

**“A STUDY ON ROLE OF MATERIAL HANDLING
IN LOGISTICS INDUSTRY”**

Project Report submitted for partial fulfilment of the requirement
of the award of degree of

MASTER OF BUSINESS ADMINISTRATION in
International Transportation and Logistics Management

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INDIAN MARITIME UNIVERSITY

SCHOOL OF MARITIME MANAGEMENT

KOCHI CAMPUS

CERTIFICATE

*This is to certify that the Project Report entitled “A Study on Role of Material Handling in Logistics Industry” School of Maritime Management, Indian Maritime University, Kochi Campus partial fulfilment of the requirements for the award of the Degree of the Master of Business Administration is a record of the original work done by **Noopura Ashokan** under by supervision and guidance and that this project work has not previously formed the basis for the award of any degree, diploma, fellowship or similar title to any candidate of this or any other University.*

Dr. SREEJITH U

Project Guide

DECLARATION

I, hereby declare that the Project Report entitled “**A Study on Role of Material Handling in Logistics Industry**” is a bonafide work carried out by me during the academic year 2020-22 in partial fulfilment of requirements for the MBA (ITLM) Degree of Indian Maritime University, Kochi Campus under the supervision & guidance Mr. Dr. Sreejith U. This work has not been undertaken or submitted elsewhere in connection with any other academic course.

Place: Kochi

NOOPURA ASHOKAN

Date:

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EXECUTIVE SUMMARY

The study was conducted on the topic “Role of Material Handling in Logistics Industry”. Material handling is an important part of the supply chain. Material handling is the function of moving the right materials to the right place in the right time, in the right amount, in sequence, and in the right condition to minimize production cost. It encompasses inventory management and control of the movement, storage, and protection of products and materials throughout manufacturing, warehousing, distribution, and disposal. The Indian material handling sector has observed a momentous growth in recent years, which results in rising investment in infrastructure development, increased demand for higher automation, and safe working practices in the manufacturing area.

The objective of the study is to explain the significance and role of material handling and to identify the ways to overcome the material handling challenges in logistics and supply chain management. A descriptive research strategy was adopted by extensive use of secondary data from books, journals, websites etc.

The findings of the study revealed that the most of the materials are handled manually in the organizations by the use of the forklifts as the commonly used equipment, followed by manual method and there is also other material handling equipment used such as cranes, pallet trucks and conveyors etc. The role of material handling systems includes the loading of goods on trucks, the offloading of materials from trucks, facilitation of other activities. The use of modern material handling systems in a transport industry can save time, save space, reduce handling costs, less fatigue etc. And the study also revealed that, the safety, which is of paramount importance in material handling because it involves moving equipment in a plant or a warehouse. So, the organisation tries to perceive the most suitable and necessary material handling methods such as using mechanical systems, utilizing automation technology for material handling, and also focuses on role of digitalisation. Thus, it can boost the entire material handling market growth. It is also observed that, automation aids in reducing costs and delivering high-quality products. It eliminates the need for manpower to check-in, sort goods, or to move bins and totes containing materials and evident that mechanical handling can lift and transport sizable load more quickly than it is possible with manual laborers and thereby saves time.

CHAPTER 1
INDUSTRY PROFILE

INDIAN SCENARIO

The Indian material handling sector has observed a momentous growth in recent years, which is chiefly brought about by rising investment in infrastructure development, increased demand for higher automation, and safe working practices in the manufacturing area. As industrialisation is set to witness pivotal development in the years to come, the material handling equipment industry has a promising future, too. India is evolving as a vital market for material handling equipment, with the growth in the number of warehouses and container freight stations. This leads to the enhancement in demand for MHE, such as, forklifts, stackers and reach trucks. In fact, the market is estimated to grow at a CAGR of 10% from 2016 through 2020. Besides, with the global industry heading towards Industry 4.0 and the anticipated advance in sectors like, automotive, the material handling equipment sector will continue to flourish. India material handling equipment market share is anticipated to grow significantly from 2017 to 2024 due to an attractive economic landscape, and significant demand for goods movement. “The increase in manufacturing activities in the region will also augment sales. The need for safe working environments in industrial facilities, developments in areas such as wireless technologies, robotics, and flexible electronics will fuel the material handling equipment market size.

