

# Analysis of Product Material Handling

**Mr. Venkatesh Ashokababu**

Assistant Professor,

Masters In Business Administration, Presidency University, Bangalore, India,

Email Id: ashokababu@presidencyuniversity.in

## ABSTRACT:

A crucial component of many businesses, including manufacturing, transport, and storage, is effective material handling. This essay examines the value of product material handling procedures and how they affect productivity, safety, and operational effectiveness. It addresses important elements of material handling, including the choice of equipment, storage arrangements, modes of transportation, and inventory control. It also emphasises the value of ergonomic factors and good training in reducing hazards and enhancing overall productivity. The study's conclusion emphasises the need of efficient material handling procedures for streamlining supply chains and optimising operational procedures.

## KEYWORDS:

Equipment Selection, Operational Efficiency, Product Material Handling, Productivity, Safety, Storage Systems.

## I. INTRODUCTION

Material handling is defined by Haynes as the basic operations associated with the movement of bulk, packaged, and individual products in a semisolid or solid state by gravity, manually or poweractuated equipment, and within the confines of an individual producing, fabricating, processing, or service establishment. Material handling adds no value to the product but increases the cost of the product, costing the client extra. As a result, handling should be limited to a minimum. Material handling accounts for roughly 40% of the cost of manufacturing in Indian enterprises. Of the overall time spent making a product, 20% is spent on actual processing, while the remaining 80% is spent travelling from one location to another while waiting for the processing. Improper material handling may cause delays and machine idle [1], [2]. Materials handling is also described as the function concerned with the preparation, placement, and positioning of items in order to enable their transit or storage. Material handling is the art and science of moving, managing, and storing materials at various stages of production. As a result, the function comprises every aspect of the product except the actual processing action. Handling is often included as an important aspect of the process. Significant cost and production cycle time savings may be realised via scientific material handling.

### Selection of Material Handling Equipment's

Material Handling equipment selection is a crucial choice since it influences both the cost and efficiency of the handling system. While choosing material handling equipment, keep the following aspects in mind.

### Properties of the Material

The kind of material to be transported, whether solid, liquid, or gas, as well as its size, shape, and weight, are all critical aspects that might lead to a preliminary rejection from the spectrum of potential equipment under consideration. Similarly, if a substance is delicate, corrosive, or hazardous, some handling procedures and containers will be preferred over others.

## Layout and Characteristics of the Building

Another limiting aspect is the unavailability of handling space. The use of hoists or cranes may be prohibited by lowlevel ceilings, and the inclusion of supporting columns in problematic areas may restrict the capacity of materialhandling equipment. Chute or ramps for industrial vehicles may be employed if the structure is multistory. The layout will identify the kind of manufacturing activity continuous, intermittent, fixed position, or group as well as which pieces of equipment will be more suited than others. The capacity of the floor also aids in the selection of the appropriate material handling equipment.

## Production Flow

Fixed equipment such as conveyors or chutes may be utilised effectively if the flow is pretty steady between two fixed places that are unlikely to alter. Moving equipment, such as trucks, would be desirable if the flow is not consistent and the direction varies from one location to another since various items are being produced at the same time.

## Cost Considerations

This is one of the most significant factors to consider. The aforementioned variables may assist in narrowing the range of viable equipment, while price can assist in making a final selection. When comparing several pieces of equipment that are all capable of bearing the same weight, many cost variables must be considered. The important expenses to consider are the initial investment as well as running and maintenance expenditures. Calculating and comparing the entire cost of each piece of equipment under discussion allows for a more sensible conclusion on the best option.

## Evaluation of Material Handling System

The cost considerations for material handling equipment evolution include investment cost, labour cost, and projected service hours per year, utilisation, and unit load carrying capabilities, loading and unloading characteristics, operational expenses, and size requirements. Additional considerations to consider include the power supply, the environment in which the device must work, and other technical concerns. As a result, equipment selection in the organisation will enhance the material handling system via work research methodologies. They often result in improved operating time to loading time ratios by palletizing, reducing duplicative motions, and so forth. Handling systems that are no longer in use may be replaced with more efficient equipment.

