to-end synergy contributes to ‘on time’ and ‘within cost completion’ to a large extent.

The importance of add-ons can be further gauged from the fact that the division has spent as much on add-ons as on the initial SAP package. Going forward, the division is going to invest more towards the betterment of its IT infrastructure.

Case No. 3 Moser Baer
Practic: Innovation, Postponement of final assembly, Discipline, Cut no corners

So you think it’s just a CD-ROM? You couldn’t be more wrong. Today’s CD-ROM business is global, fast paced, frenetic and has very high stakes. Delhi-based Moser Baer is the third largest manufacturer of optical media with the full range of CDs – ROMs, R/W, VCDs, DVDs- the lot. It holds 20% of the global market share and counts Sony, Toshiba, TDK and many other globally recognised names as its customers. It makes five million CDs a day from 200 lines. It has backward integrated into making its own packaging and cases. This business can be as complicated as any, and being in India adds another whole new dimension to issues related to management supply chain management.

The case study can aptly be called ‘complexity and simplicity’. At the very basic level, every CD-ROM is the same - the same medium, the same process and the same category of use. But that’s where the simplicity ends. Says Moser Baer general manager (supply chain and logistics) B Ganesh, “The differentiator for the CD-ROMs is in the uniqueness of printing and packaging.” Differentiator, sure, but that’s where the complexity is introduced, and that’s the point where the
supply chain really kicks in. Ganesh sums it well, “Every order is unique and customized.”

Ganesh lists a mind-boggling array of options that a customer demands – and takes as well. CD-ROMs can be packed in ‘cake boxes’, in soft boxes, in slim cases, in shrink wraps, in cigarette wraps, in bundle wraps which can make shrink, heat or tight finishes. Even within these varieties, pack sizes can be 10, 20, 30, 40, 60 or 100 CDs to a pack. Each pack has a label, has a booklet inside (the correct booklet of the correct company must be placed in the correct pack). Apparently, the 60s pack is the latest craze among users. This is certainly not out of the ordinary as FMCG and pharma industries are used to such varieties in packing. But the fun starts when the same CD-ROM run has to be packed on-line in all these different pack configurations along with printing – and all this has to be done absolutely seamlessly, lest dust get into the CD-ROMs.

Says Ganesh, “We can still pack the CD-ROMs in different pack sizes and configurations right off the line, no problem at all. We have our own shrink and heat treatment facilities; we make our own boxes. Our machines can sort out the packs and sizes and finish the job.” Easy? Not so. The crux is the printing. Every company, says Ganesh, has a different printing style, logo, colour and preference. Some have one colour, others multi-colours; some use holographs, others don’t. The whole idea is that until the CD-ROMs are made, they may be indistinguishable from each other, but towards the end of the production process, the CD-ROMS must be handled in such a manner that they have the exact printing that different customers need - 100% correct printing with the right pack size and configuration – each and every time.
It would be disastrous, says Ganesh, if a Sony got delivered a TDK printed pack! Moreover, the screens for the printing must arrive at the line just as the appropriate batch of CD-ROMs arrive off the line at the printing post. The two streams – the CD-ROMs from the manufacturing line and the printing details - must arrive in sync just in time for each other. Such a requirement needs a supply chain capable of handling bulk and yet be able to customize.

The process of printing also adds to the complexity of the line. Every CD-ROM for a customer, say, Sony, must have exactly the same colour and shade as every other Sony CD-ROM in the world. This is because at the retail end, CD-ROMs made in Taiwan and India may be placed side by side. Obvious differences in logo, shade and colour cannot be tolerated. Says Ganesh, “Even minute and small shade changes can cause CDs to be rejected.”

Moser Baer’s cracked the code for this complexity. Only the top people see order copies and price details. Passwords control access to all files and databases. The idea is that the man handling a particular client should know only about that client and none else. Moser Baer has also developed its own 13-digit code to track its own products.

On the logistics front, Moser Baer uses what Ganesh calls ‘the round robin’ system. The system is simple. Moser Baer does not use many trucks to transport its export containers to Mumbai port. Instead, it uses the Dadri Inland Container Depot (ICD). Essentially, the Concor trains bring the containers of imports (Moser Baer imports chemicals for the CD manufacturing process) to Dadri, from which they are trucked to the Moser Baer plant at Noida, less than 10 km away. The very same import containers are emptied out and stuffed with ready to go CDs for export. These same containers are then trucked to Dadri, put
on the Concor train and railed down to Mumbai port where they are loaded onto the ships for sailing to Europe, SE Asia or the US.