The increase in consumption, change in lifestyles and unwillingness to do menial jobs will lead to the growth of the material handling industry and on these factors, in conjunction with the Government’s “Make in India” initiative, are expected to spur local manufacturing. This will lead to the setting-up of new facilities requiring forklifts in order to support its operations. In addition, the immense growth being witnessed in the warehousing sector to support the booming e-commerce and modern retail sectors will be another key driver for growth in the industry.

The state of MHE sector in India

According to Global Market Insights, the worldwide material handling equipment market size was about INR 560 billion (excluding inventory carrying costs, which amount to another INR 4,340 billion) and growth is pegged at over 5 per cent CAGR estimation from 2016 to 2024. In fact, in 2017, the Indian MHE market witnessed a growth of around 20% on year- to-year basis, which was doubled in 2018 to around 40%. Increasing penetration of advanced technologies, such as RFID, IoT, and voice picking,

are expected to drive the material handling equipment market over the forecast time frame. The evolution in the technology to assist smooth warehouse and logistics operations in meeting customer demand is rapidly changing the business environment. For the near future, the growth projection for the electric counterbalance and warehouse equipment segment is also high. The key opportunity for the material handling industry stays in the continued growth potential. This potential, at the same time, includes a challenge, as the industry needs to invest in R&D, production as well as human resources, in order to be able to handle this growth. This higher growth is mainly supported by an investment friendly environment as well as an infrastructural boost from the government, “the tax reform in 2017 was a catalyst for the MHE industry, as it eliminates the cascading impact of different taxes and reduces the overall manufacturing cost. In addition, the advanced techniques of cargo handling, growth in the port sector, and the increasing e-commerce as well as increasing lack of space will be other drivers of the MHE market growth.