The efficiency of the material handling system may be calculated by dividing the time spent on handling by the total time spent on production. This will take care of the time factor. The expenditures spent per unit weight handled may be used to calculate cost effectiveness. It is reasonable to say that very few organisations attempt to collect costs and time in this way in order to objectively assess performance and take corrective action. The movement's operations ratio, computed by dividing the total number of movements by the total number of new operations, reveals if employees are going through too many motions as a result of inefficient routing. It should be noted, however, that the efficiency of materials handling is primarily determined by the following factors: I the efficiency of the handling methods used to handle a unit weight over a unit distance, ii the efficiency of the layout that determines the distance over which the materials must be handled, iii the utilisation of the processing facilities, and iv the efficiency of the handling speed. To summarise, a good material handling system is dependent on adapting the layout and equipment to individual needs. Fixed route equipment like as rollers, belt conveyors, overhead conveyors, and gantry cranes are recommended when a significant volume must be transferred from a restricted amount of sources to a limited number of destinations. Diverse path equipment is chosen for additional flexibility[3]–[5].

## II. DISCUSSION

### Material Handling Equipment's

Material handling equipment is broadly divided into two categories: a fixed path equipments and variable path equipments. Fixed route equipment that moves in a straight line. This category includes conveyors, monorail devices, chutes, and pulley drive equipment. The overhead crane provides a little variation in this category, since its design allows it to transport items in any way within a confined space. Overhead cranes have a wide tonnage range and are utilised for handling large raw materials, stacking, and sometimes palletizing. Variable path equipment has no constraints in terms of movement direction, albeit their size must be taken into account. This category includes trucks, forklifts, mobile cranes, and industrial tractors. Forklifts come in a variety of sizes, are manoeuvrable, and may be equipped with a variety of accessories to boost their flexibility. Material Handling Equipment is divided into five primary groups.

### Conveyors

Conveyors are used for constantly or occasionally transporting material between two stationary workstations. They are primarily utilised for ongoing or mass manufacturing processes—in fact, they are appropriate for most operations with a more or less constant flow. Conveyors come in a variety of shapes and sizes, including rollers, wheels, or belts to assist move the material along; they may be powered or freerolling. Conveyors must be chosen with caution since they are often expensive to build; also, they are less flexible, and if two or more converge, the rates at which the three conveyors travel must be coordinated [6]–[8].

### Industrial Trucks

Industrial trucks are more adaptable than conveyors since they may travel between several places and are not permanently placed in one location. As a result, they are best suited for occasional use.

### Cranes and Hoists

Cranes and hoists have the primary benefit of being able to transfer large things via above space. They may, however, generally only service a small region. Again, there are numerous kinds of cranes and hoists, with varying payload capacity within each category. Cranes and hoists are useful for both intermittent and continuous manufacturing.

### Robots

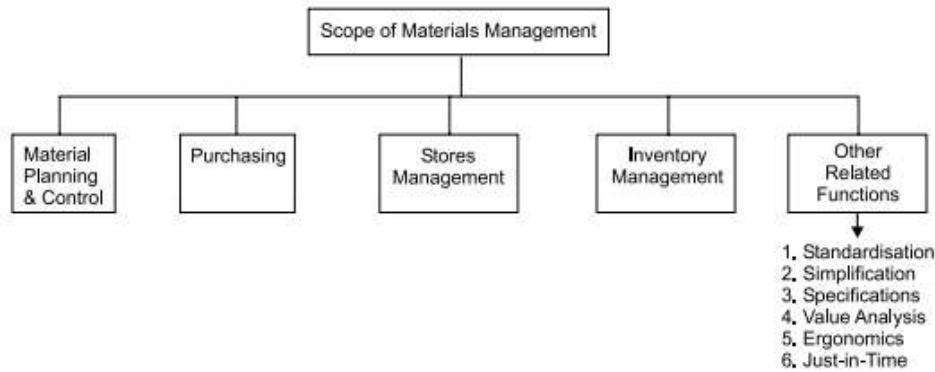
There are several sorts of robots. They differ in size, purpose, and manoeuvrability. Although many robots are employed for material handling and transportation, others are utilised for tasks like as welding or sprayed painting. Robots have the benefit of being able to function in hostile environments such as hazardous circumstances or difficult jobs such as the repeated moving of large goods. It is difficult to choose material handling gear among the many options available. In other circumstances, the same material may very well be handled by different kinds of equipment, and the wide range of available equipment and attachments does not make the issue any simpler. Yet, in other circumstances, the structure of the substance to be treated limits the options.

