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Introduction to Supply Chain Management

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Abstract: ***The Industrial Revolution has brought about immense changes in the market globally. Since then, we have been seeing an ever-increasing change in demand trends across various industries around the world, and at the same time, the advancements in science and technology over the years have been another reason for the growth and diversification of the global market. [9][10] According to sources, the supply chain management market has steadily grown from $15.85 billion in 2020 to $21.95 billion in 2023 and is expected to reach $30.91 billion by 2026. In today's world, the growth in population and increasing requirement for commodities, acts as another challenge for the network chain between the manufacturer and consumer.[11] It is very important to manage the involved factors in these chains to maintain proper balance and ensure efficient production at the manufacturer's end, effective distribution of these commodities, and timely fulfillment of consumer demands. This project aims to provide a brief understanding of the importance and steps involved in the management of this Demand-Supply chain.***

I. INTRODUCTION

Supply Chain Management is the science that deals with the efficient and economical integration of Supplying, Manufacturing, and Warehousing.[1][2] It refers to the management of all aspects of the flow of goods or services, right from the procurement of required resources and raw materials to the delivery of the finished goods. Effective Supply Chain management strategies benefit organizations in several ways:

1) *On-Time Delivery to the Customer:* An effective Supply Chain strategy can help in the delivery of products to the end user while maintaining the service levels.
2) *Reduction in time Required for Order Fulfillment:* Effective management of the Supply Chain not only minimizes System costs but also helps to reduce the Order Fulfillment time for every customer, this will in turn helps reduce the amount of energy and effort in the manufacture and delivery for products.
3) *Minimal Wastage Production:* An efficient Supply Chain strategy helps us plan the required raw materials and resources that will help in timely usage, and this will reduce the wastage produced during the manufacturing and delivery.

II. STAGES IN SUPPLY CHAIN

The process of Supply Chain Management can broadly be classified into the following stages:



Fig (1). Steps in SCM

- Planning
- Procurement
- Manufacturing
- Warehousing
- Distribution

Fig (1) explains the stages in Supply Chain and the general process flow in Supply Chain.[3] These stages are the building blocks of any Supply Chain and each of them has its importance and greatly affects the overall efficiency of the Supply Chain. Hence it is very important to understand each of them in detail.

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A. Planning

[12]Planning is the process of balancing the available supply of products against the demand for each of them. The main goal of Planning activity is to make efficient use of available inventory and production capacity. Planners are required to have a good understanding of the customer demands and should also be able to predict the demand for future buckets It is very important to get the correct balance of supply and demand along with a good understanding of the changing demands and the future trends in the markets.

Planning can be broadly classified into three categories according to the period for which planning is done:

1) *Strategic Planning:* Strategic Planning deals with planning for a long period (around 3-5 years) and is generally used to define the mission and vision of the organization. Strategic planning defines the course of action to be taken by the entire organization and affects major business units within the organization. This type of planning needs to be periodically reviewed as it helps set broader goals at an organizational level.
2) *Tactical Planning:* Tactical Planning deals with medium-term planning (around 1-2 years) and it defines the process or strategy for the departments within the organization. Tactical planning includes specific goals that deal with defining the tactics for achieving the set goals at the department level. Tactical planning needs to be reviewed on a quarterly or semi-annual basis to define various parameters within the business units according to the changing trends in demand.
3) *Operational Planning:* Operational Planning deals with short-term planning (less than 1 year). This mainly deals with the planning done for very specific and granular tasks. Operational planning is done to ensure the smooth day-to-day functioning of the organization from the grassroots level. Operational plans mainly deal with very specific tasks, and they need to be reviewed on a daily or weekly basis, to ensure maximum efficiency and effective output.

