STUDY ON COMPETITIVE ADVANTAGE THROUGH LEAN SUPPLY CHAIN MANAGEMENT



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DEHRADUN



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Declaration Letter

DECLARATION BY GUIDE

This is to certify that the Mr Jitendra Singh Rathore, a student of MBA - Logistics and Supply Chain Management, SAP ID 500070738 of UPES has successfully completed this dissertation report on "Study on competitive advantage through Lean Supply Chain Management" under my supervision.

Further, I certify that the work is based on the investigation made, data collected and analyzed by him and it has not been submitted in any other University or Institution for award of any degree. In my opinion it is fully adequate, in scope and utility, as a dissertation towards partial fulfillment for the award of degree of MBA.

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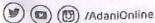


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EXECUTIVE SUMMARY

In the Traditional way of doing business, the functions of marketing, distribution, planning, manufacturing, and purchasing organizations operated independently along the supply chain. The conflicting objectives resulted in a lack of co-ordination that hampered the overall efficiency of the chain. Often, there is not a single, integrated plan for the organization. SCM is a strategic tool that helps organizations tie these functions together into an integrative whole. It can be defined as, 'a systemic, strategic coordination of traditional business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of individual companies and the supply chain as a whole.'

The inventory turnover rate in our country is quite low compared to other developed nations. It therefore entails considerable costs in the form of interest on capital, storage charges and losses on account of obsolescence. The average manufacturing company makes a profit of about 10% on its production cost. Since material cost amount approx. 70% of the total production cost, slight reduction in it would exert enormous leverage on profit. If material costs are reduced by 3%, which is by no means difficult, the profit margin increases from 10 to 12% and total profit go up by 21%. Any such saving in material cost is thus, the equivalent of raising sales by more than 20%. That being so every effort in the direction of reducing material cost, including cost of carrying inventories, is well worthwhile.

SCM emerged as an effective tool to reduce costs and improve manufacturing efficiencies for organizations that seemed to have exhausted all means of reducing costs including increasing manufacturing efficiencies and focusing on logistics management. SCM improves customer service, inventory management, transportation systems and distribution networks.

CHAPTER 1

INTRODUCTION

The topic competitive advantage through Lean Supply Chain Management is basically concerned with the following process of supply chain management and operations, like

- Procurement and Production
- Packaging

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Distribution

INTRODUCTION TO SUPPLY CHAIN MANAGEMENT

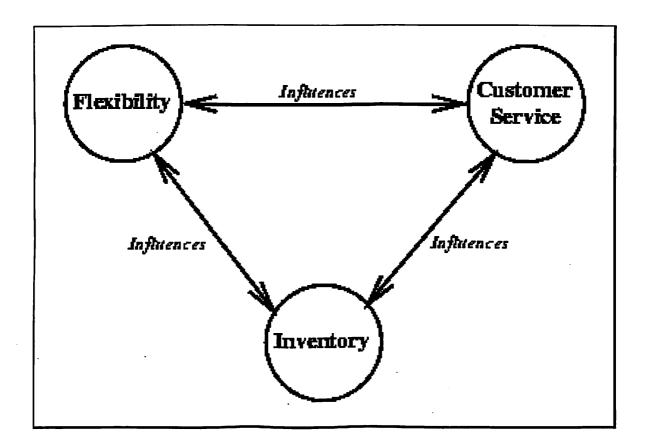
A supply chain is a network of facilities and distribution options that performs the functions of procurement of material, transformation of these material into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and manufacturing organization, although the complexity of the chain may vary greatly from industry to industry and firm to firm

Traditionally, marketing distribution, planning, manufacturing, and the purchasing organization along the supply chain operated independently. These organizations have their own objectives, and these are often conflicting. Marketing's objective of high customer service and maximum sales dollars conflict with manufacturing and distribution goals.

Many manufacturing operations are designed to maximize throughput and lower cost with little consideration for the impact on inventory levels and distribution capabilities. Purchasing contracts are often negotiated with very little information beyond historical buying patterns. The result of these factors is that there is not a single, integrated plan for the organization---there were as many plashes as businesses. Clearly, there is a need for a mechanism through which these different functions can be integrated together. Supply chain management is a strategy through which such integration can be achieved.

Supply chain management is typically viewed to lie between fully vertically integrated firm, where the entire material flow is owned by single firm and those where each channel member operates independently. Therefore, coordination between the various players in the chain is key in its effective management. Copper and EII ram [1993] compare supply

chain management to a well-balanced and well-practiced relay team. Such a team is more competitive when each player knows how to be positioned for the hand-off.



The relationships are the strongest between players who directly Pass the baton, but the entire team needs to make a coordinated effort to win the race.

SUPPLY CHAIN DECISIONS

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We classify the decisions for supply chain management into two broad categories-strategic and operational. As the term implies, strategic decisions are made typically over a longer time horizon. These are closely linked to the corporate strategy (they sometimes {/it are} the corporate strategy), and guide supply chain policies from a design perspective. On the other hand, operational decisions are short term, and focus on activities over a day-to-day basis. The effort in these types of decisions is to effectively and efficiently manage the product flow in the "strategically" planned supply chain.

There are four major decision areas I supply chain management:

- 1) Location.
- 2) Production,

- 3) Inventory,
- 4) Transportation. (destitution) and there are both strategic and operational element in each of these decision areas.

Location Decisions

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The geographic placement of production facilities, stocking points is the natural first step in creating a supply chain. The location of facilities involves a commitment of resources to a long-term plan. Once the size, number, and location of these are determined, so are the paths by which the product flows through to the final customer. These decisions are of great significance to a firm since they represent the basic strategy for accessing customer markets, and will have a considerable impact on revenue, cost, and level of service. These decisions should be determined by an optimization routine that considers production costs, taxes, duties and drawback, tariffs, local content, distribution costs, production limitations, etc. although location decisions are primarily strategic, they also have implications on an operational level.

Production Decisions

The strategic decisions include what products to produce, and which plants to produce them in, allocation of suppliers to plants, plants to DC's and DC's to customer markets.

As before, these decisions have a big impact on the revenues, costs and customer service levels of the firm. These decisions assume of the existence of the facilities but determine the exact path (s) through which a product flows to and from these facilities. Another critical issue is the capacity of the manufacturing facilities—and this largely depends the degree of vertical integration within the firm. Operational decisions focus on detailed production scheduling. These decisions include the construction of the master production of Master production schedule, scheduling production on machines, and equipment maintenance. Other considerations include worked balancing, and quality control measures at a production facility.

Inventory Decisions

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These refer to means by which inventories are managed. Inventories exist at every stage of the supply chain as either raw material, semi-finished or finished goods. They can also be in- process between locations. Since holding of inventories can cost anywhere between 20 to 40 percent of their value, their efficient management is critical in supply chain operations. It is strategic in the sense that top management sets goals. However, most researchers have approached the management of inventory from an operational perspective. These include deployment strategies (push versus pull), control polices---the determination of the optimal levels of order quantities and reorder points, and setting safety levels, at each stocking location. These levels are critical, since they are primary determinants of customer service levels.

Transportation Decisions

The mode choice aspect of these decisions is the more strategic ones. These are closely linked to the inventory decisions, since the best choice of mode is often found by trading-off the cost of using the particular mode of transport with the indirect cost of inventory associated with that mode. While air shipments may be fast, reliable, and warrant lesser safety stocks they are expensive. Meanwhile shipping by sea or rail may be much cheaper, but they necessitate holding relatively large amounts of inventory to buffer against the inherent uncertainty associated with them. Therefore, customer service levels and geographic location play vital roles in such decisions. Since transportation is more than 30 percent of the logistics costs, operating efficiently makes good economic sense.

THE LEAN SUPPLY CHAIN

It is believed almost worldwide, that Lean thinking originated from Japan (Toyota, specifically), but Henry Ford (Ford Automobiles, U.S.A) had been using parts of Lean thinking as early as the 1920's, as evidenced by his quote:

"One of the most noteworthy accomplishments in keeping the price of Ford products low is the gradual shortening of the production cycle. The longer an article is in the process of manufacture and the more it is moved about, the greater is its ultimate cost." Henry Ford 1926

Lean is defined by many organizations as "A systematic approach to identifying and eliminating waste through continuous improvement, flowing the product at the pull of the customer in pursuit of perfection."

Cappello (2006) argues that wherever lean principles are applied, they must be enforced by strong leadership. It is, a battle not only for minds, but for hearts as well." Lean principle application requires that managers convince employees (and other supply chain stakeholders) that lean is not just a short-term campaign, but a long-term strategic proposition aimed at achieving a competitive advantage. This requires daily efforts to continually remind, educate, and enforce lean policies.

The principle for applying lean supply chain management is to maximize value for customers and profit for corporations by eliminating waste, "Muda", through each stage of commerce and implementing business strategies that enable continuous and sustainable improvement throughout the supply chain. The main aim of a lean supply chain is to meet each customer's demand the first time, at the lowest cost, at every time. This enables "flowing" the product through the chain in response to the pull of the customer in pursuit of perfection. This flow process is also known as "Kanban". "Kanban", a Japanese term, means card signaling. It is the information signal used to indicate the need for material replenishment in a pull production process. An effectively designed Lean supply chain delivers true value to the end customer at a reduced cost to the organization.

Though there are many vital principles underlying the Lean thinking process, there are some key principles that serve as the driving force propelling the theory into practice in almost all organizations. These are demonstrated below with the primary focus as the customer driving the wheel of lean thinking and all principles being enabled through technology.

Value and Identifying the Value stream: — Value in lean thinking can be simply defined as everything involved in supplying goods or services to a customer in a way that profitably meets or exceeds the customer's requirements and expectations. The value stream is determined in two ways, the internal Value stream, which is the internal stream of activities to be performed to create a product and the second being the supply chain value stream, which is based on the business, its supplier and the customer. Value in its entirety can only

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be defined by the customer regardless of the amount of effort put into the product or service by the provider of the service or product.

Waste: - Waste in this context refers to all non-valued-adding activities that ultimately increase cost throughout the chain. There are eight main identified categories of waste pertaining to lean supply thinking: -Over production, Non Value adding Processes, Transportation, Delays, Excess motion, unnecessary stocks/ inventory, Delays and Product& Service quality defects. The kinds of waste and how they affect organizations will be treated in detail in the following pages of this paper.