Says Ganesh, had a hard time convincing Concor to set up the Dadri ICD. In fact, for a few months after it was set up, Moser Baer was the only player there. Then others came up. But we gave the undertaking that we alone would be able to use most of Dadri capacity. Today that is happening.” The other issue was the containers. Usually, import and export containers are separate, which involves duplication of loading, unloading, checking and so on- all revenue earning actions for handlers, shippers, truckers, workers. But Moser Baer, by coordinating imports and exports, was able to recycle the same container that brought in their imports for their finished goods exports. The logistics of moving this container from inbound to outbound is what Ganesh calls the ‘round robin’ system.

This is how it works. Moser Baer owns ‘prime movers’- trucks with just a cab and engine and a chassis- no body. These prime movers shuttle between the plant and the ICD, ferrying containers to and fro. At Dadri, for example, one prime mover would load the import container onto its chassis; go down to the plant to the inbound dock where machines could lift the container off the prime mover. This relieved prime mover would then drive down to the export dock, where a previously arrived and emptied import container would have been loaded with export material. The container would be loaded onto the chassis, after which the prime mover would ferry the container to Dadri for loading onto the train to Mumbai port. The phrase round robin comes from the fact that the prime mover keeps going round and round, and containers keep coming in full, get empty, get loaded again and go out again. Moser Baer imports 10 containers a day and exports 25 a day (see table ‘Smooth Operator).
**Value Engineering of Moser Baer**

Moser Baer has maximized stuffing of the containers as well. A typical 40-footer container can take 26 tonnes of material. They have fitted in 1.4 million CDs into a 40’ container, against a usual of 1 million previously, by changing the packaging and value engineering. At 10 cents a CD, Moser Baser price, that’s $4,000 extra – Rs 17 lakh extra into one container. It has also value engineered to reduce weight per CD. For example, a typical DVD weighs between 20-22 grams, which can now be made at 19 grams- a direct saving in inbound materials like silver or metals, as well as more stuffing in containers. Some metals are at Rs 5 lakh per kg – and at Moser Baer’s production of 5 million a day, that’s a saving of Rs 25-30 lakh a day. No mean numbers!

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<td>Net Working Capital Cycle</td>
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</table>

(Average days)

Source: Capitaline 2000

**Planning**

Moser Baer works on the CRDD concept – Customer Required Delivery Date. It does door delivery, preferring to do so because they can control freight, timing, quality and safety. Moser Baer has a license for freight forwarding as well. Typically, for a customer in Germany, for example, the company would work backwards, adding in time for customs clearances in Germany, sea travel time, Mumbai port times, freight to Mumbai from Delhi time, and so on, keeping some extra margin days as well. A typical cycle can be 45-50 days. In seasons (Europe/US and Asia have different holiday seasons, when sales of CDs are highest) this time has to be crunched - and that’s where Moser Baer uses its
warehouses at Hamburg and trucks down to customers anywhere in Europe. The company owns all the assets.

**Case no. 4: Pantaloon Retail**

**Practices:** Toll-free number, Personnel training, Think to market – explore new channels, Invest in back office

“**Cover all channels**”. That’s the mantra in Pantaloon Retail’s headquarters in Mumbai. And as the company adds channels to its portfolio, supply chain and logistics management -- never an easy task in organized retail -- just became more complicated. Pantaloon SCM handles 30 million stock-keeping units (SKUs) every day, across the country all the time. Each SKU has to be tracked, stocked, sold, and attended to. And if the Big Bazaar and Food Bazaar supermarkets were not enough, Pantaloon also entered direct-to-home selling in a big way in June 2004 in Mumbai.

The company understands very clearly that home delivery systems are essentially logistics systems. The system involves starting from **toll-free numbers** to taking the calls, taking the orders, conveying it to the picking and kitting system, and delivering them, and not the least, taking payment. All of this is hard-core logistics driven. The importance that SCM gets in Pantaloon is manifest in the fact that it’s the first and only retail company in India whose SCM department has got ISO 9001:200-certified. Such a focus will be required for Pantaloon’s new venture – Food Bazaar on Call.