Planning is a very important practice for industries like Pharmaceuticals and Life Sciences as there is a large variety in the type of products present, also there is a large network of wholesalers and retailers that need to be supplied with the products regularly. Improper planning can lead to an increasing burden on the manufacturing and distribution units, which may lead to longer request fulfillment time, which may lead to fatal loss. For example, during the COVID-19 pandemic, the pharmaceutical industry saw an epic surge in the demand for various medicines and the Life Science industry also faced many challenges as the demand for Critical care beds and oxygen cylinders. Systematic planning and structured distribution have helped us save millions of lives during the pandemic.

B. Procurement

Procurement is the process of obtaining the right material (meeting quality requirements), in the right quantity and in the right amount (as per the requirement of the product) from a reliable source with good service (before and after sale) at a cost-effective price. Different factors need to be considered during the procurement of materials or machines for the production or pre-production stage, some of them are listed below:

1) *Ensuring Proper Standardization:* Proper standardization certifications and approvals from respective government authorities and Laboratories help set quality standards which once met can ensure the quality of the product and safety of the end user who is using the material or machine.
2) *Service Given before and After Sale:* Resources required to be procured may not always be in the required form (dimensions, material, or packaging may vary), in such cases it is very important to ensure proper service to get the materials and machines within the required specifications. Machines and resources procured for usage in manufacture, storage and transport of goods may require regular maintenance to ensure efficient working. Hence it is very important to have a proper service guarantee during procurement to ensure regular maintenance of the procured items.
3) *Delivery Constraints:* During the procurement of material for manufacturing or packing, it is very important to ensure timely delivery of the procured materials in sufficient quantity regularly, as scarcity might lead to fatal losses. Hence, delivery constraints if any for these materials need to be addressed during procurement.

The procurement process is very important as the next steps of Manufacturing and Packaging are highly dependent on it. Procurement of semi-finished or raw materials of proper quality at the proper time is important to align the manufacturing process with the demand. Similarly, procurement of desired packaging material at the right time is important to keep the flow of distribution and supply moving forward.

C. Manufacturing

Manufacturing is the process of producing the desired goods that meet the quality standards, with the help of the procured raw material using the available resources. Today, we see the production of a variety of goods is done on a large scale for different industries. However, different products have different constraints that they must adhere to to ensure efficient and effective production and minimize wastage. Some of the common constraints that need to be addressed during the manufacturing process are given below:

1) *Physical Environment Constraints:* Some products especially from the pharmaceutical and life science industries require special physical conditions (like temperature, and pressure) for the manufacturing of products. Such industries need to understand and maintain the standard required conditions to ensure orderly production.
2) *Packaging size Constraint:* Various products across the market have been seen to be available in different packaging sizes. For example: Various commodities in the FMCG (Fast Moving Commodity Goods) like soaps are found to have different packaging sizes. Hence manufacturers need to understand the volume of the desired product to go ahead with the production.
3) *Resource Constraint:* Manufacturing is a continuous process and needs to have different resources (man and machine) aligned to ensure smooth functioning. However, these resources might face breakdowns due to unforeseen conditions. Hence it is very important to maintain and align these resources in such a way that minimum breakdown takes place and parallel processes need to be devised to guarantee continuous production.

Manufacturing is important as it brings together the procured raw and semi-finished materials and gives shape to the finished product that is to be supplied to the market. The goal of the manufacturing process in general is to produce goods in the desired quantity in the right time frame and at the same time make sure that quality standards are maintained. Different industries have different types of manufacturing strategies, but generally, the manufacturing industries can be broadly classified as follows:

a) *Branded Manufacturing Industries:* These Industries produce their material and have a major Research wing. These industries come up with extensive research and devise products according to the results, which are further tested by them, once everything is found to be in place, these research and products are patented by the companies, following which mass production is set up under the brand's name.
b) *Generic Manufacturing Industries:* These are the industries that generically manufacture products, that is, the products are manufactured without a proper brand name or logo. These industries have more focus on manufacturing a high volume of products. The volume of batches manufactured decides the size of the industries.
c) *Contract Manufacturing Industries:* Contract Manufacturing industries are third-party organizations that produce products or components for industries that cannot have the same products produced in-house. Contract manufacturing is done to distribute the load on the production line and also helps industries save greatly on the economic front.