Flow production is a way of doing things in small quantities in sequential steps, rather than in large batches, lots or mass processing. Systematic and fluid movement of goods throughout the chain with minimal storage or inventory without allowing materials to idle in queues or stagnate at large stock points is key to the supply chain. From engineer to order all the way to repetitive and process manufacturing and delivery to the end customer, tremendous gains can be realized by using flow manufacturing principles. Examples of improvements include:

Increased inventory turns

- Lowered manufacturing time
- Decreased component and finished goods defects

The "Kanban" is an underlying factor to both the flow process and the Pull process.

The Pull principle works on the theory that goods or services are "tugged" or derived from the supplier based on the demand from the downstream customer instead of suppliers "pushing" goods downstream. The idea behind the "pull" principle is to keep producing parts as close as possible to the time when the parts are needed. "Need" in a lean environment is typically associated with true demand by the market or a real live customer sales order. In a pull environment, finished goods inventories are extremely limited or almost non-existent.

People: - Apart from the operational changes, adoption of the Lean methodology requires a significant organizational transformation. It requires formation of work teams, made up of multi-skilled workers who need to continuously improve upon performance and production processes.

Responsiveness to demand and to change deals with delivering quality products or services as promised, when required, and at the agreed-on price. However, market or demand changes must be well anticipated to cater for adjustments in the supply chain

Pursuit of Perfection: - This is concerned with the continuous search for methods of improvement, causes of waste, and their elimination from eth supply chain. It is an effort by each member of the chain to improve upon skills and ideas and strive for "perfect leanness" in the organization

All these underlying principles are directed toward one goal, that is, Total Customer Satisfaction. As Li (2008) observes, lean principles and lean policies are not only about eliminating waste, but also about human behavior, culture, teamwork, leadership and executive force.

Benefits and limitations of implementing a Lean supply chain

The advantages of Lean Supply Chain Management cut across every kind of company. The biggest advantage is the reduction in cost to the company. The traditional way of reducing cost is through mass production. Although this requires an investment in very expensive equipment, through Lean Supply Chain Management, the company enjoys reduced cost by mass production. Traditional mass production tries to minimize unit costs by increasing total production over the life cycle of the product.

A second advantage is reduced volume of transaction. This can be equated to speed and responsiveness to client demands. This means that supply chain is now faster and more efficient. The customer's needs are met rapidly. Lean supply chain management makes the company action biased. Once a customer is delighted there is room to serve the next hence increase company revenue.

Lean Supply Chain Management relies heavily on outsourcing. Outsourcing is the contracting of certain essential components of the business to another organisation.1 The

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role of outsourcing in lean supply chain management reduces risk to the company as it hands over certain ill-performed tasks previously performed by the organization to third party experts. The company is therefore in a better position to focus on its strengths in the supply chain, thus increasing value for the customer.

Yet another advantage of Lean Supply Chain is Customer Satisfaction. Lean supply chain management means that customer needs are satisfied in the shortest possible time. Lean supply chain management also makes it possible to incorporate current requirements into the production process bringing out newer versions of a particular well performing product on the market which makes the company look fresh (case of many electronic and automobile industries). The company gets more revenue and loyalty will increase as customers tend to purchase their needs from companies they can trust.

Lean thinking brings about many Operational benefits including: -

- Lead Time (Cycle Time) reduction
- Increase in Productivity

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- Reduction in Work-In-Process Inventory
- Quality improvement
- Reduction in space Utilization

Administrative benefits in organizations are noticed. Reduction in order processing errors & elimination of "putting customers on hold" by streamlining of customer service, improved product quality as well as product delivery function are brought about through lean management. Higher staff profiling standards and staffing, and recruitment demands are reduced. This is achieved when the same number of staff is equipped with multi skills to handle larger numbers of orders that would have previously needed more staff. Documentation and streamlining of processing steps enable the outsourcing of non-critical functions, allowing the company to focus their efforts core competencies and on customers' needs.

The main aim of every organization is to meet or achieve its strategic goal, that is ultimately Customer satisfaction the lowest possible cost to the organization. Lean supply chain management with a stepwise advantage through the operation and tactical levels help organizations to meet their strategic aspirations.

Most organizations implement Lean principles based on the operational improvements, primarily because of the perception that Lean only applies to the operations side however benefits cut across the main decision-making processes or departments of every organization.

Even though Lean supply chain has many advantages, there are also limitations to apply its principles to each and every organization. Thought lean principles are good theoretically, it has not worked well for most companies.

Lean supply chain management is very expensive in the sense that the expertise needed at every level (since all staff need to be multi skilled) come at a high investment premium.

Also, it relies heavily on outsourcing which has many disadvantages. Outsourcing comes at a cost because the third party is a business entity and will have to make profit on its operation. It also means that the organization will have to stomach some initial costs. Some of which are redundancy costs and the costs in selling equipment. During outsourcing, when a fault slips through the checks in lean supply chain management, the company will have to bear the costs of production as products will have to be recalled. This has been evident recently with the pioneers of Lean Thinking, Toyota motor company facing multiple recalls.

Traditional mass production tries to minimize unit costs by increasing total production over the life cycle of the product. To recover the enormous initial capital costs sunk into the product before it was produced, mass producers forecast and run long production cycles for each SKU(stock keeping unit). Consumer preferences and variety suffer in this scenario. Costs is minimized using lean theories but at the expense of what more sophisticated consumers now demand. Customer demands in recent times are focused on variety of products and this cannot be achieved on a solely "lean" platform.

One can therefore conclude that Lean thinking is not dynamic or aggressively changeembracing. Strictly using Lean principles may cause organizations to fail under the recently thriving environment of unpredictable and rapid change. This is not largely friendly toward the needs of the customer as new innovations based on customer needs are not implemented. Lean supply thinking is known to be quite inflexible to changing patterns and insensitive to the market. Customization demands in current markets by the consumers

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have been the main downfall of strict lean thinking. It is therefore being revisited to help improve its practicality in today's organizations.

Industry Profile

Printed circuit boards (PCBs) are the backbone of the electronics industry. These are deployed in almost all electronic products, ranging from consumer gadgets such as PCs, tablets, smartphones and gaming consoles to industrial and even high-tech products in the strategic and medical electronics domains.

Considering the importance of the PCB industry in the electronics manufacturing ecosystem, the October 2015 issue of *Electronics Bazaar* had published an article titled, 'An Outlook for the PCB Industry in 2015-16: The Indian Perspective', covering the views of various stakeholders from within the industry.

However, given the evolution of the electronics industry's ecosystem over the last six months with respect to the implementation of government policies, the investment climate and consumer demand, we decided to take a fresh look at the Indian PCB industry to understand how it has been shaping up. In this edition, however, rather than merely presenting perspectives shared by industry thought leaders, we also thought of sharing industry trends through a mini-survey of a sample group of 15 senior level industry members.

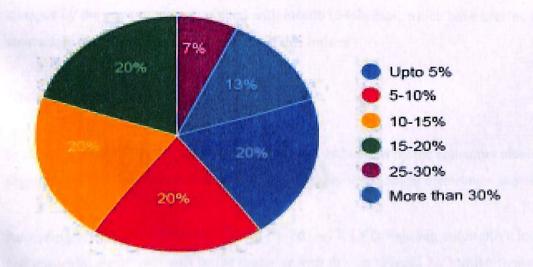


Figure 1: Expected growth of the Indian PCB industry in FY 2016-17

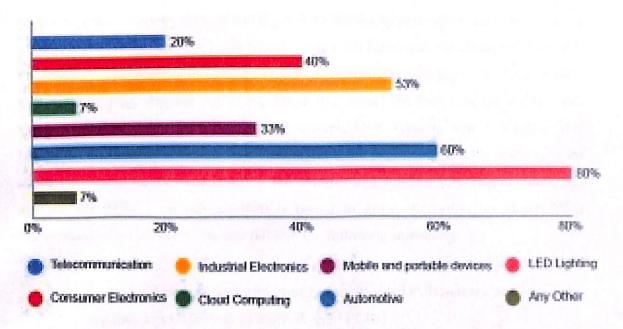


Figure 2: Growth amongst the sectors driving the PCB industry

Signs of growth

Survey participants unanimously stated that they feel the industry is poised for growth during FY 2016-17. They feel the Indian electronics industry will touch US\$ 400 billion by 2020, and will in turn fuel a high demand for PCBs. "The Indian PCB industry is showing signs of growth, at last. I can confidently say that one of the primary reasons would be the Make in India initiative. There are other reasons as well, such as policy changes by the government, combined with incentive schemes, which have created a very encouraging environment for the growth of this industry

Growth drivers

In the past, most of the growth in the PCB market was driven by the consumer electronics segment, followed by requirements from the strategic and medical electronics segments.

According to survey participants, during FY 2016-17, LED lighting, automotive industry and industrial electronics will be the major growth drivers (Figure 2). Miniaturizations of semiconductor devices and enhanced functionality in electronic products is expected to drive the demand for more complex PCBs with higher number of layers, in large volumes.

In recent years, consumer demand and regulations aiming for low carbon emissions, energy savings and environmental protection have made LED lighting more attractive. The LED manufacturing segment in the country is poised to grow at a very high rate. This, in turn, will generate huge demand for PCBs. Presently, one of the best bets for Indian PCB manufacturers is in the area of energy meters, UPS systems and the automotive industry. "Given that the automotive industry in India is growing steadily and every car needs two to 15 PCBs, depending on the features and functionality requirements, the demand for PCBs from this segment is bound to grow. According to Doshi, PCB manufacturers in the country mostly fall into the following segments:

- Large-volume manufacturers (mostly double-sided PCB makers, and a few who
 produce a good amount of multi-layered PCBs)
- Small-volume manufacturers (both double-sided PCB makers and a few who produce multi-layered PCBs)
- Small-volume fast-delivery manufacturers (both double-sided PCB makers and a few who produce multi-layered PCBs)
- Small-volume complex-design PCB manufacturers

Some of the survey participants indicated the possibility of demand arising out of advances in technology such as high-density interconnection (HDI). This enables more interconnection functions per unit area, which will positively impact the market for advanced-level applications. According to Muni Swamy, Internet access in remote areas, changing lifestyles with the increased purchasing power of the middle class and rapid growth of the e-commerce industry is expected to generate demand for PCBs required in mobile and portable devices, cloud computing servers and networking devices.