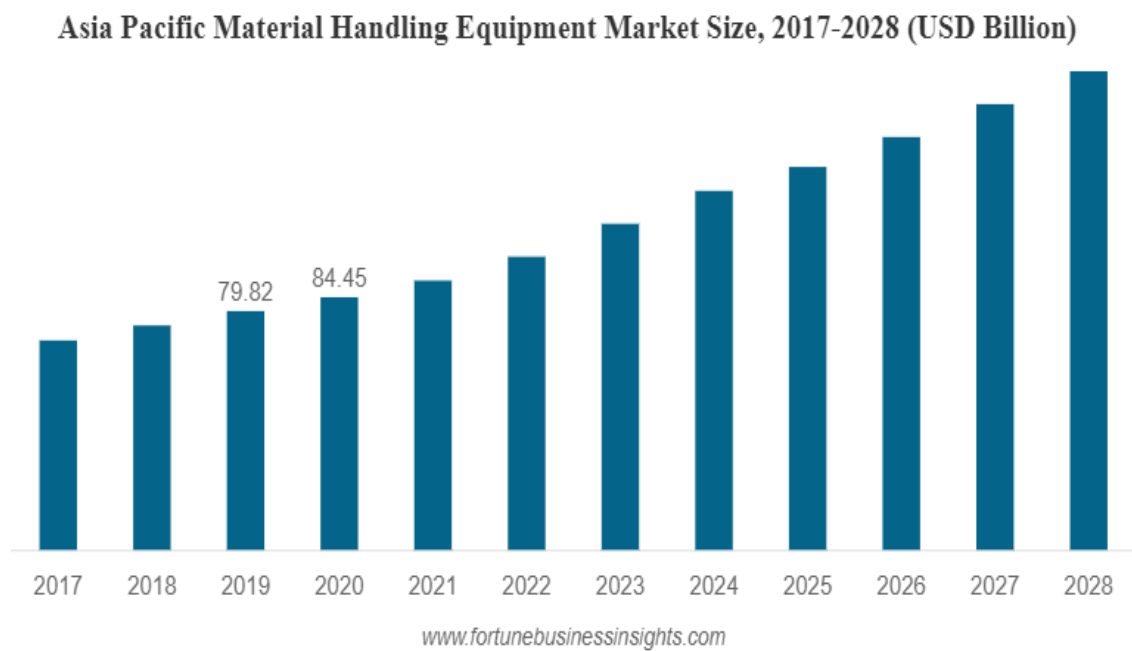


Figure1.1 Showing the Material Handling Equipment market size of Asia in coming years.

Trends in the material handling sector

With the prospects for material handling sector being very bright in India, the sector has the latest trends, in terms of advanced technologies, to embrace and look into. Productivity, safety and reliability continue to be the main drivers that determine the specifications of material handling equipment. Material handling being fundamentally a non-value-added activity, the demand is for high productivity systems that reduce the per unit cost and time spent in moving the goods from one place to another. The current trends in the industry focus on increasing productivity by means of higher capacities and speeds, when you increase the capability of a system to deliver more throughput, the safety becomes paramount. Hence, a lot of thrust is being given on enhancing the safety features on equipment by ensuring safety of the operators, the material being handled and the infrastructure. Reliability, the third cornerstone, is being addressed by leveraging new age technologies like, Internet of Things, in order to ensure that timely maintenance takes place before a catastrophic breakdown.

The material-handling market has three use cases for equipment: warehouse management, shop-floor operations, and field operations. These spaces share a few common drivers of success, such as accuracy, reliability, and cost efficiencies. In warehouse management, key success metrics include picking and sorting speed and tracking accuracy. Shop-floor operations tend to value timely delivery of products to production lines and low operating costs. Finally, the field-operations use case benefits from mechanical capabilities such as construction, mining, and ports, as well as the flexibility to handle multiple operations simultaneously.

With evolving technology, increased competition, and a growing market, the material handling industry has been experiencing significant changes. However, the rise of the COVID-19 pandemic has created a significant impact on the supply chain and material handling industries.

Recent four trends in material handling sector are as follows: -

❖ Robotics and Process Automation

As seen over the last decade, the introduction of robotics to the material handling industry has begun to reshape our processes and productivity. When it comes to the

supply chain, manufacturing facilities are under more and more pressure to get quality products produced quickly and with fewer resources.

❖ **The Rising Popularity of E-Commerce**

While the industry has slowly embraced the trend of e-commerce for the last decade, the rising popularity of ordering online will continue to put stress on manufacturing and distribution centres. With more online companies gaining more traction, there's a growing consumer expectation of receiving purchased items quickly and at an inexpensive rate.

❖ **Changes in the Workforce**

As technology advances, automation will continue to lighten the load of physical labour needed for most employees working throughout the supply chain. As a result of these changes, material handling experts project that the dynamic of the workforce will shift. With more automation, the necessity to diversify the workforce will become more apparent and expected.

❖ **Prioritizing Sustainability**

In the past, the material handling industry has not made a collective priority on managing resources with an eco-friendly strategy. With material handling, it can be difficult to perform standard procedures at a low operating cost while trying to maintain environmental safety and preservation. However, with the turn of the decade, more material handling companies are placing value on their environmental impact.

		Level of automation →					
Activities		Cranes and hoists	Conveyors	Industrial trucks and forklifts	AGVs ¹	ASRS ²	Robotic systems
Warehouse management	Loading and unloading material into storage bays	✓		✓	✓	✓	✓
	Picking required material based on production needs	✓	✓	✓	✓	✓	✓
	Moving storage bays to optimize time-to-pick					✓	✓
	Packing material for shipments				✓		✓
Shop-floor operations	Delivering material JIT ³ to drop-off point in assembly lines	✓		✓	✓		
	Transferring in-process components along value stream				✓		✓
	Moving goods during continuous-flow operations		✓				
	Preparing and positioning heavy components in assembly lines	✓		✓	✓		
Field operations	Delivering and removing material (eg, construction, mining)	✓	✓	✓	✓		
	Moving products from area to area (eg, ports, etc)	✓		✓	✓		

Figure 1.2 Showing the level of automation of material handling equipment in different operation.