### Materials Management

Materials management is a function that seeks for an integrated approach to material management in an industrial project. Its primary goal is reduced costs and effective material management at all phases and portions of the project. Its role involves various crucial material related features such as buying, storage, inventory management, material handling, standardisation, and so on.

## Scope and Functions Of Materials Management

Materials management is described as the role responsible for coordinating the planning, sourcing, buying, transferring, storing, and regulating of materials in an optimal way in order to give a predetermined service to the client at the lowest possible cost (Figure. 1). The term makes it clear that the scope of materials management is broad. Materials management functions may be classified in the following ways:



**Figure 1: Represent the Scope of materials management [Databaazi].**

1. Materials planning and control are completed. This includes assessing individual component needs, creating a materials budget, projecting inventory levels, scheduling orders, and evaluating production and sales performance.
2. Buying include selecting sources of supply, finalizing purchase terms, placing purchase orders, following up, maintaining smooth interactions with suppliers, approving payments to suppliers, and reviewing and rating suppliers.
3. Stores management or managing includes physical control of items, store preservation, reduction of obsolescence and damage via timely disposal and efficient handling, store record keeping, right positioning and stocking. A shop is also in charge of physically verifying goods and reconciling it with book data. A shop is essential to a company's operations.
4. Inventory control or management: Inventory refers to the resources that are in stock.

It is also known as an enterprise's idle resource. Inventories are goods that are either stored for sale, in the production process, or in the shape of a product. materials, which have yet to be exploited. The period between acquiring bought components and changing them into finished goods varies by industry and depends on the manufacturing cycle time. For the system to operate well, multiple types of inventories must be held to function as a buffer between supply and demand. Hence, good inventory management is essential for the smooth and efficient operation of the production cycle with the fewest disruptions. Value analysis is concerned with the expenses incurred as a result of inefficient or unneeded specifications and features. It contributes in the last step of the product cycle, namely the maturity stage. At this point, research and development offer no meaningful contributions in terms of enhancing the efficiency of the product's functions or adding new functions to it. Human Engineering Ergonomics. Human factors, often known as human engineering, are concerned with manmachine systems. Ergonomics is defined as the design of human jobs, manmachine systems, and successful work performance, including displays for displaying information to human sensors, controls for human activities, and complicated manmachine systems. Each of the aforementioned functions is discussed in depth.

### Material Planning and Control

Material planning is a scientific approach for anticipating the needs for raw materials, supplementary parts and components, spares, and so on as instructed by the production schedule. It is a component of the entire planning effort. There are several elements that impact material planning activities. These elements may be divided into macro and micro systems.

1. **Macro Variables:** Price patterns, economic cycles, government import policies, and so on are some of the micro elements that influence material planning.
2. **Micro Variables:** Plant capacity utilisation, rejection rates, lead times, inventory levels, working capital, delegation of powers, and communication are some of the micro elements that influence material planning.

### Techniques of Material Planning

Bill of material explosion is a material planning approach. Bill of material explosion for material planning. The predicted demand for the final goods serves as the foundation for material planning. Forecasting approaches such as the rolling average method, exponential smoothing, and time series models are used. After the demand projection has been established, the material planning process may begin. A bill of materials is a document that lists the materials needed and the location code for a certain product. An explosive chart is a series of bill of materials gathered in a matrix manner so that combined needs for multiple components may be done using explosion charts. Requirements of various materials are arrived at from the demand forecast, to use bill of materials. Hence, the material demand plan will result in the establishment of a material supply schedule and the purchase of those material needs.

### Purchasing

Buying is a critical component of materials management. In every business, purchasing entails purchasing the necessary equipment, materials, tools, and components. The buying function's relevance varies according on the kind and scale of the industry. This duty is handled by the works manager in small industries, and by a distinct department in major industrial concerns. When a customer puts an order, he commits a significant amount of the corporation's financing, which impacts the working capital and cash flow situation. He is a highly responsible individual who interacts with numerous salespeople and so may be deemed to have contributed to the company's public relations efforts. As a result, the buyer's good or terrible relationships with suppliers may build or break the company's reputation.