"Mobile computing, cloud computing and the Internet of Things (IoT) are the latest fads in the electronics industry, and we are seeing the emergence of local brands in mobile computing, which includes smart phones, tablets and laptops, among others. Policy changes are forcing local companies to start manufacturing in India and this should help the local PCB manufacturing ecosystem," Muniswamy adds. In addition, the recent thrust towards indigenization in strategic electronics manufacturing is likely to fuel the demand for high-grade multi-layered PCBs.

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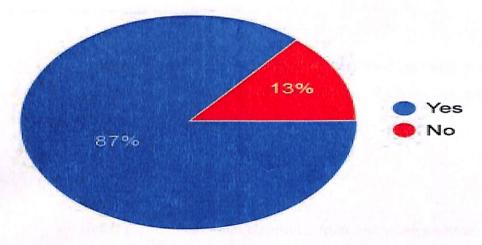


Figure 3: Is there a significant demand-supply gap in the Indian PCB industry?

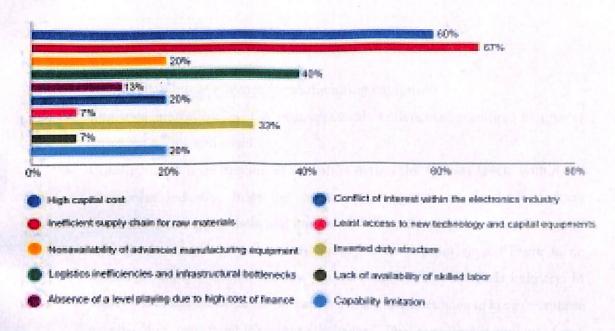


Figure 4: Top challenges hampering the growth of PCB manufacturing in India

The demand-supply gap

Among the survey respondents (Figure 3), 87 per cent feel that there is a demand-supply gap in the ecosystem as imports play a significant role in meeting local demand for PCBs. This does not bode well for the economic health of the industry in the long-term. According to an IPCA report, there is a gap of around US\$ 950 million between the demand and supply of PCBs in the Indian market, which indicates that there are enough opportunities for new manufacturing plants to come up in India.

Obstacles in the path of growth

Currently, the output of the Indian PCB industry is less than 1 per cent of the total global capacity. According to the survey participants, the top challenges (Figure 4) that PCB manufacturers in the country face are:

- Inefficient supply chain for raw materials
- High capex requirements
- Unfair playing field, since companies from competing countries have access to finance at much lower cost

Other challenges include:

- Non-availability of advanced manufacturing equipment
- Logistics inefficiencies and infrastructural bottlenecks, resulting in greater turnaround time and costs
- Conflicting policies that are in operation across the various levels within the electronics industry, from the components segment to finished products An inefficient supply chain and non-availability of a significant percentage of critical raw materials increases inventory costs. Vasani says, "There is no domestic supply chain for the raw materials required in the PCB industry. In view of our huge dependence on imports, manufacturers have to keep over three months of inventory, which adds to the costs." The large import content of raw materials during a period when the dollar is strong, significantly impacts margins and hinders growth.

The capital costs go up due to the very high cost of finance in the country—both for capital investment, as well as for working capital. The very low capital-output ratio in the PCB industry entails the need for huge investments and high interest costs. Thus, profitability is an issue. Manufacturers are not able to invest in new equipment, most of which is imported.

Infrastructural challenges such as insufficient clean water and uninterrupted

power, only a in this regard, he emphasizes the need for limited number of developed industrial parks, and the lack of a raw-material ecosystem are some of the hindrances in the PCB industry. Vasani also mentions the need for huge investments associated with the creation and maintenance of effluent treatment facilities as one of the major challenges for this industry.

support from the government, and feels that this could enable India to exploit the opportunities created by the widespread shutting down of PCB manufacturing in the European Union due to stringent pollution-control laws.

All these challenges lead to an increase in the price of the products, making Indian-manufactured PCBs less competitive than their Chinese counterparts. The life span of the typical PCB manufacturing equipment used today is a maximum of four years, after which these tend to become redundant. The survey participants also revealed that there are some capability constraints faced by the Indian PCB industry. At present, India does not manufacture PCBs for the high-growth segments such as mobile handsets, laptops or set-top boxes. The Indian industry manufactures PCBs only for consumer durables like televisions and power electronics products such as UPS systems and inverters. Even LCD/LED televisions require high-tech PCBs with a specification of 5mil x 5mil boards. This often results in high rejection of Indian PCBs in this segment.

Most Indian PCB companies in the past catered to a small local market consisting primarily of public sector companies and, therefore, never felt the need for continual improvement. To grow in today's competitive environment, however, PCB companies must focus on top-notch quality that can be sold in any market across the globe. Developing a global market for products will reduce reliance on local demand.

Growing inorganically

Almost two-thirds of the survey participants believe that inorganic growth can play a major role in this segment (Figure 5), either through mergers and acquisitions (M&As) or through joint ventures (JVs). Muniswamy states, "I strongly believe in M&As as these help companies to grow inorganically in a short span of time. Entrepreneurs often fail to grow beyond a certain point due to lack of vision and leadership. They begin to resist change. Most early starters restrict themselves to the domestic market, thereby limiting their exposure, unlike Chinese firms that set out to conquer the world markets. There are still many PCB companies that are running businesses like a lifestyle and these are good candidates for M&As. The founders of these firms need to let capable people run the company, sit back and enjoy the success."

Since most manufacturers in the country will find it challenging to make the huge investments required to produce PCBs for high-tech products like set-top boxes and mobile handsets in large volumes, any kind of partnership with foreign companies could help Indian firms manufacture high-tech PCBs via technology transfer.

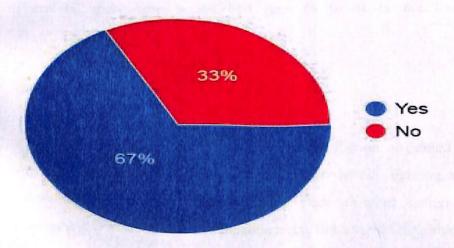


Figure 5: Will the industry grow inorganically? Figure 6: Top three favorable initiatives

Advantages in India

In the last few months, campaigns like Make in India and Digital India have attracted huge FDI inflows to the country from across the globe. This has created more opportunities for outsourcing work by companies such as Foxconn. Besides, the exponential growth of the mobile phone market is fueling the growth of electronics manufacturing units, and the day is not far when a large company will set up a local manufacturing facility for HDI boards to cater to the mobile phone industry. Survey participants identified the top three favorable initiatives as (Figure 6):

- Special incentive schemes such as MSIPS by DeitY
- Electronics manufacturing clusters by industry associations
- Special PCB manufacturing clusters by state governments

"For the first time in decades, venture capital (VC) funds are available at interest rates as low as 6 per cent to 8 per cent. Some companies are looking for JVs with foreign companies to bring cutting-edge technology to India. There are at least half a dozen companies in the pipeline for establishing greenfield PCB projects in India, which include two JVs. Therefore, right now is the best time to invest in the Indian PCB industry.

Company Profile

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Circuitronix specializes in manufacture and distribution of printed circuit boards for a variety of applications, including – automotive, industrial, lighting, security systems, and other niche application areas. Utilizing state-of-the-art factories in South China Guangdong Province, dedicated manufacturing units build single sided, double-sided, and multi-layer printed circuit boards (of up to 22 layers). In addition to rigid boards, Circuitronix fabricates flexible printed circuit boards, rigid-flex boards, and metal clad circuit boards. All boards are built to global quality standards, such as ISO & TS.

Circuitronix

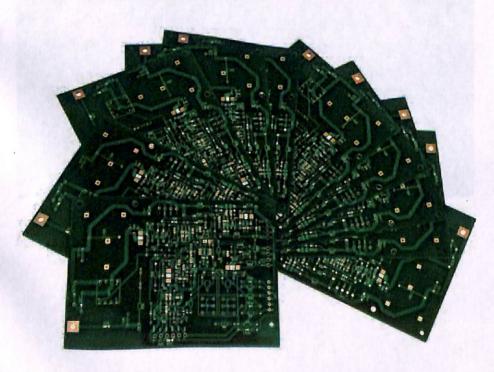
With over 3000 skilled technicians and associate worldwide – based in USA, Canada, Mexico, China, Hong Kong, India, Thailand, and Philippines – Circuitronix caters to 99% of PCB technologies commercially available

Mission

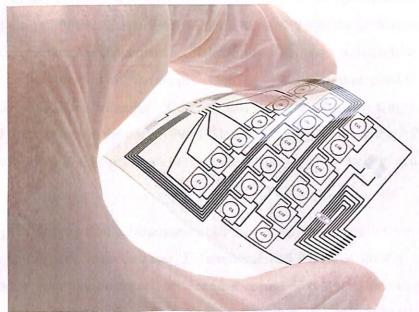
Circuitronix listens to its customers in order to mutually develop strategies that achieve innovative and market leading products. Our commitment to technology, quality, service and aggressive pricing assures that we will have long term partnerships that exceed our customers' goals

Products

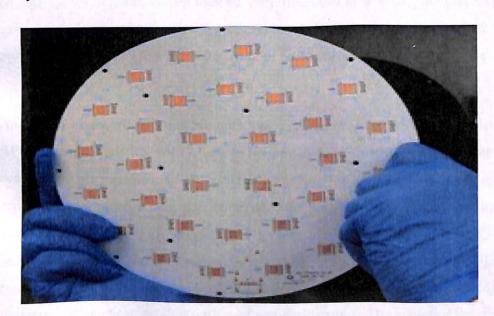
1) Rigid Printed Circuit Boards



2) Flexible Printed Circuit Boards



3) Metal Clad Printed Circuit Boards



CHAPTER-2

LITERATURE REVIEW

Competition in the new millennium will be across supply chains, not individual companies. The central aim of any business is to have the right products in the right quantities, at the right place, at the right time at minimal costs. This is in turn translated into the interrelated issues of customer satisfaction, inventory management and flexibility. Customer satisfaction to a high degree is dependent on the flexibility of the supply chain, i.e., its ability to respond to changes in demand. General Electric, Dell Computers, Compaq and other leading firms in the USA successfully introduced this concept in the early 1990's. Since then, many firms in the APO member countries have also introduced SCM practices to meet the challenge of the heightened competition.

The concept of Supply Chain Management (SCM) involves the application of state-of the-art IT tools such as Internet, Intra/Extranet, E-commerce and EDI that greatly help organizations to simultaneously improve customer service and reduce inventories across the chain. An SCM system works collaboratively with customers, suppliers, trading partners and third parties to change the way operations are viewed, performed and measured. As today's companies focus on gaining economic and competitive advantage throughout the entire product life cycle, this can only be best achieved through leveraging of SCM across the entire enterprise.