Indian Material Handling Industry: Eying the Future

The Indian MHE industry is expected to grow steadily. The improvement in the Indian economy will result in accelerated demand for goods movement and create opportunities for suppliers of goods handling products and services of all types. With the government’s ambitious ‘Make in India’ plan taking root, the industry is expecting to see good growth in manufacturing and consequently in logistics and distribution activities for the next few years.

With the government’s renewed focus on incentivising the manufacturing sector, the logistics market will reap the benefits in the coming years. Chennai is emerging as a key market for material handling equipment with a spurt in the number of warehouses and container freight stations in and around the city. This will, in turn, boost the demand for MHE like forklifts, pallet trucks, stackers, order pickers and reach trucks.

India Material Handling Equipment Market Share, By Equipment Type, 2020

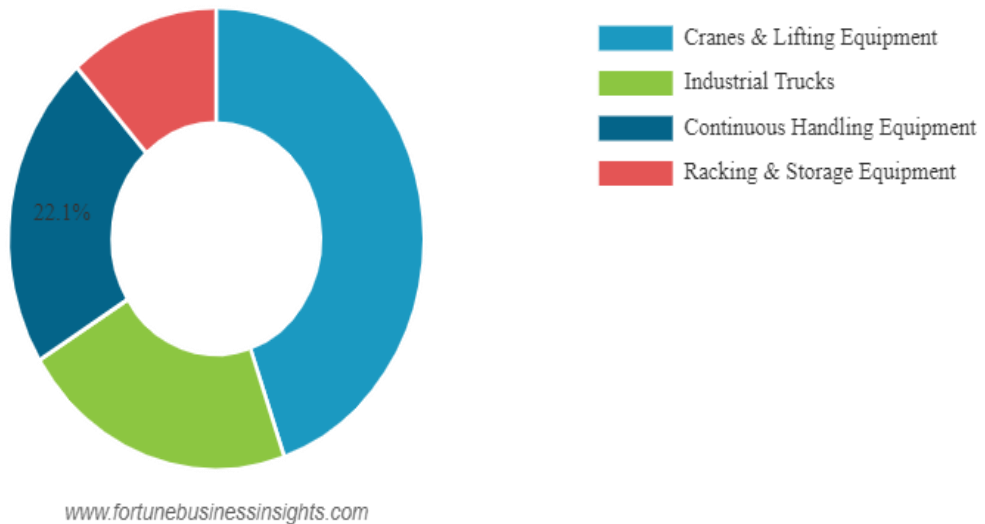


Figure 1.3 Showing the Indian material handling market share by equipment type.

Driving factors – Rising E-commerce sector to propel Market Growth

The material handling industry is highly driven by rising E-commerce sector across the globe. Consumers worldwide spent nearly USD 3.46 trillion on online. So, the, material handling industry is focusing on developing customized equipment and systems aligning with warehouses and supply chain ecosystems. This includes manufacturing engineered systems, remotely traceable transport vehicles, and smart warehousing systems to gauge real-time visibility and better consumer services.

SEGMENTATION

1. By Equipment Type Analysis

Increasing Bulk Loading Consignments and Expanding E-commerce industry to boost industrial trucks segment growth. Based on the equipment type, the market is segmented into cranes & lifting equipment, industrial trucks, continuous handling equipment, racking and storage equipment.

2. By operations Analysis




Growing infrastructure activities to depict highest CAGR for transportation segment. This segment covers assembling, distribution, transportation and others. Transportation holds the highest market share and is projected to grow significantly owing to, the increasing demand for transportation & logistics sector, online shopping, and the rising infrastructure development.







3. By industry Analysis

Based on industry, infrastructural development to drive demand across construction sector. The market is categorised into consumer goods & electronics, automotive, food & beverages, pharmaceuticals, construction, mining, semiconductors, and others.