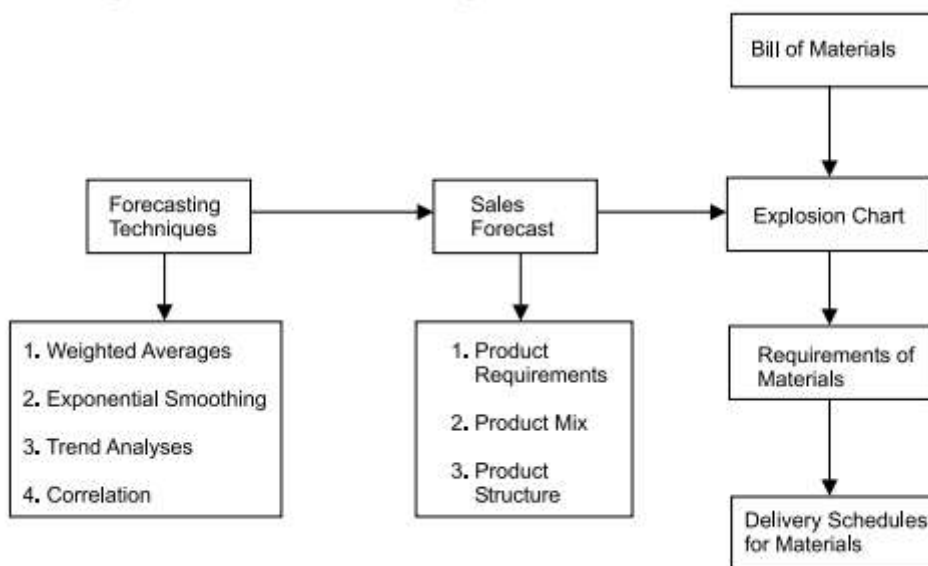


Figure 2: Represent the Material planning [Wisdom Job].

### Objectives of Purchasing

The buying function's primary goal is to maintain the continuous supply of raw materials, subcontracted products, and replacement components while lowering the overall cost of the final goods. In other words, the goal is to minimise the cost of the end product as well as the cost of the raw materials. The buying department's goals may be summarised as follows:



1. To get materials, suppliers, and equipment at the lowest feasible cost:
2. These are the materials used in manufacturing activities. The reduction of input costs boosts productivity and, as a consequence, the profitability of the operations.
3. To assure the ongoing flow of production by supplying raw materials, components, tools, and so on on a continual basis, as well as providing repair and maintenance services.
4. Increase asset turnover: Inventory investment should be maintained to a minimum in proportion to sales volume. This will enhance the asset turnover and consequently the company's profitability.
5. To establish an alternative source of supply: Investigation of other sources of supply of materials boosts the buyer's negotiating power, reduces material costs, and increases the capacity to meet crises.

Establish and maintain strong relationships with suppliers: Maintaining good relationships with suppliers helps in the development of a favourable image in business circles. Such relationships benefit the buyer by adjusting the fair price, preferred material allocation in the event of material shortages, and so forth. To achieve optimum integration with the company's other departments: The purchase function is linked to the production department for material specifications and flow, the engineering department for the purchase of tools, equipment, and machines, the marketing department for sales forecasts and their impact on material procurement, the financial department for maintaining material levels and estimating the working capital required, and the personnel department for manning and developing the purchase personnel [9]. To educate and develop personnel. The purchasing department employs a diverse range of individuals. The organisation should aim to generate a creative workforce via training and development. Effective record keeping and management reporting. The purchasing function requires paper processing. Such paper processes should be harmonised to enable record keeping. The department's independence is justified by periodic reporting to management on its purchasing actions.

### III. CONCLUSION

In a variety of sectors, effective product material handling is essential for streamlining workflows, boosting output, and guaranteeing a secure workplace. Organisations may optimise their supply chain and achieve operational excellence by putting into place efficient practises in equipment selection, storage systems, transportation, inventory management, training, and ergonomic considerations. For operations involving material handling, selecting the appropriate equipment is crucial. Operations are efficient and economical when aspects like load capacity, manoeuvrability, and automation capabilities are taken into account. Choosing the right equipment, whether it be forklifts, conveyors, or automated guided vehicles AGVs, increases production and decreases human labour.

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