Against this background, this program was implemented for the benefits of organizations in the APO member countries, with a view to helping them significantly improve their productivity and competitive performance in the emerging millennium through the effect application of SCM principles and practices. In particular, the program provided a platform for the participating member countries to understand the difficulties of developing SCM in APO member countries and to discuss the possible alternatives of treating these difficulties and challenges; and to share their experiences on the practical applications of SCM that have contributed to increasing customer satisfaction, productivity, and competitiveness. The scope of the discussions covered, inter alia, conceptual and theoretical issues related to SCM and logistics strategy, critical elements of world-class supply chain planning, facilitating SCM through internet infrastructure, and technology for the supply chain of the future, building customer focused supply chain, organizational issues in implementation, and recent advances in SCM.

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SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) is the process of planning, implementing, and controlling the operations of the supply chain with the purpose to satisfy customer requirements as efficiently as possible. 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. The term supply chain management was coined by strategy consulting firm Booz Allen Hamilton in 1982.

A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm.

According to the (CSCMP), a professional association that developed a definition in 2004, Supply Chain Management "encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes 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."

Supply chain event management (abbreviated as SCEM) is a consideration of all possible occurring events and factors that can cause a disruption in a supply chain. With SCEM possible scenarios can be created and solutions can be planned.

Some experts distinguish supply chain management and logistics management, while others consider the terms to be interchangeable. From the point of view of an enterprise, the scope of supply chain management is usually bounded on the supply side by your supplier's suppliers and on the customer side by your customer's customers.

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SUPPLY CHAIN DECISIONS

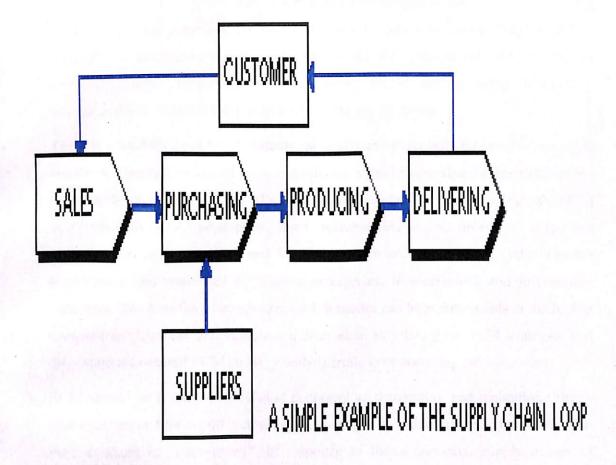
We classify the decisions for supply chain management into two broad categories: strategic and operational. As the term implies, strategic decisions are made typically over a longer time horizon. These are closely linked to the corporate strategy, and guide supply chain policies from a design perspective. On the other hand, operational decisions are short term, and focus on activities over a day-to-day basis. The effort in these types of decisions is to effectively and efficiently manage the product flow in the "strategically" planned supply chain.

Shortened product life cycles, increased competition, and heightened expectations of customers have forced many leading-edge companies to move from physical logistic management towards more advanced supply chain management. Additionally, in recent years it has become clear that many companies have reduced their manufacturing costs as much as it is practically possible. Therefore, in many cases, the only possible way to further reduce costs and lead times is with effective supply chain management.

In addition to cost reduction, the supply chain management approach also facilitates customer service improvements. It enables the management of inventories, transportation systems and whole distribution networks so that organizations are able meet or even exceed their customers' expectations.

To simplify the concept, supply chain management can be defined as a loop: it starts with the customer and ends with the customer. All materials, finished products, information, and even all transactions flow through the loop. However, supply chain management can be a very difficult task because in the reality, the supply chain is a complex and dynamic network of facilities and organizations with different, conflicting objectives.

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What has then enabled the effective implementation of supply chain management? The answer is found from the rapid developments in information and communications technologies. Use of databases, communication systems, and foremost advanced computer software are crucial for the development of a modern cost-effective supply chain management.

NEED FOR SCM

1. SCM is a concept or a mechanism to improve the total productivity of enterprises in a supply chain by optimizing the timing, location and quantity of materials flow from raw material provider to the consumer of the final products. This concept is especially useful in the industry where (1) the competition in the market is very high, (2) the customers are very demanding for example in the well documented Dell Built-To-Order model where 84% of Dell's revenue is derived from online customers who have the final say in the final configuration of their personal computers and notebooks, (3)

the product life cycle is very short for example the electronics contract manufacturing industry currently experiences product life cycles of short as three months from raw materials to final consumption, and (4) stakeholders request for high returns on investment (ROI). Promising Asian companies should start investing in good IT infrastructure to improve the productivity in the supply chain.

- 2. There is a need for good SCM systems nationally and regionally for the APO member countries. This system should include databases, model bases, visual maps and friendly user interfaces. The proper use of such a system can help to minimize the total SCM cost (materials cost, production costs, warehousing costs, inventory costs and transportation costs). In ROC and Singapore, there are already such systems in the marketplace and well used by leading enterprises, in electronics and information industries. The benefits of employing such a model can help enterprises in the highly competitive electronic and computer industries to simulate their SCM strategies and determine the optimal SCM strategy under certain cost operating environments.
- 3. SCM should be linked to the digital economy as demanding and technology savvy customers around the world increasingly expect goods and materials to be delivered to their doorstep at "click-speed". In response to these demands, supply chains of enterprises and industries need to be more real-time and dynamic. Therefore, new technologies, intelligent software agents, will become an integral part of SCM. Quantum leaps in productivity and agility in the supply chain can be made possible by the courageous adoption of these intelligent agent-based decision support systems. The US experience in the use of these software agents has been very successful as these agents (software programs) can actively engage with the user in dialogue and negotiate and coordinate the transfer of real-time information to other users on web-based platform. Proper interfacing and integration of such agents can help realize the fruition of a truly global logistics network. An example is the establishment of the Global Transport based out of the US. The Transport serves to link manufacturing, transportation and information to create innovative logistical infrastructure for global commerce.
- 4. In the past, SCM is predominantly enterprise focused with mutually exclusive set of activities. Today, progressive firms are readily embracing systems integration through ERP and other means of electronic connectivity, primarily for cost reduction purposes. In the future, SCM would have to integrate enterprises, ensure greater collaboration

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between supply chain partners, and work towards a synchronized value collaboration network. Only then can firms talk about chain-wide profit maximization and economic value add.

- 5. Some of the main challenges presented by the resource persons include the following: building a supply chain infrastructure without damaging the environment i.e. how to have a green supply chain, setting up a reverse logistics program for firms to ensure ecological balance and waste reduction, managing of demand volatility face by enterprises when they move to a digital arena and greater dynamic customization, how to extract better channel coordination between partners in the supply chain, how to obtain better procurement leverage using real-time information and the Internet, how to extract greater profitability out of decreasing business margins, and the need to manage services besides the traditional product-based approach given the blurring between design and outsourcing of manufacturing.
- 6. Several pertinent concerns were also highlighted by the resource persons: sharing of risk between partners in the supply chain, the ownership of inventory (vendor managed of co-managed inventory), the applicability of some good SCM practice in certain industries (like VMI in the retail sector) to other industries, and information in the supply chain, the management of demand forecast projection and accuracy, and the ability of SMEs to invest in much needed IT and related technologies to improve their supply chain processes
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OPPORTUNITIES ENABLED BY SUPPLY CHAIN MANAGEMENT

The following strategic and competitive areas can be used to their full advantage if a supply chain management system is properly implemented.

Fulfillment: Ensuring the right quantity of parts for production or products for sale arrive at the right time. This is enabled through efficient communication, ensuring that orders are placed with the appropriate amount of time available to be filled. The supply chain management system also allows a company to constantly see what is on stock and making sure that the right quantities are ordered to replace stock.

Logistics: Keeping the cost of transporting materials as low as possible consistent with safe and reliable delivery. Here the supply chain management system enables a company to have constant contact with its distribution team, which could consist of trucks, trains, or any other mode of transportation. The system can allow the company to track where the required materials are at all times. As well, it may be cost effective to share transportation costs with a partner company if shipments are not large enough to fill a whole truck and this again, allows the company to make this decision.

Production: Ensuring production lines function smoothly because high-quality parts are available when needed. Production can run smoothly as a result of fulfillment and logistics being implemented correctly. If the correct quantity is not ordered and delivered at the requested time, production will be halted, but having an effective supply chain management system in place will ensure that production can always run smoothly without delays due to ordering and transportation.

Revenue & Profit: Ensuring no sales are lost because shelves are empty. Managing the supply chain improves a company's flexibility to respond to unforeseen changes in demand and supply. Because of this, a company has the ability to produce goods at lower prices and

distribute them to consumers quicker than companies without supply chain management thus increasing the overall profit.

Cost: Keeping the cost of purchased parts and products at acceptable levels. Supply chain management reduces costs by increasing inventory turnover on the shop floor and in the warehouse, controlling the quality of goods thus reducing internal and external failure costs and working with suppliers to produce the most cost-efficient means of manufacturing a product.

Cooperation: Among supply chain partners ensures mutual success. Collaborative planning, forecasting and replenishment (CPFR) is a longer-term commitment, joint work on quality, and support by the buyer of the supplier's managerial, technological, and capacity development. This relationship allows a company to have access to current, reliable information, obtain lower inventory levels, cut lead times, enhance product quality, improve forecasting accuracy and ultimately improve customer service and overall profits. The suppliers also benefit from the cooperative relationship through increased buyer input from suggestions on improving the quality and costs and though shared savings. Consumers can benefit as well through the higher quality goods provided at a lower cost.

SUPPLY CHAIN MANAGEMENT PROBLEMS

Supply chain management must address the following problems: -

Distribution Network Configuration: Number and location of suppliers, production facilities, distribution centers, warehouses and customers.

Distribution Strategy: Centralized versus decentralized, direct shipment, cross docking, pull or push strategies, third party logistics.

Information: Integrate systems and processes through the supply chain to share valuable information, including demand signals, forecasts, inventory and transportation.

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Inventory Management: Quantity and location of inventory including raw materials, work-in-process and finished goods

SCM ACTIVITIES

Supply chain management is a cross-functional approach to managing the movement of raw materials into an organization and the movement of finished goods out of the organization toward the end-consumer. As corporations strive to focus on core competencies and become more flexible, they have reduced their ownership of raw materials sources and distribution channels. These functions are increasingly being outsourced to other corporations that can perform the activities better or more cost effectively.