KEY INDUSTRY PLAYERS

10 Most Promising Material Handling Equipment Providers

Company Logo	Company Name	Company Description
	ABCN Manufacturing	A one-stop solution for body customization on all types of chassis from all the brands right from TATA, Eicher, Bharat Benz, AMW, Ashok Leyland, Mahindra and a lot more.
	Fabtex Engineering Works	A prime manufacturer importer, trader and exporter of Textile Machines and offers extent of products like Hydraulic Bailing Press, Reeling Machine and Honed Tube.
	Jaldoot Materials Handling	A leading independent manufacturer of Material Handling Equipments with a proven track record of over 30 years.

	<p>Japstech Engineers</p>	<p>An ISO 9001 - 2008 certified company engaged in the activity of Manufacturing Material Handling Equipments, Warehouse Automation, Centrifugal Blowers and Special Purpose Machines.</p>
	<p>JREW Engineering</p>	<p>JREW is providing excellent services to the customers with respect to quality, delivery, price, integrity and commitment.</p>
	<p>Renders Smarter Solutions</p>	<p>A leading company involved in the manufacturing process of special purpose machines, plant machinery, material handling equipment and control panels.</p>
	<p>Saifi Con Fab System</p>	<p>Set up with the objective of providing customers with highly customizable tailor-made conveyor solutions engineered with utmost precision and with the best possible technology available.</p>
	<p>Santek Equipments</p>	<p>Santek is supporting the material handling equipment industry by formulating a high performing range of material handling equipments in state-of-the-art infrastructure.</p>
	<p>Toyota Material Handling India</p>	<p>Dedicating itself to delivering superior material handling solutions, carefully analyzing</p>


		customer demands at their actual worksites while offering equipments which are more productive, safer and cost-effective.
	Tractors India	Engaged in designing, manufacture and marketing of a comprehensive range of material handling, port equipment and crushing & screening solutions for the Indian market, supported by an integrated after-sales support.

Table1.1 Showing most promising material handling equipment providers

CHAPTER- II
THEORETICAL
FRAMEWORK

Introduction

The global industry soothsayers point out, industrialisation is set to post good growth over the coming years, there is every possibility that the material handling equipment industry will also take giant leaps ahead. The highly competitive environment, linked to globalization phenomena, demands from companies become more agility, better performance, and constant search of cost reduction. The relevance of material handling stems from the intrinsic relationship that it has with the production flow. When it presents an imbalance, there is a formation of extra stock or rupture in supply. When the flow does not have enough velocity, transit time is long and the system is not capable of serving the customers when they need it.

A thriving successful Logistics industry is often seen as a symbol of economic success and as a sign of mastery of modern technologies. Logistics is the management of the flow of goods between the point of origin and the point of consumption in order to meet some requirements. The resources managed in logistics can include physical items, such as food, materials, animals, equipment, and liquids, as well as abstract items, such as time, information, particles, and energy. The logistics of physical items usually involves the integration of information flow, material handling, production, packaging, inventory, transportation, warehousing, and often security. The complexity of logistics can be modelled, analysed, visualized, and optimized by dedicated simulation software. The minimization of the use of resources is a common motivation in logistics for import and export. It also puts emphasis on the activities of handling product, which include the storage, transportation, distribution, and packaging and processing. Although business logistics involves many activities, the traditional research of operations management on logistics mainly relates to the fields of logistics facility, transportation, and inventory planning.

Definition

The Materials Handling Industry of America [MHIA] defines materials handling management as “Material Handling is the movement, storage, control and protection of material, goods, and products throughout the process of manufacturing, distribution, consumption and disposal. The focus is on the methods, mechanical equipment, systems and related controls used to achieve these

functions”. Material Handling is the field concerned with solving the pragmatic problems involving the movement, storage, control and protection of materials, goods and products throughout the processes of cleaning, preparation, manufacturing, distribution, consumption and disposal of all related materials, goods and their packaging.