D. Warehousing

[10] Warehousing is the process of storing produced goods until they are ready to be distributed to wholesalers and retailers. Warehousing also refers to storing the extra goods produced in the batch as inventory or stock until there is a demand for the same from the consumer. The main goal of the warehousing process is to provide conditions that are suitable for the product to be stored until it is ready for transport. Following are some of the things that need to be considered while storing the products:

1) *Shelf Life of Product:* Shelf life is the period for which the product is fit or suitable for use. It is very important to consider the Shelf-life period for certain products from the food, pharmaceutical, and life science industries while storing them in warehouses. It is very important to manage the warehousing process for such products that have a limited shelf-life time as lapse may lead to heavy wastage and losses.
2) *Managing Physical Conditions:* Products from different industries require different physical conditions during storage, hence it is very important to understand and maintain the physical conditions like temperature, pressure, humidity, etc. required for the proper storage of the products.

E. Distribution

Distribution of goods is the process of transporting the product from the manufacturing plant or the distribution centers to the wholesalers, retailers, and consumers. The distribution process is important as reaching the consumer is very important to ensure the cash flow to the industries. The Distribution network needs to be set up in such a way that each order from the customers needs to be fulfilled in minimal time. Following are some of the things that need to be considered while planning the distribution:

1) *Minimum Lead Time:* The lead time is the time required for the product to reach the consumer from the manufacturer. The distribution network needs to be designed in such a way that the time required to deliver the order is minimal.
2) *Shelf-Life Constraint:* The Distribution network for some products needs to be designed considering the shelf life for those products. The products with shorter shelf-life need to be transported and delivered faster.
3) *Breakdown Considerations:* Breakdowns in the distribution may occur due to unforeseen problems with the involved modes of transport (bad weather stopping flight for air transport or vehicle failure in road transport). The Distribution network should be designed considering these breakdowns to ensure continuity in the distribution.

III. CHALLENGES IN SUPPLY CHAIN

1) *Innovation in Science and Technology:* [6][7] Increasing rate of innovation, in different sectors poses new challenges for industries to develop new products that are compliant with all the necessary standards and manage the entire supply chain from procurement of required items to the delivery of these items. For example: In the Telecommunication Industry, with the emergence of 5G technology, it is very important for companies that the next version of their mobile devices be compliant with this technology.
2) *Growth of New Business Models:* [5] New Business models are emerging daily and it is very important to be compliant with these new models to provide an enhanced customer experience. For example: In the food industry, recently we have seen a huge growth in the number of online orders via various mobile applications, hence it has become very important for restaurants and cafes to be active on these platforms, to attract a larger customer base.
3) *Cost Focus:* Industries need to be aware and ready for innovations and research but at the same time focus on the cost incurred over these research and innovation needs to be monitored to ensure avoiding over-expenditure.
4) *Digitalization of Supply Chain:* The increasing variety of products and the growing demand for commodities has made it important for organizations to digitalize their supply chain, to allow analysis of demand and supply statistics, that help them plan and predict the future demand. [8] It has been proven from several research, bringing digital transformation into the supply chain can lead to a 20% increase in revenue and a 50% reduction in process costs. This will help bring down overall costs and increase efficiency.
5) *Real-Time Integration of Supply Chain:* [4] Nowadays, with the increasing competition and complexity in the range of products and demand, it is very important to integrate the supply chain to display the key performance indicators and provide on-time alerts in case of breakdowns. This helps to keep the supply chain continuously up and running with the best quality standards.