The effect has been to increase the number of companies involved in satisfying consumer demand, while reducing management control of daily logistics operations. Less control and more supply chain partners led to the creation of supply chain management concepts. The purpose of supply chain management is to improve trust and collaboration among supply chain partners, thus improving inventory visibility and improving inventory velocity.

Strategic

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- Strategic network optimization, including the number, location, and size of warehouses, distribution centers and facilities.
- Strategic partnership 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 design coordination, so that new and existing products can be optimally integrated into the supply chain, load management
- Information Technology infrastructure, to support supply chain operations.
- Where to make and what to make or buy decisions
- Align Overall Organizational Strategy with supply strategy

Tactical

- Sourcing contracts and other purchasing decisions.
- Production decisions, including contracting, locations, scheduling, and planning process definition.
- Inventory decisions, including quantity, location, and quality of inventory.
- Transportation strategy, including frequency, routes, and contracting.
- Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise.
- Milestone Payments

Operational

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- Daily production and distribution planning, including all nodes in the supply chain.
- Production scheduling for each manufacturing facility in the supply chain (minute by minute).
- Demand planning and forecasting, coordinating the demand forecast of all customers and sharing the forecast with all suppliers.
- Sourcing planning, including current inventory and forecast demand, in collaboration with all suppliers.
- Inbound operations, including transportation from suppliers and receiving inventory.
- Production operations, including the consumption of materials and flow of finished goods.
- Outbound operations, including all fulfillment activities and transportation to customers.
- Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other customers.
- Performance tracking of all activities

Information Technology for Supply Chain Management

Information technology (IT) is an important enabler of effective supply chain management. Much of the current interest in supply chain management is motivated by the possibilities that are introduced by the abundance of data and the savings inherent in sophisticated analysis of these data. The innovative opportunities coming to the fore with electronic commerce (e-commerce), especially through the Internet, have also increased the interest in IT.

Supply chain management spans the entire enterprise and beyond, encompassing suppliers on one end and customers on the other. Therefore, our discussion of IT for supply chains will include both systems that are internal to an individual company as well as external systems, which facilitate information transfer between various companies and individuals.

In addition, supply chain management typically spans many functional areas within a company and is affected by the way the various groups communicate and interact.

For many firms, IT provides a competitive advantage. Though this has been true for some time in service industries such as banks, it is also becoming more relevant for firms such as large retailers, airlines, and manufacturers. Prominent examples include Wal-Mart with its satellite-connected Information Technology, American Airlines with its innovative Sabre reservation system, Federal Express with its superb tracking system, and Cisco with its "virtual manufacturing environment".

When applying supply chain strategies that reduce cost and lead times and increase service level, the timeliness and availability of relevant information are critical. In addition, an increasing number of companies are providing value-added IT-based services to their customers as a way of differentiating themselves in the marketplace and developing strong long-term relationships with their customers. Of course, once these kinds of services are offered by even one company within an industry, they can very quickly become a basic requirement for all others.

In many cases, current IT that supports the components in the supply chain process is diverse and disconnected. It has typically evolved throughout the years based on various local and companywide requirements that were rarely integrated. This issue must be addressed if a company is to position itself to manage its supply chain effectively. Various

strategies are utilized by companies to overcome these problems and create systems that can use the multitude of data in the system effectively.

Information flow between suppliers, manufacturers, and customers is critical for effective supply chain management. This entails information flow between different companies, a relatively new concept that is already widely practiced to varying degrees (e.g., e-mail, EDI, exchanges).

The implementation of advanced IT solutions typically requires changes in organizational structure, as well as in employee job descriptions and behavior

GOALS OF SUPPLY CHAIN INFORMATION TECHNOLOGY

We consider some of the ultimate goals of IT as it relates to the supply chain. Some companies and industries are currently far from achieving these goals, while others are well on their way to accomplishing many of them.

To utilize information, we need to collect it, access it, analyze it, and have the ability to share it for collaboration purposes. Supply chain management system goals in these areas are:

- Collect information on each product from production to delivery or purchase point, and provide complete visibility for all parties involved.
- Access any data in the system from a single point of contact.
- Analyze, plan activities, and make trade-offs based on information from the entire supply chain.
- Collaborate with supply chain partners. Collaboration allows companies to manage uncertainty, for example, through risk sharing or information sharing, and achieve global optimization.

The primary goal of IT in the supply chain is to link the point of production seamlessly with the point of delivery or purchase. The idea is to have an information trail that follows the product's physical trail. This allows planning, tracking, and estimating lead times based on real data. Any party that has an interest in the whereabouts of the product should be able to have access to this information. As figure given below, information and products

flow from the supplier to the manufacturer, internally through the manufacturer's distribution system, and then on to the retailers

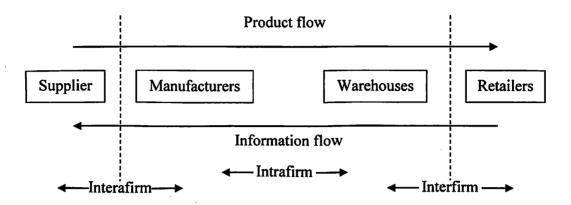


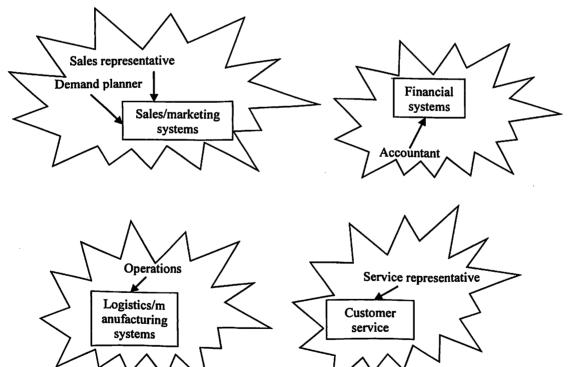
Figure: Flow of information and goods in the supply chain

• Collect information: Evidently, the retailer needs to know the status of its orders and the suppliers need to be able to anticipate an incoming order from the manufacturer. This entails access to data that reside in other companies' information systems as well as across functions and geographic locations inside a company. Furthermore, the participants need to see data in their own terms; that is, if suppliers of cotton are looking at the demand for Q-Tips, they need it translated into pounds of cot ton consumed. Therefore, translation tables, such as bills of material, are required throughout the system.

The availability of information regarding the status of products and material is the basis on which intelligent supply chain decisions can be made. Furthermore, it is not sufficient to simply track products across the supply chain; there is also a need to alert diverse systems to the implications of this movement. If there is a delay in a delivery that will affect production schedules, the appropriate systems need to be notified so they can make the proper adjustments by either delaying the schedules or seeking alternative sources. This goal requires standardization of product identification (e.g., bar coding) across companies and industries. For example, Federal Express has implemented a tracking system that provides ongoing information on the whereabouts of any package handled by the company and makes this information available

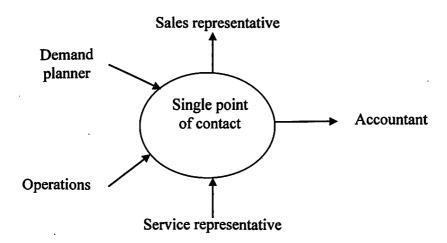
internally as well as to customers.

• Access to data: Here we introduce an important concept, the single-point-of-contact concept. The goal here is that all the available information, either information provided to a customer or required internally, can be accessed in one stop and be the same, regardless of the mode of inquiry used (e.g., phone, fax, Internet, kiosk) or who is making the inquiry. This requirement is complicated by the fact that to satisfy a customer's query, information may be required that resides in various locations within one company and, in some cases, across several companies. In many companies, information systems tend to be islands, depending on their functions within the company. Customer service will work with one system, accounting with another, and the manufacturing and distribution systems are completely separate (Figure given below).



Occasionally there may be a transfer of some cruefal information that needs to be accessed across systems, but if the transfer is not done in real time, then the systems never have exactly the same data. The customer service representative receiving an order may not be able to provide shipping status information, and the plant may not be able to inquire about

current outstanding orders. Ideally, everyone who needs to use certain data should have access to the same real-time data through any interface device (see Figure given below).



- Banking applications are advanced in this respect: you can access the same account
 information the bank tellers use, from almost anywhere over the telephone, computer,
 or ATM machine. Nevertheless, these systems may still be weak at linking all of a
 customer's accounts into a single point of inquiry—for example, accessing mortgage
 information at the same time as a bank account.
- Analyze based on supply chain data: The third goal is related to analyzing the data, especially in a way that takes into account the global supply chain picture. In addition, the information system must be utilized to find the most efficient ways to produce, assemble, warehouse, and distribute products—in other words, the best way to operate the supply chain. As we have seen, this entails various levels of decision making: from operational decisions involving the way to fulfill a customer order, to tactical decisions related to which warehouse to stock with what product, or what the production plan for the next three months should be, to strategic decisions about where to locate warehouses, and what products to develop and produce. To facilitate this, systems need to be flexible enough to accommodate changes in supply chain strategies. To achieve this kind of flexibility, systems need to be highly configurable and new standards need to be developed.

• Collaborate with supply chain partners: The ability to collaborate with supply chain partners is essential to a company's success. Indeed, an important objective in supply chain management is replacing sequential processes with global optimization. This requires not only sophisticated alignment of IT systems but also the integration of business processes. Depending on its supply chain role, a company may be required to either integrate with a customer's procurement system or require its own suppliers to link into its own systems or collaborative platforms, or both. The level and type of collaboration vary between industries. For instance, collaborative forecasting was initiated in the consumer packaged goods industry while supplier integration is more common in the hi-tech industry where outsourcing of critical components requires systems that support the product and logistics coordination.

In recent years, collaboration has become the focus of supply chain systems. The ability to link and work effectively with suppliers has produced new systems called supplier relationship management (SRM). In addition, the various exchanges that were developed during the Internet boom of the late 90s are becoming collaboration platforms, whether private or public. On the other end of the supply chain, customer relationship management (CRM) systems are evolving to provide better contact and understanding of customer needs.