Its Food retail venture, Food Bazar has big plans to expand into the ‘on call’ channel this year. Says the company, “We are exploring every channel of sales – from internet, telephonic ordering, physical stores, mobile Food Bazaar
vans to kiosks.” He says Food Bazaar On Call, as the on-call venture is called, plans to deliver ordered material at home, office, at whatever time the caller specifies. The idea is to take an ever-larger share of the consumer’s spend and take share when the consumer doesn’t want to step out in rains, or late evenings or when both husband and wife are working. In the Food Bazar model, a caller rings up the 1600 toll free number which goes to a 20-seater call centre in Chembur, the helpline agent guides the caller through the products and then confirms the order. Presently, the Food Bazar-On-Call has been operational in Vashi, Navi Mumbai since June-end 2004 and the preliminary results there have been encouraging. Says Singh, “We have been receiving 800 calls a day, with 200-300 of them converting into orders. The average order size is around Rs 550.” 24x7 systems don’t seem to make sense right now, as they find orders start coming in only after 8 am everyday, and almost no one orders at night. Pantaloon’s initial investment into this venture has been around Rs 30 lakh, and the company was confident of recovering it all by the end of the year ’04.

The company says the entire software for the on-call venture was developed in-house, leveraging the understanding of products and retail of the staff that he already had. “It took us just 40 days to launch the software for the Food Bazaar-on-Call.” What are the operational differentiators against HLL’s Sangam and Fabmart’s home delivery in the suburbs? Says the SCM department, “We have no repeat delivery charges, unlike others. Also, there’s no minimum order size, whereas others have.” Pantaloon also says that sales from Food Bazaar-on-Call are estimated to be higher on weekdays rather than weekends, when malls and his own Big and Food Bazaars will draw the consumer. The company has plans a foot to streamline the on-call venture quickly. On the cards is a catalogue that will be available for callers to choose from different products. The helpline agents are also being trained all the time. “The average length of a
call to our 1600 number has fallen from 12 minutes to under 3.5 minutes today,” says the company. This is by itself an addition to the bottom-line, as Pantaloon pays for every minute the call lasts. Pantaloon notes the shift in nature of calls, “When we first started, we had more enquiry calls, more curiosity. Now we have more calls that place orders.” There’s a favorable offshoot as well. Pantaloon says brand awareness of Big Bazaar and Food Bazaar has also gone up, with greater footfalls at the physical stores as well. “We have a solid physical infrastructure to back up the online and on call retail models unlike the earlier days where ordering was easy, delivery wasn’t,” says the company. Backward integrating the fledgling call centre that presently caters to the on call venture is also not ruled out.

Pantaloons Retail India Limited (PRIL), the country’s leading player in the organized retail segment has been awarded the ISO 9001:2000 quality certificate by Det Norske Veritas, one of the world’s leading quality certifiers, for its Supply Chain and Logistics function. Pantaloon Retail is the first company in the organized retail sector in India to win an accredited ISO Certificate exclusively for its Supply Chain and Logistics function.

The ISO 9001:2000 standard, established by DNV, the Netherlands-based certifying agency, is a quality management standard that establishes an international benchmark and standard for logistics and supply chain process within the company and ensures that the practices, systems and procedures followed by the company in the above function follow defined systems and practices, thus facilitating rapid growth.

“Today supply chain and logistics is a very critical function for any customer-centric business, especially, the retail sector,” said Kishore Biyani, Managing Director, Pantaloon Retail (India) Limited. “The ISO 9001:2000
quality certificate will help in our continuous quest for quality and promise to deliver the customer the best -- in fashion, price and experience. Surely, this is another step towards Pantaloons journey of becoming a world class retailer!”

To get the ISO 9001:2000 Certification, Pantaloons had to meet rigorous standards in designing the supply chain across the country, reducing lead time of delivery, resource and product management and a strict measurement parameter. The ISO 9001:2000 certification recognizes the company’s supply chain and logistics functions, critical design practices, committed management focus and universal application of the quality standards across the company’s locations, stores, warehouses and vendors.

Commenting on the above certification, Anshuman Singh, Head, Supply Chain and Logistics, Pantaloon Retail (India) Limited said, “Achieving the ISO 9001:2000 certificate is excellent for an operation that is growing as quickly as ours. Like any company that has been through this process, we knew that it was demanding. Every employee and operation was totally committed to quality from the very beginning. By scrutinizing the supply chain and logistics at every level, we assure our customers that we are committed to providing them with superior customer service and the highest quality products. The implementation team and employees' level of commitment and knowledge about ISO 9001:2000 principles were an important factor in the independent audit team's unanimous favourable assessment.”