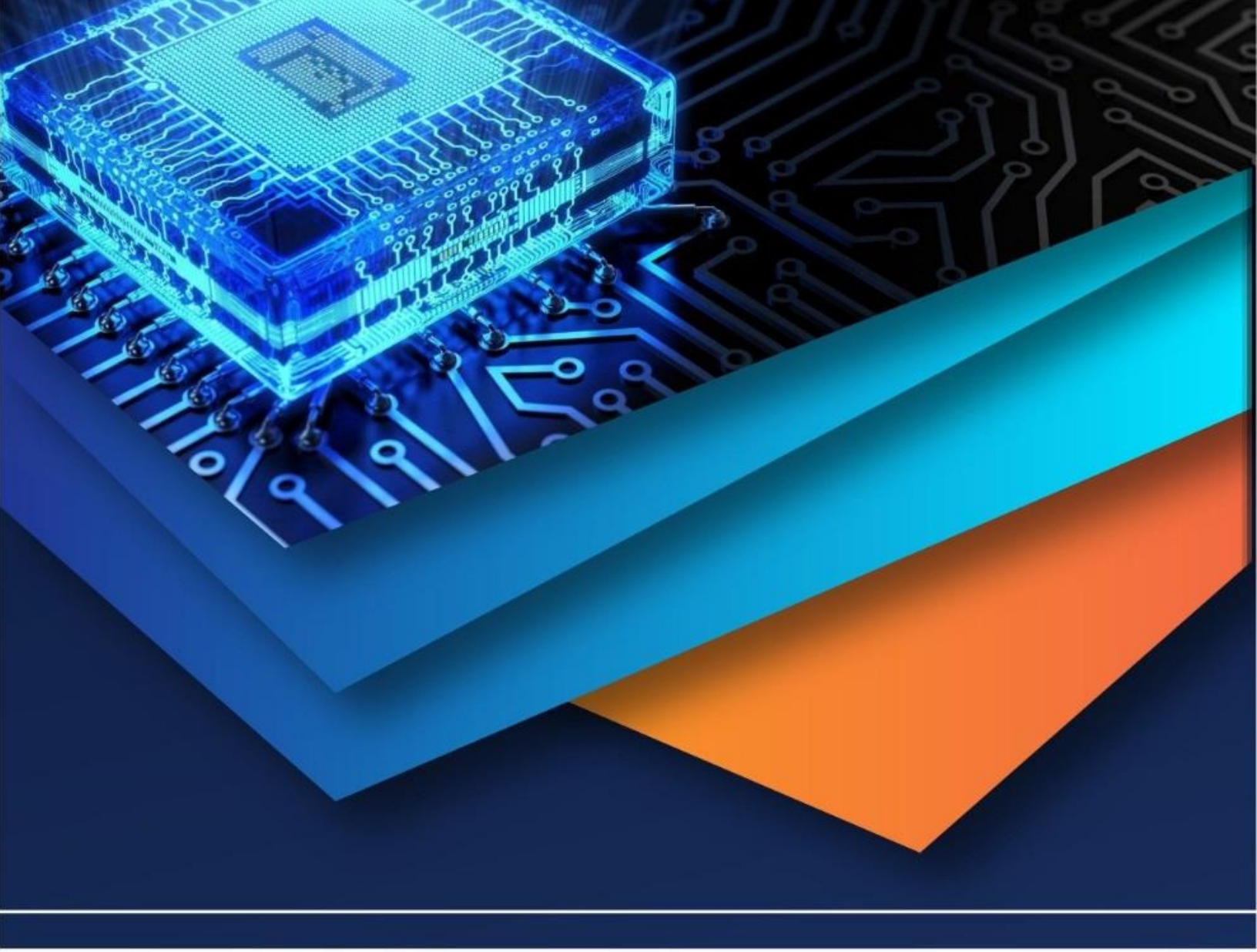
IV. CONCLUSION

In this paper, we discussed the basics of Supply chain management. We also had a brief overview of the steps involved in Supply Chain Management, we also had a brief overview about how these steps of planning, procurement, manufacturing, warehousing, and distribution work. We also looked at some constraints and conditions that need to be considered while going through these steps. Along with this brief overview, we discussed some challenges faced during the Supply Chain Management process.

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