As we will see, the four goals of supply chain management do not all have to be achieved at the same time, and are not necessarily dependent on each other. They can be targeted in parallel, with the order of importance depending on the industry, company size, internal priorities, and return on investment considerations. For instance, a bank could not survive without single-point-of-contact capability, a delivery company without a sophisticated tracking system, and a high-tech manufacturer without a production planning system.

To achieve these goals and to master the decisions and problems that arise when considering how to address them, it is helpful to understand many of the major issues in IT development, particularly as they relate to supply chain management. As we see in Figure given below, the following are the means toward achieving these goals.

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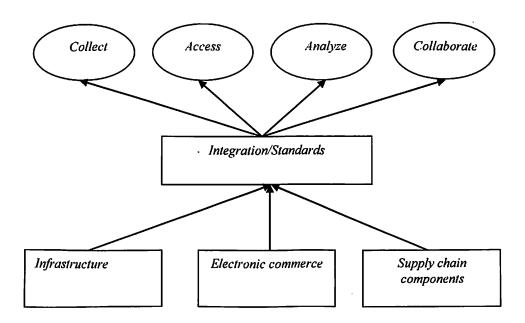


Figure: Goals and means of supply chain management

- Standardization: IT standards are what allow systems to work together. They drive the cost and sometimes the feasibility of implementation.
- IT infrastructure: The IT infrastructure, whether internal or external to a company, is a basic component of system capabilities. Without the communications and database capabilities, some of the goals outlined cannot be achieved.
- Electronic commerce: Electronic commerce has been the most important emerging IT field in the last few years. It has enabled not only internal efficiencies but also the ability to collaborate with partners in the supply chain.
- Supply chain system components: These components comprise the various systems that are involved directly in supply chain planning. These are typically systems that combine short-term and long-term decision support system and intelligence elements. Integration-related issues: How should priorities be set in order to achieve the goals discussed above? What kind of investments should be made in the short term and in the long term?

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INVENTORY MANAGMENT

In business management, inventory consists of a list of goods and materials held available in stock. An inventory can also mean self-examination, a moral inventory. In computing, inventories can comprise physical and non-physical components. The dictionary meaning of inventory is 'stock of goods'. An inventory may be defined as a stock of goods or services, which are held for the purpose of future production or sale. The goods or services may be a consumptive or non-consumptive type. Inventories form an alternative to the production or purchase in future. Thus inventory on one side is stock of goods and services but on the other hand it is locked capital.

Inventory serves as a cushion between the production and consumption of goods necessitated by the technological demands of production and transportation and customer needs. Inventories can be categorized into several types. These are generally classified as Raw Material and Supplies Inventories, Production Inventories, and MRO Inventories, In Process Inventories, Finished Inventories, Material in transit inventory and Dealer stock.

INVENTORY CONTROL

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Inventories are generally justifiable and there are obvious economic reasons for their existence. Since there are several costs associated with the inventories, an effective inventory management boils down essentially to setting a balance between the opposing cost factors. Inventory control means controlling the inventories in the organization. It is a technique of maintaining stock items at desired levels, whether they may be a raw material, goods in process or finished products.

FACTORS INFLUENCING INVENTORY DECISIONS

There are both internal and external factors, which influence decisions on inventory in an organization. The external factors arise from market conditions, credit availability and government regulations. Market conditions can be viewed from two angles. Firstly there is the dynamic nature of prices and availability. To combat this we adopt efficient forecasting and planning techniques. Secondly there is the finite time lag between the placing of an order and obtaining the materials, known as lead time which is defined as the period that elapses between recognition of a need and its fulfillment. Inventory level

increases with increase in lead-time. It is comprised of administrative lead-time, manufacturing lead-time, transporting lead time and inspection lead-time.

Generally there is variation in demand rate and lead-time. In order to compensate for uncertainties in either lead time or demand rate, additional stocks may be carried to reduce the risk of stock out during the lead time interval. This additional stock is known as safety stock or buffer stock, which is held in excess of expected demand. There is direct relationship between safety stock and service level.

Costs Associated With Inventories

The problem of balancing the costs of less than adequate inventories versus more than adequate inventories is a complex one due to numerous costs involved. The major tangible costs associated with inventories are ordering costs or set up costs, carrying costs, purchase cost, under stock costs and overstocking cost.

COST INVOLVED IN HOLDING STOCKS

The various costs associated with the stock can be classified into following groups:

1. INVENTORY CARRYING COSTS

Inventory carrying costs represent the expenses of holding the stocks of goods. These include opportunity costs of funds invested in inventories, insurance, taxes, storage and cost of deterioration and obsolescence. These carry cost move in that proportion to the size of inventory.

2. ORDERING COST:

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These costs are in the form of procurement expenses which are incurred as and when we have to place purchase order. These include costs incurred in the following activities: requisitioning, purchase ordering, transporting, receiving, inspecting, and storing.

The ordering cost increase in proportion to the number of order placed.

3. STOCK OUT COST:

These costs arise when there is equal to the storage in production facilities. It may be in the shape of lost sales or lost good will.

MATHEMATICAL MODELING FOR INVENTORY CONTROL

The solution of inventory problem with mathematical models is to find appropriate levels of holding inventory, ordering sequence and the quantity that have to be ordered so that the total cost incurred is minimized. The demand and supply conditions that act within and without impose constraints on the decision-making process. The demand can be fully known, partially known or completely unknown. These **three situations** are termed as **demand being certain**, **demand being risky and demand being uncertain** respectively. On supply side there are two distinct possibilities:

- 1. The supply being static if only a single supply is possible during the entire consumption period.
- 2. Supply being dynamic if more than one supply can be obtained during the consumption period.

These states of nature of demand and supply conditions can be combined to form six different practical situations, namely:

1. Supply station-demand certain

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- 2. Supply station-demand risky
- 3. Supply station-demand uncertain
- 4. Supply dynamic-demand certain
- 5. Supply dynamic-demand risky
- 6. Supply dynamic-demand uncertain

MODERN INVENTORY CONTROL TECHNIQUES

Material Requirement Planning and Just in Time techniques have taken care of most of the draw-backs which were being experienced with traditional inventory control techniques for managing inventories in manufacturing environments. These techniques termed as modern inventory control techniques are primarily meant for manufacturing environment. JIT philosophy is of recent origin and is being widely applied in Japan. Under these techniques component parts are manufactured only when required by down steam work center, thus right amount of parts are made at the right time and the inventory is kept to virtually near zero. JIT techniques are being considered and tried in other industrialized countries too now.

The success of JIT techniques in Japan is due to unique physical and philosophical characteristics typical of Japanese production system/culture. These include the ability to virtually freeze master production schedules, to cross train the highly skilled and very disciplined Japanese workers, to utilize high degree of automation and robotics and to profit from close proximity and reliability of material and parts suppliers. These characteristics enable Japanese firms to reduce system variability to the extent that demand can be estimated very accurately and production parameters such as machine processing times and utilization approach very stable levels. These factors are not exhibited in manufacturing systems in other countries. JIT techniques are at trial stage in industrially advanced countries and have not found their way in developing countries, as yet. MRP items are widely used for controlling manufacturing inventories in industrially advanced countries.

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CHAPTER 3

RESEARCH METHEDOLOGY

In planning and designing a specific research project, it is necessary to anticipates all the steps that must be undertaken if the project is to be successful in collecting valid and reliable information. For successful completion of any project, there should be some steps which are necessary to taken out. The step process is called research process.

FOMULATIMG THE RESEARCH PROBLEM:

Formulating the research problem means defining the research objectives in the specific way. The objective of the research should be clear specific. It includes who, when, where, what.

STATEMENT OF THE PROBLEM

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Today Consumers have higher expectations than ever before. They want products to match these expectations. They also want accurate, up-to-date and useful information about what they buy and above all they need Quality. So, in order to understand the nature of supply chain management of the organization, I took this Lean supply chain Management as a topic for my project, to give findings and suggestions by adopting and analyzing supply chain management of Circuitronix Pvt. Ltd.

OBJECTIVES OF THE STUDY

This project was undertaken to have an insight into the supply chain management of Circuitronix Pvt. Ltd. The study aims to investigate the minute details of the supply chain management. An analysis of the various facts and figures has been done to arrive at logical recommendations. In short, at it can be said that this study has two-fold objective of knowing, "what is the present supply chain management?" And "what should be the future supply chain management?"

- To study the role of supply chain management in companies in manufacturing company like Circuitronix Pvt. Ltd
- To study the supply chain management system and practices of Circuitronix Pvt. Ltd

In today's scenario almost every organization faces the paradox that holding inventory is expensive and speculative yet market demand is often immediate and highly uncertain. This

study makes an effort for establishing norms the designing of effective supply chain network. But the effective supply chain system is predicated on the availability of accurate input to any organization with help of the timely and accurate information. The study also accounts for estimating the future uncertainties so that appropriate designs and operating plan can be designed.

SCOPE OF THE STUDY

An efficient "supply chain management" plays a vital role in the success of any organization. A chain system has to be designed carefully, as it normally takes years to build and is not easily changed. This study provides a bird's eye view of distribution channel of Circuitronix Pvt. Ltd. This report would do well to the entire person interested in learning about distribution channel of Circuitronix Pvt. Ltd. A general idea about Circuitronix Pvt. Ltd presence in PCB market is also well given by this report. After a thorough analysis of various facts and figures, a set of recommendations, with regard to the distribution channel, has been given in the concluding part of the report.

The company would find it useful to look into the viability of the implementation of the recommendations, once implemented, and are expected to fetch immense benefits to the company. It is thus clear that this report would serve a variety of purposes and its scope is very wide and open.

RESEARCH DESIGN:

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1.

Research design tells us about tools and techniques are used to find the result in a better way. For this on the "supply chain management in Circuitronix Pvt. Ltd"

We are going for the descriptive research and exploratory research which is mainly based on primary data.

EXPLORATORY RESEARCH:

In this research type we explore the ideas. It could conduct a study of secondary source if information is not available. Get expert opinions or report to case study analysis.

DESCRIPTIVE RESEARCH:

It is used to describe marketing phenomenon while trying to determine the association among variable. Mainly in this research we used to primary data. The research objective in this type of research is generally describing the characteristic of a consumer segment.

SAMPLING METHOD

Convenience sampling was used by the researcher because it is easy and cheap to collect data. Moreover the population size was very large to cover so it was best to use convenience sampling.

SOURCES OF DATA:

In this project we use both primary as well as secondary data but mainly research is based on the primary.

SELECTION OF METHOD:

In this we use convenience sampling method and stratified random sampling method.