The initiative began about six months back and each and every process was scanned and major re-engineering or elimination of non-value added steps were undertaken. The Supply Chain forms the backbone for the activities along the value chain and currently handles approximately half a million units per day across the country with the quantum likely to increase to three million
transactions and two million pieces per day respectively in the next two years. Today, all the SCM activities such as **Supplier Relationship Management**, **Quality Assurance**, **Logistics and Warehousing** and the **Central Procurement Cell** are geared to work as per the best global standards which the ISO 9001:2000 certificate mandates and deliver the highest customer value with increased efficiency.

**Case no.5:  Carborundum Universal**

**Managing End-to-End Supply Chain – Post-Production**  
H Ganesh DGM (Marketing)  
**Best Practice:** Formation of Supply Chain cell – single point accountability, Focus on key lines of products for improvement, Central warehousing, Rationalize transportation vendors

It was in late ’90s when in Carborundum ‘Raw Logistics’ matured into Supply Chain Management. However, it took another few months for the company to realize that the supply chain excellence was something more than a means to operational efficiency. Apart from streamlining internal processes and eliminating redundancies, it was also a necessary part of capturing and retaining customers, addressing market channels and increasing profits -- a boon to the back and front office. Issues like non-availability of products even at excess manufacturing capacities, higher inventories, multiple contact and dispatch points, quantitative methods of forecasting, could be addressed better by supply chain management. Having realized, the next step was to ensure a proper set-up for SCM.
Carborundum Universal, a company from Murugappa group, the largest manufacturer of abrasive in India, was facing certain complexities. It had more than four manufacturing locations, 12 depots, more than 50 product lines, 30,000 Skus and last, but not the least, was the average management age of the company to deal with. Since the objective was clear and benefits were visible it did not take much time to align all the resources, internally and the need to outsource the expertise. The expertise was required for the suitable strategy to develop for the required supply chain and for its design. The need was also felt to de-link the pre and post-production supply chain in the first phase and linking them back in the second phase to handle specific internal issues and desired flexibility. By the end of 2000, the direction was set and the ball started rolling.

Addressing the Supply Chain

The first and the major issue was the product availability in the market, at the right place and the right time. The product availability index was as low as 70%, indicating that 30% of Skus were not available in the respective depots at the time of placing orders by the dealers/customers, either in full or less than the requirement. Though the non-availability of the products cannot be taken as loss of sales in full, being in a push market, an estimate of 40% as loss of sales can be considered as conservative. Some of the factors that were contributing to the cause were – higher sales skews, poor forecasting, poor capturing of order-related information, poor production planning, no defined mechanism of reviewing the performance of supply chain, sales and production.

Another major issue was poor linkage between the various planning processes, e.g., forecasting, production, inventory and distribution planning throughout the chain. Having different platforms for planning of supply chain element resulted in generating fats across the chain, making it bulky and reducing
operational efficiency. This also resulted in poor flexibility and blockage of working capital.

The other issue was on response time to the call. The average time taken from booking an order to supplying the material was as high as 23 days and the response time was sometimes higher than the product delivery time. This was more because of the lack of IT usage in data management, warehousing and planning process.

**Supply Chain Strategy**

Setting up the Supply Chain Cell and making it responsible and accountable for the execution of SCM activities: A set of people were made responsible and accountable for managing all the supply chain elements, planning for demand and distribution, warehousing and transportation. They conduct all the planning processes of the chain.

One-point contact for information flow and material through the chain -- production to customers: This also supported in supplying the right product mix at the right loadability. Think of one depot getting the product mix from more than 4-5 locations and communicating with a similar number of locations for supplies and priorities.

The locations for a few of the warehouses were also changed in view of local tax structures and other statutory levies. Some of the warehouses were closed and a few were linked with the central warehouse. The southern warehouses where approach from the central warehouse was hardly 24 hours were closed and linked directly with central warehouse. (see chart ‘Then &
Now’). The concept was also predefined to all stakeholders (see box ‘Crystal Clear’)

Chart:
Title: Then & Now
Subhead: Warehousing Changes
Model in the Past

Role of IT, Usage of Barcode, ERP, WMS & DRP resulted in much improved operations. Supply chain become more visible, it become much easier to monitor and hence manage the chain. The visibility across the chain helped in building confidence amongst chain members.

Box:
Title: Crystal Clear
Subhead: SCM Concept

To make an end-to-end SCM, the problem needs to be simplified. The products were grouped into product lines, based on the similarity in the processes and the complexities within the processes. Thus, the Bonded Abrasives Division was divided into Vitrified Product group and the Organic Product group and within the Vitrified Product group six product lines were made. Similarly, in the Organic product group five lines were made. Thus, the complex 20,000 varieties
were grouped into 11 lines. Each line capacity is defined in terms of a widely manufactured product (within the Line). Finally, the demand from the nine distribution centres and the capacities of the 11 lines were matched. Thus the problem now is matching the customer demand with the capacities of the 11 lines and then linking with the RM suppliers.

Source: B John Devadason, Senior Manager – Manufacturing, Carborundum Universal

Supply Chain Design

Key planning operations, e.g., forecasting, demand planning and distribution planning were given due importance. Before concluding the design enough simulations were tried and the best one was chosen.

The introduction of third-party service providers for warehousing operation added flexibility in warehousing to meet sudden marketing surges and sales skews. The offices and warehouse in key locations were clubbed for better coordination with the local sales offices.

A lesser number of service providers, high volume region-wise, 2-tier arrangement and annual contracts helped the company to reduce the cost and transportation time. The average transit time reduced from eight days to five days.

Usage of Technology: The ERP played a vital role, distances collapsed and plants central warehouse and sales depots were sharing information and data online. The presence of ERP has helped in stabilizing the supply chain faster. Carborundum had ERP in place right from 1996. The usage of warehouse management software at Central warehouse increased the speed of operations and reduced errors in dispatches. The ease of operations was such that even a layman could handle technical products. The usage of bar coding helped in
palletized movement of products and picking and put them away at warehouses. The traceability of the Sku multi-fold. The introduction of DRP helped in terms of handling complex statistical calculations in a much easier way. Complex logics become simple and more reliable. **The risks of wrong calculations were reduced to zero.** Data warehousing helped the company to use and retrieve past data faster.

The benefits were clear for the company (see table ‘Worth The While’). The cost in setting up the central warehouse was Rs 210 lakh and RoI was two years.

**Title:** Worth the While

**Subhead:** Benefits From Efficient SCM Systems

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Source: Carborundum Universal

**Case no. 6 : Sundaram Brake Lining**

**Practices:** Raw material systems in place, Agreed specifications, standardized tests and joint testing with suppliers, ‘Spider man’ system of replenishment.

**Core Practices**

Supply chain is a core part of the value chain of Sundram Brake Linings, says company president V R Janardhanam. This 30-year old company, a part of the TVS group, was set up with American collaboration. It is an excellent example of how auto-component manufacturers in the country are latching on to best practices to make themselves globally competitive. Its main products include drum brake linings, disc brake pads, moulded and woven clutch facings, flexible rolls and bonded shoes. SBL’s net sales went up to Rs 120.7 crore, up by 18.4%
from last year. Its net profits also went jumped 21.9% to Rs 8.9 crore. While a part of that came from new market entries, profits also came from an extensive revamping of the supply chain set up, as can be seen from the turnover/average inventory ratio which went down to 19.5 from 16.3 last year.

For SBL the supply chain used to be an inbound logistics to operations and manufacturing to warehouses flow situation. No longer so. Things have changed in the last couple of years. These days, SBL focuses on being customer-responsive, and has therefore, reorganized its inbound logistics, operations and manufacturing and the outbound logistics section. SBL now has a milk run supply to customers, for a daily order, from that a part levelling and a daily order, which moves into the finishing cells, where upstream processes issue Kanban production cards and requirements of raw materials to flow in for manufacturing. Says, Mr Ramasubramanian, the executive vice president of SBL, “this we call as a spiderman concept, in which we scan the market, get the requirements and integrate with our raw material providers for just in time production.” The results are there too see, here is a summary of the reorganization done.

**In-Bound Logistics**

With a habit of ordering and storing in bulk, raw material quality suffered, and the inconsistency was considered inevitable. Three steps have changed everything. With a prerequisite to get zero defects for all supplies, SBL increased the frequencies of raw material supplied while decreasing the batch sizes through its initiative of a supplier integration programme, a raw material control system (RMCS), and introducing milk run in the in-bound section. (see chart ‘Basic Instincts’)

- The first initiative saw SBL introducing steps like agreed specifications, standardized test procedures, and joint testing with suppliers.
- The Raw Material Control System saw SBL introducing Kanban supplies, which meant that practices like, fixed review days and maintaining ownership of cards were put in place. (see Graph 2.) The initiative ensured that a weekly ordering system was maintained with 6-7 batches sailing at any time. The RMCS programme has started showing exciting results. For example for imported materials, the inventory has reduced to Rs 28 lakh from Rs 63 lakh ever since the system was implemented, and in volume terms to 191MT from 437 MT in the amount of inventory stored at SBL. At an overall level also, RMCS has started showing results. From an inventory turn ratio of 74 for indigenous raw materials in 99-00, the Graph has gone up to 127 in 2003-04, For imported raw materials, the same Graph has improved 167 times, 139 in 1999-00 in the latest year. All this means that the overall inventory turn ratio for raw materials at SBL has moved up to 49 times in 2003-04 from 40 in 1999-00.