DESIGNING THE DATA COLLECTION FORM:

Observational method

Survey method

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For this project we are going for survey method (questionnaire method).

In this we will fill up questionnaire forms from various people in company which give the results for the project .Questions are going to be open ended and close ended as per the requirement of the information. Questions formed by me will be easily understandable and clear to everyone about their meaning.

DATA COLLECTION

Both Primary as well as Secondary Research Method has been included for preparing this final report.

PRIMARY SOURCE

- Observation
- Personal Interviews

SECONDARY SOURCE

- Google search engine.
- Other web links.

DETERMINATION OF SAMPLE SIZE:-

Sample size for the research project will be 30 respondents.

ORGANIZING AND CARRING OUT THE FIELD WORK

After all survey and observation have been made, the completed data-collection forms must be processed in a way that will yield the information the project was designed to obtain. Firstly, see that all collected data and logical. Then data must be prepared for tabulation this means the data must be assigned to the categories and then cooled so that data can be put in to the computer. So that we can analyze the data easily

REPORTING THE FINDING:-

1.1

After tabulating and analyzing that we you must prepare a report on the finding. Report should be clear which so the whole result in the research project. Findings are clear to its objective and result should be clearly mentioned.

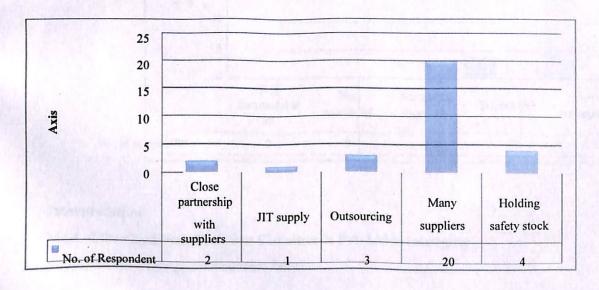
LIMITATIONS OF THE STUDY

- This study throws light on advantages of supply chain management process commenced at the Circuitronix Pvt. Ltd.
- The SCM studied in this report focuses on the PCB industry and it may differ from firm to firm.
- The disadvantage of study SCM is investment of time, money and resources needed to implement and overlook supply chain.
- Convenience sampling used here has its own limitations.
- There have been some inaccuracies due to non cooperative and rude behavior of the respondents.

CHAPTER 4 DATA ANALYSIS

Close partnership with suppliers JIT supply Outsourcing Many suppliers	
Holding safety stock	
OTA SERVICE DE LA CONTRACTOR DE LA CONTR	No. of Respondent
Close partnership with suppliers	2
JIT supply	1
Outsourcing	3
Many suppliers	20
Holding safety stock	4

How do you manage your supply chain?



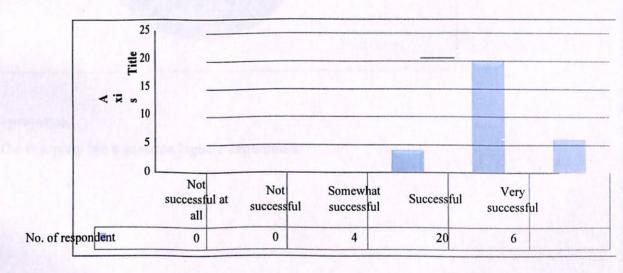
Interpretation

Out of 30 employees of Circuitronix Pvt. Ltd maximum no. of employees think that supply chain management of Circuitronix Pvt. Ltd is managed by many suppliers.

2. How successful do you think is your company in managing its supply chain in general?

- * Not successful at all
- * Not successful
- * Somewhat successful
- * Successful
- * Very successful

	No. of respondent
Not successful at all	0
Not successful	0
Somewhat successful	4
Successful	20
Very successful	6



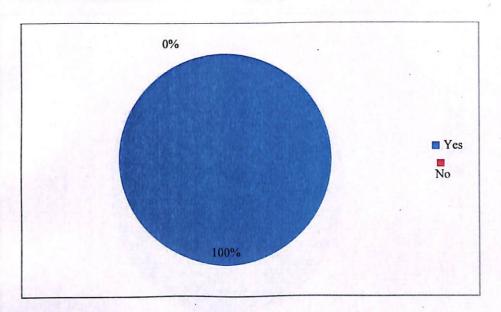
Interpretation

Most of the employees think that Circuitronix Pvt. Ltd is managing Supply Chain Management successfully

3. Does your company have a separate logistics department?

YES NO

Jennige et	No. of respondent
Yes	30
No	0



Interpretation

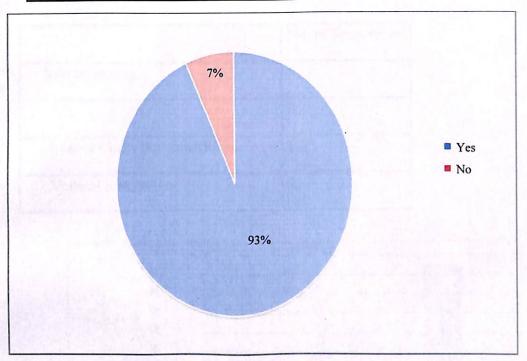
The company has a separate logistic department.

4. Does your company have a clear logistics strategic plan?

YES

NO

	No. of respondent
Yes	28
No	2



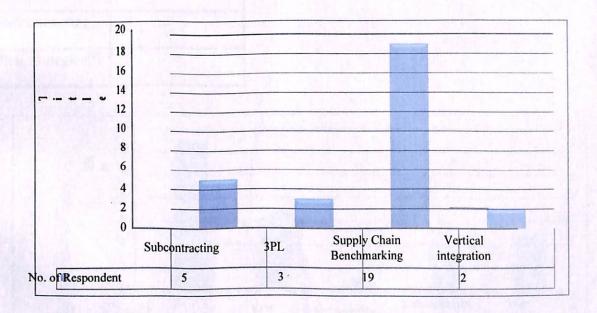
Interpretation

Out of 30 employees 28 think that Circuitronix Pvt. Ltd has a clear logistic plan

5. What types of systems are currently in use in your company to support Supply Chain Management?

•	Subcontracting	
•	3PL	
•	Supply Chain Benchmarking	
	Vertical integration	

an strategically.	No. of Respondent
Subcontracting	5
3PL	3
Supply Chain Benchmarking	19
Vertical integration	2



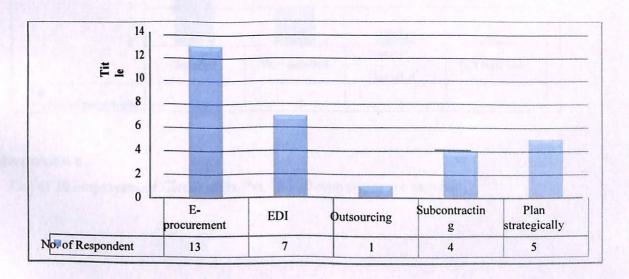
Interpretation

Out of 30 employee 19 think that supply chain benchmarking supports supply chain management of Circuitronix Pvt. Ltd.

6. What types of systems do you plan to implement in the near future (within the next 2 years)?

E-procurement	
EDI	
Outsourcing	
Subcontracting	
Plan strategically	a with the U

AND BUILD	No. of Respondent
E-procurement	13
EDI	7
Outsourcing	m 1
Subcontracting	4
Plan strategically	5



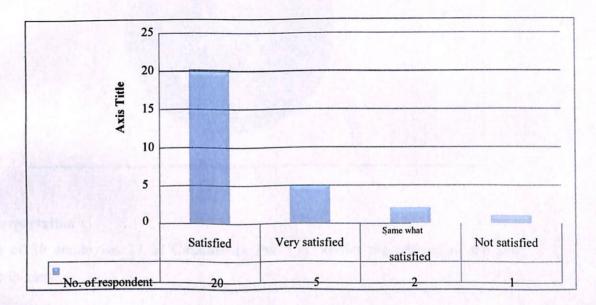
Interpretation

Out of 30 employees 13 employees think that in future there is need of implementing eprocurement

7. How satisfied are you with the current public policy regarding SCM and IT?

- *Satisfied
- *Very satisfied
- *Same what satisfied
- *Not satisfied

	No. of respondent
Satisfied	20
Very satisfied	5
Same what satisfied	2
Not satisfied	1



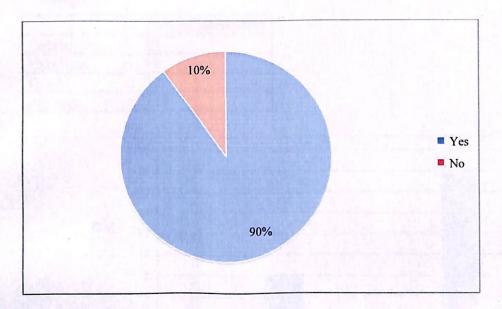
Interpretation

Out of 30 employees of Circuitronix Pvt. Ltd 20 employees are satisfied.

8. Is supply chain management having all the address of the sub distributor's branches of the company?

Yes No

thee i	No. of respondent	
Yes	27	
No	3	

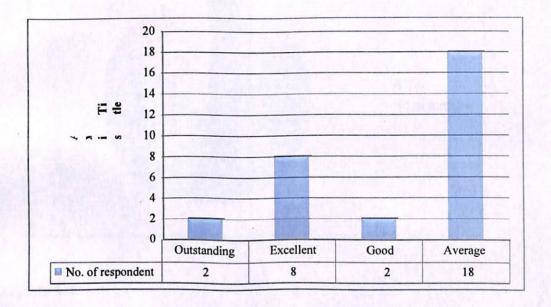


Interpretation

Out of 30 employees 27 of Circuitronix Pvt. Ltd. knows the address of the sub distributors.

- 9. Rate the working strategies of supply chain management department on the basis of the current programs?
 - * Outstanding
 - * Excellent
 - * Good
 - * Average

godenki yezhoù e-	No. of respondent
Outstanding	2
Excellent	8
Good	2
Average	18

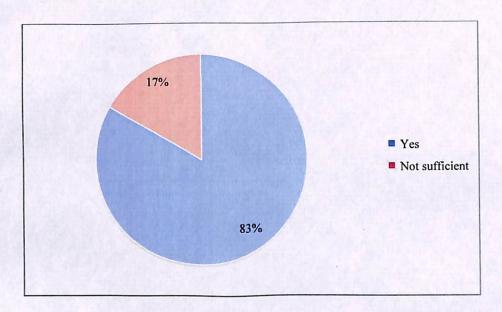


Out of 30 employees 18 employees think that the working strategies of supply chain management department are average.