- To follow up on this initiative, SBL also introduced the concept of milk runs, a method by which the company collected its own raw materials, by sending its own truck to supplier locations. According to SBL executive vice president of operations, Mr Ramasubramanian such an initiative enables, “Drastic reduction of inventory at the company’s end, in line with just-in-time supplies for just-in-time manufacturing. It also helped us in reduction of cost of raw materials.” Ever since the last three years since the milk run became operational, the number of raw materials procured by SBL has fallen to 33 from 74 earlier, the square feet used for storage decreased to 71 from 262 sq feet. The inventory value went down to Rs 6 lakh from Rs 10 lakh earlier and a reduction in inventory as such to 25 MT from 64 MT earlier.
Operations

On the operations front, SBL faced problems of long lead times, huge work in progress, high manufacturing costs and low profits because of a process layout in the plants, an inward focus on the shop floor rather than on the customer and also, what the management described to the ETIG team as an ‘inflexible manufacturing’ habit. The overall manufacturing layout was changed to a cellular set up, waste elimination, reducing lead time and keeping production stockless became SBL’s key focus areas. Some of the initiatives as revealed to the ETIG team are:

- A material flow control system, MFCS, ensured the introduction of a Kanban loop, which meant that now the 2-bin system which was used to store raw materials were additional to the system of using raw material stores.
- The introduction of ‘lean manufacturing’ and TPM concepts also improved the process ratio. For example, for the truck brakes linings, the process ratio (equivalent to the value added time divided by the production lead time) went up to 50% from 10.5% earlier.
- The initiatives on the operations side saw the work-in-progress turn ratio go up to 405 in 2003-04 from 281 in 1999-00. This ratio is measured as the annual sales value divided by the work in progress.

Outbound Logistics

The situation on the outbound side at SBL was gloomy as well. A lack of customer focus and huge finished goods stock meant that SBL’s products were pushed into the market, as warehouses located all over India worked on forecasting and inventory cuts rather than managing the inventory. The reorientation of philosophy at SBL saw the following changes in the outbound logistics side:

a. SBL shifted its focus to operate on the principle of high inventory.
b. Also it decided to produce to order, which meant that concepts like ‘make half-weekly’ and then ‘sell half-weekly’ for the domestics market, and ‘make monthly’ and sell ‘monthly’ for the export market were introduced.

c. Finally SBL started manufacturing a safety stock based on a statistical workout.

d. One chief objective was to implement production smoothing for after-market products. A unique initiative, according to Mr Janardhanam, on this front was the production replenishment system (PRS). The system works by production instruction Kanban cards issued by the sales warehouse, which go into the production instruction box, triggering a production instruction Kanban to presses by the spiderman. The produced quantity, along with the Kanban card on the press, is sent to the sales warehouse, where an acceptance card is issued. Quoting the noted supply chain expert of Europe, Professor Daniel T Jones, the SBL management team emphasises, “Demand smoothing means reduction in variability in customer demand and insulating manufacturing from demand spikes.”

All this, of course, meant that SBL is now one of the better managers of after-market demand spikes in the auto-components segment, and its inventory-turn ratio, measured as annual sales value to average finished goods value, increased to 164 in 2003-04 from 157 in 1999-00.

<table>
<thead>
<tr>
<th>Title: <strong>Looking Up</strong></th>
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<td>Subhead: <strong>SBL’s Financials</strong></td>
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<th>FY04</th>
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<tr>
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<tr>
<td>RoCE</td>
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<td>18</td>
</tr>
<tr>
<td>Turnover/Avg. Inventory Ratio</td>
<td>19.5</td>
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Source: Company
The case studies cited above are just a few of the many supply chain stories in India Inc today. These highlight particular instances of how companies find their solutions and convert these into best practice. The essential part of these case studies is that best practices aren’t limited to these companies; they are transferable from one industry to the other, from one function to another. Adoption and updating of best practice is just as critical in ensuring a healthy competitive industry as just cost or efficiency. Therefore, it will helpful to the industries of present study region.