10. Is the supply chain management department is having sufficient transportation?

- * Yes
- * Not sufficient

	No. of respondent	
Yes	25	
Not sufficient	5	



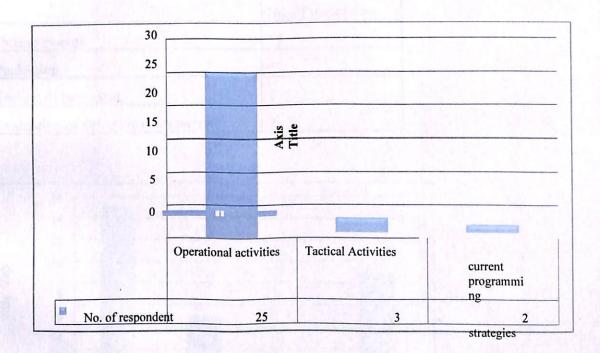
Interpretation

Out of 30 employees 25 think that transportation is sufficient Circuitronix Pvt. Ltd.

11. According to the current growth process of the organization, which of the following needs much attention and progress to boost the production?

- * Operational activities
- * Tactical activities
- * Current programming strategies

	No. of respondent
Operational activities	25
Tactical activities	3
Current programming strategies	2

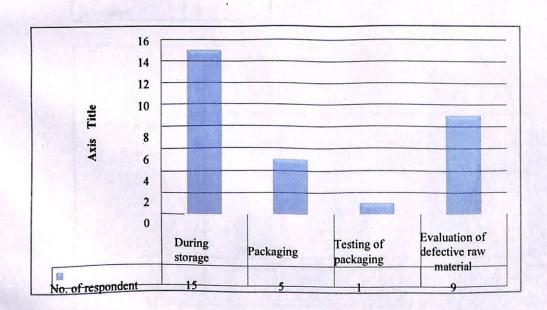


Out of 30 employees 25 think that there is a need to pay attention on operational activities.

12. Choose the right option, where the supply chain department is facing problem in taking care of the raw material?

- * During storage
- * Packaging
- * Testing of packaging
- * Evaluation of defective raw material

Dec 200	No. of respondent
During storage	15
Packaging	5
Testing of packaging	1
Evaluation of defective raw material	9

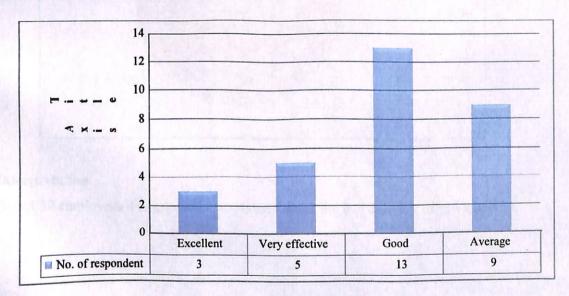


Out of 30 employees 15 employees think that supply chain management is facing problem during storage

13. How do you rate the delivery activity of the department?

- * Excellent
- * Very effective
- * Good
- * Average

- No. 1	No.
	of respondent
Excellent	3
Very effective	5
Good	13
Average	9

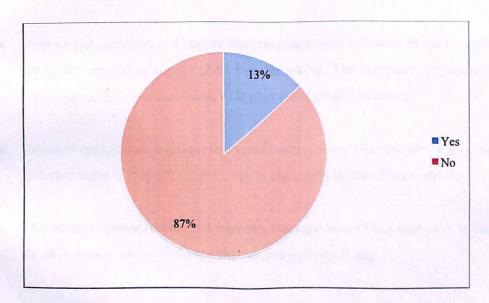


Out of 30 employees 13 employees says that delivery system is very good.

14. Is there any case recorded by the supply chain department in which the production department complained late delivery of raw materials?

- * Yes
- * No

dean	No. of respondent
Yes	4 - 6 (25.00)
No	26



Interpretation

Out of 30 employees 4 employees complained about the late delivery of raw material.

CHAPTER 5 INTERPRETATION OF RESULTS

FINDINGS

According to the study done on the feedback of questionnaire, data interpretation and analysis the results are as follows-

- The result shows that the Circuitronix Pvt. Ltd. practices supply chain with the help of many suppliers. Meanwhile the company is managing its supply chain successfully. The company has a separate logistics and dispatch department.
- Circuitronix Pvt. Ltd has a clear and sophisticated logistic plan.
- Operational activities and supply chain management activities of the Circuitronix Pvt. Ltd
 are by the support of supply chain benchmarking. The company is planning to implement
 and practice the e-procurement, EDI plan strategically in future.
- Current supply chain management and IT activities of the company are going flawless and in future there is scope for better supply chain and distribution network.
- The current transportation and logistics management of the company is sufficient and is flexible enough so as to change the current policies if any.
- The study has shown us that there is some obstacles during handling and storage of dairy products which creates hurdle in SCM therefore should be eradicated.

SUGGESTIONS

The company should start a home delivery where a particular corporate will order full range of products required by it over a period of time. For this the company could provide a deliveryman to reach the different corporate.

In order to motivate the channel members it is also very essential for the company to increase the distributors for the hard selling items

Circuitronix Pvt. Ltd should go in for exclusive outlets in at least all the shopping malls coming up these days and any location where footfalls are large in number. The advantages of this channel will be:

- i. Full range display
- ii. Convenience for distributors.
- iii. Easier to access new customers.
- iv. Easy to push impulse purchase products
- v. Brand building will be facilitated
- In order to remain sensitive to market demand, it is essential for the company to have additional procurement options ready that will help company to cope up with the problem of less supply or shortage of PCB's.
- In order to practice a better supply chain management Circuitronix Pvt. Ltd should make use of updated/upgraded/latest ERP packages.
- · Distribution strategies.

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Which is facilitated by price offs, which are frequently offered by the company.

- · Route planning and optimization
- · Load optimization
- For the dairies to remain competitive, they need to diversify their products through value addition by using simple and cost-effective methods of PCB.

CHAPTER 6

CONCLUSION

Organizations have multiple objectives like enhanced competitiveness, better customer service and increased profitability etc. To seek these objectives organizations employ various defensive as well as offensive business performance improvement approaches. Often these approaches focus on any one operational area of organization. But the approach we have discussed (SCM) covers all functional areas of organization. It is the network of customers, suppliers, manufacturers, and distributors concentrating the flows of material, information, and finance through physical and human resources. Due to globalization organizations cannot work as standalone units.

There is a continuous need to interact with Logistics partners to achieve the basic objective of organization. SCM requires concerted action of all the participants therefore adoption and implementation cannot be as straightforward as other approaches. Researchers and practitioners have developed a sustainable body of knowledge by deploying various qualitative and quantitative tools and techniques. It is observed that organizations have unique products, operations, culture; and have a different level of compatibility & adaptability. Therefore there cannot be one fix solution for all organizations. Depending upon corporate strategy organizations will have to develop a suitable Logistics management strategy. It would be a formidable task for managers if they do not understand the theoretical foundations and practical implications of logistics management. In this paper it has suggested that managers must probe why to manage, what to manage and how to manage the Logistics.

We interrogated the theory and research practice to find what the various logistics management activities are. This through analysis of activities sheds light on the potential of Logistics management. Next big challenge for organizations is to make a suitable roadmap for adoption and implementation. We have suggested a six-step approach to meet this challenge. This step-by-step assessment of business operations would certainly assist organizations to completely understand the concept of Logistics management. Sooner or later all organizations would adopt logistics management; therefore we recommend that managers should examine the domain of logistics management to achieve business excellence. Current trends like outsourcing, information

technology adoption and third party logistics presents an opportunity for development of logistics management.

It is felt that in future all organizations will have to adopt partnership information sharing initiative with suppliers. Therefore establishment of mutual trust within Logistics to share the vital information for effective logistics management practice; and development of suitable mathematical model for the same would be the greatest challenge for researchers and practitioners.

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QUESTIONNAIRE

	:				
Name of Employee					
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	•••••				
Name of Company	•••••				
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Address	***********				
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Country		Tel.:	•		
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Contact Person	•••••				
					
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Position in company	•••••				
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E-Mail	••••••				
Sector Types	: Manufacturing	Service		Both	
Industry	: PCB	Auton	notive	Other (define)	
·		-			
No of Employees	:	_	Turnover	2018 :	
	anage our supply cha	ain?			
Close partnership	with suppliers				
JIT supply		П			
Outsourcing					
_		닏			
Many suppliers					
Holding safety stock					
2 How successful d	o vou think is vour o	company	in managin	g its supply chain in gen	eral?
		· · · · · · · · · · · · · · · · · · ·		P 110 2 mbb1)	
* Not succes					
* Not succes	sful				
* Somewhat	successful				
70					
/ U					

* Successful	·
* Very successful	•
3. Does your company have a separa	ite logistics department?
. YES	NO
4. Does your company have a clear l	
YES	NO
5. What types of systems are current	tly in use in your company to support Supply Chain
Management?	
Subcontracting 3PL	
Symply Chain Danahmanking	
Supply Chain Benchmarking	
Vertical integration	
6. What types of systems do you playears)?	n to implement in the near future (within the next 2
E-procurement	П
EDI	
Outsourcing	
Subcontracting Plan strategically	
7. How satisfied are you with the cur	rrent public policy regarding SCM and IT?
*Satisfied	
*Very satisfied	
*Same what satisfied * Not satisfied	
71	

•		
8. Is supply chain	management having all the address of the developer branches of the	
company?		
Yes	No	
9. Rate the working	strategies of supply chain management department on the basis of the curren	t
programs?		
* Outstandin	g	
* Excellent		
* Good		
* Average		
10. Is the supply cha	in management department is having sufficient transportation?	
* Yes		
* Not suffici	ent	
11. According to th	e current growth process of the organization, which of the following need	S
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* Operations	l activities	
* Tactical ac	tivities	
* Current pr	ogramming strategies	
12. Choose the righ	t option, where the supply chain department is facing problem in taking	
care of the raw mat	erial?	
* During sto	rage	
* Packaging		
* Testing of	packaging	
* Evaluation	of defective raw material	

- 13. How do you rate the delivery activity of the department?
 - * Excellent
 - * Very effective
 - * Good
 - * Average
- 14. Is there any case recorded by the supply chain department in which the production department complained late delivery of raw materials?
 - * Yes
 - * No