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3.5 SUPPLY CHAIN MANAGEMENT OF DABBAWALA IN MUMBAI

A dabbawala is a person commonly found in the city of Mumbai, who is employed in a unique service industry whose primary business is collecting the freshly cooked food in lunch boxes from the residences of the office workers (mostly in the suburbs), and to deliver it to their respective workplaces and returning the empty boxes back to the customer’s residence by using various modes of transport. "Tiffin" is an old-fashioned English word for a light lunch or afternoon snack, and sometimes for the box it is carried in. For this reason, the Dabbawalas are sometimes called Tiffin Wallas.
Etymological and historical roots of dabbawalas can be found in British rules. The Nutan Mumbai Tiffin Box Suppliers Trust is the organization feed ten thousands people. Supply Chain of Dabbawalas is extremely surprising. Appearance and coding are the lesson for management’s techniques. Uninterrupted services of Dabbawalas are well administered. Their economics and recognition are surprising and encouraging to every person in the world.

The word "Dabbawala" in Marathi when literally translated, means "one who carries a box". "Dabba" means a box (usually a cylindrical tin or aluminium container), while "wala" is a suffix, denoting a doer or holder of the preceding word. The closest meaning of the Dabbawala in English would be the "lunch box delivery man". Though this profession seems to be simple, it is actually a highly specialized service in Mumbai which is over a century old and has become integral to the cultural life of this city.

The concept of the Dabbawalas originated when India and Pakistan was under British rule. Many British people who came to the colony did not like the local food, so a service was set up to bring lunch to these people in their workplace straight from their home. Nowadays, although Indian business men are the main customers for the dabbawalas, increasingly affluent families employ them instead for lunch delivery to their school-aged children. Even though the services provided might include cooking, it primarily consists of only delivery either home-made or in that latter case, food ordered from a restaurant.

3.5.1 THE NUTAN MUMBAI TIFFIN BOX SUPPLIERS TRUST

This service was originated in 1880. In 1890, Mahadeo Havaji Bachche, started a lunch delivery service with about 100 men. In 1930, he informally
attempted to unionize the dabbawallas. Later a charitable trust was registered in 1956 under the name of Nutan Mumbai Tiffin Box Suppliers Trust. The commercial arm of this trust was registered in 1968 as Mumbai Tiffin Box Supplier's Association. The present President of the association is Sopan Laxman Mare. Nowadays, the service often includes cooking of foods in addition to the delivery.

3.5.2 SUPPLY CHAIN OF DABBAWALAS

A Dabbawala literally means a box-carrier. Everyone who works within this system is treated as an equal. The service is uninterrupted even on the days of extreme weather, such as Mumbai's characteristic monsoons. Regardless of a dabbawala's function, everyone gets paid about two to four thousand rupees per month. About 175,000 or 200,000 lunches get moved every day by an estimated 4,500 to 5,000 dabbawalas. It is with an extremely small nominal fee and with utmost punctuality. According to a recent survey, there is only one mistake in every 6,000,000 deliveries. Dabbawalas collect dabbas on a bicycle in Mumbai, which is densely populated city with huge flows of traffic. Because of this, lengthy commutes to workplaces are common, with many workers traveling by train.

Instead of going home for lunch or paying for a meal in a café, many office workers prefer a cooked meal sent either from their home, or sometimes from a caterer who essentially cooks and delivers the meal in lunch boxes and then have the empty lunch boxes collected and re-sent the same day. This is usually done for a monthly fee. The meal is cooked in the morning and sent in lunch boxes carried by dabbawalas, who have a complex association and hierarchy across the city.
Dabbawalas working at a Mumbai Suburban Railway station. A dabbawala, usually, collects dabbas either from a worker's home or from the dabba makers with the help on bicycle. The dabbas have some sort of distinguishing mark on them, such as a color or symbol.

The dabbawala then takes them to a designated sorting place, where he and other dabbawalas sort (and sometimes bundle) the lunch boxes into groups. The grouped boxes are put in the coaches of trains, with markings to identify the destination of the box (usually there is a designated car for the boxes). The markings include the rail station to unload the boxes and the building address where the boxes have to be delivered. At each station, boxes are handed over to a local dabbawala, who delivers them. The empty boxes, after lunch, are again collected and sent back to the respective houses.

### 3.5.3 Appearance and Coding

Abbreviations for collection points, colour code for starting station, Number for destination station and Markings for handling dabbawala at destination, building and floor. The appearance and coding are clear with the help of following fig.no.3.6.

**A typical dabbawala lunch:** It is estimated that the dabbawala industry grows by 5-10% each year. Although the service remains essentially low-tech, with the barefoot delivery men as the prime movers, the dabbawalas have started to embrace technology, and now allow booking for delivery through SMS. An online poll on the web site ensures that customer feedback is given pride of place.
The success of the system depends on teamwork and time management. Such is the dedication and commitment of the barely literate and barefoot delivery men (there are only a few delivery women) who form links in the extensive delivery chain, that there is no system of documentation at all. A simple colour coding system doubles as an ID system for the destination and recipient. There are no multiple elaborate layers of management either just three layers. Each Dabbawalas is also required to contribute a minimum capital in kind, in the form of two bicycles, a wooden crate for the Tiffin’s, white cotton kurta-pyjamas, and the white trademark Gandhi cap (topi). The return on capital is ensured by monthly division of the earnings of each unit.
3.5.4 TEAMWORK AND METICULOUS TIMING OF DABBAWALAS

The entire system depends on teamwork and meticulous timing. Tiffin boxes are collected from homes between 7.00 am and 9.00 am, and taken to the nearest railway station. At various intermediary stations, they are hauled onto platforms and sorted out for area-wise distribution, so that a single Tiffin box could change hands three to four times in the course of its daily journey.

At Mumbai's city stations, the last link in the chain is the final destination of office workers. Lunch hour over, the whole process moves into reverse and the Tiffin boxes return to suburban homes by 6.00 pm.

We understand the complex sorting process of dabbas with the help of an example. At Vile Parle Station, there are four groups of Dabbawalas. Each has twenty members and each member services 40 customers. That makes 3,200 Tiffin boxes in all. These 3,200 boxes are collected by 9.00 am, reach the station and are sorted according to their destinations by 10.00 am when the 'Dabbawalas Special' train arrives.

**Uninterrupted services:** The service is almost always uninterrupted, even on the days of severe weather such as monsoons. The local Dabbawalas and population know each other well and often form bonds of trust. Dabbawalas are generally well accustomed to the local areas they cater to, and use shortcuts and other low profile routes to deliver their goods on time. Occasionally, people communicate between home and work by putting messages inside the boxes; however, with the rise of instant communication such as SMS and instant messaging, this trend is vanishing.
Above fig.no.3.7 shows the collection of dabbas with the help of bicycle. Each Dabbawala, regardless of role, gets paid about two to four thousand rupees per month. In 2002, Forbes Magazine found its reliability to be that of a six sigma standard. More than 175,000 or 200,000 lunch boxes get moved every day by an estimated 4,500 to 5,000 Dabbawalas, all with an extremely small nominal fee and with utmost punctuality. According to a recent survey, they make less than one mistake in every 6 million deliveries, despite most of the delivery staff being illiterate.

The BBC has produced a documentary on Dabbawalas. Prince Charles, during his visit to India, visited them (he had to fit in with their schedule, since their timing was too precise to permit any flexibility). Prince Charles also invited them to his wedding with Camilla Parker Bowles in London on 9 April 2005.
Following fig.no.3.8 shows how dabbawallas carries dabbas on their vehicle.

**Fig.no.3.8**

*Vehicle to carry dabbas*

Owing to the tremendous publicity, some of the Dabbawalas were invited to give guest lectures in some of the top business schools of India, which is very unusual. Most remarkably, in the eyes of many Westerners, the success of the Dabbawalas trade has involved no advanced technology. The New York Times reported in 2007 that the 125-year-old Dabbawalas industry continues to grow at a rate of 5–10% per year. ISO 9001:2000 certified by the Joint Accreditation System of Australia and New Zealand got the Awards and recognition.

The best supply chains aren't just fast and cost-effective. They are also responsive and adaptable, and they ensure that all their companies' interests stay aligned. Mumbai’s Dabbawalas have the similar work passion. Now days all the corporate cities around Mumbai are rapidly growing and get urban stress to the
service sector as well as society. Best Chain System with joyful life of the Mumbai Dabbawalas motivating to the several people by innovation.

Therefore the above multidimensional observation of the SCM practices reveals the sense for the making industrial growth from any corner. The Nasik region is growing very fast without observing management strategy. If the region using needful strategies in business environment like western management or as explained above Management practices. It is resulted in increasing productivity which counts to overall growth of the business environment.


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