Material Handling

Material handling is the movement, protection, storage and control of materials and control of materials and products throughout manufacturing, warehousing, distribution, consumption and disposal. As a process, material handling incorporates a wide range of manual, semi-automated and automated equipment and systems that support logistics and make the supply chain work. Their application helps with:

- Forecasting
- Resource allocation
- Production planning
- Flow and process management
- Inventory management and control
- Customer delivery
- After-sales support and service

A company’s material handling system and processes are put in place to improve customer service, reduce inventory, shorten delivery time, and lower overall handling costs in manufacturing, distribution and transportation.

Material handling, which includes the movement, storage, and protection of products, is only as effective as the technology it relies upon. And each of the industry’s primary subsegments—including cranes, conveyors, and forklifts—has its own markets, technologies, and capabilities. Traditionally, material-handling subsegments have been highly fragmented. This fragmentation has allowed manufacturers to specialize in their respective areas, benefiting from existing brand recognition and relatively stable competition. In recent years, these subsegments have closely mirrored economic cycles, further allowing manufacturers to benefit from comparatively steady growth.

Today, however, manufacturers are having a harder time adapting to a number of trends. Urbanization and an aging industry workforce have required manufacturers to offer

progressively integrated and automated services and products. Accelerating adoption of e-commerce on a larger scale is putting additional pressure on the segment with regard to SKU granularity, delivery times, and responsiveness. Furthermore, the advent of artificial intelligence (AI) and automation has created new market subsegments for automated guided vehicles (AGVs) and automated storage-and-retrieval systems (ASRS), both of which are growing at a much faster rate than traditional subsegments and are creating significant challenges.

Objectives

- Minimise cost of material handling.
- Minimise delays and interruptions by making available the materials at the point of use at right quantity and at right time.
- Increase the productive capacity of the production facilities by effective utilisation of capacity and enhancing productivity.
- Safety in material handling through improvement in working condition.
- Maximum utilisation of material handling equipment.
- Prevention of damages to materials.
- Lower investment in process inventory

Dimensions of Material Handling

- The movement aspect of materials handling involves the conveyance of good into and out of storage facilities. Efficient materials handling means efficient movement of goods to, from, and within the storage facility.
- The time dimension of material handling is concerned with readying goods for production or for customer order filling.
- The quantity issue addresses the varying usage and delivery rate of raw, materials and finished goods, respectively. Material-handling systems are designed to assure that the correct quantity of product is moved to the needs of production and customers.
- Material-handling equipment consumes space in the warehouse and plant. This space in a facility is fixed, and the materials-handling system must utilize this space effectively.

Importance of material handling

Material handling is an integral part of every industry. It is an essential component of any successful warehouse. Material handling can improve customer service by making products easy to find, move, and ship out, cut costs by reducing the amount of time spent moving the products and reduce product damages by properly transporting your products. It also ensures increased safety from permanent and temporary disabilities. Material handling is an important part of the supply chain. It encompasses inventory management and control of the movement, storage, and protection of products and materials throughout manufacturing, warehousing, distribution, and disposal. It includes diverse equipment types and storage systems—like single level or multi-level storage—and conveyor belt systems. Material handling, when well-planned, ensures that materials are safely transported across facility areas, facilitates streamlining work activities and organizing space, and reduces accidents in locations that require the transport of heavy materials or loads. But material handling is more than just about the goods—it's about logistics like:

- Warehouse design
- Structural engineering and installation
- Storage and conveyance solutions

This logistics process includes various equipment that's manual, automated, and semi-automated. Equipment might include forklifts, trailers, pallets, hand trucks, tugger trains, and more. And if you're involved in industry, it makes more operational sense to factor in the materials handling logistics earlier—not later—in the process of starting, expanding, or moving your business. Material handling is integral to projects that include building or renovating plants and facilities, launching new products, improving workstations, and streamlining or reducing forklift traffic. The right material handling system supports diverse needs—and having a system that's adapted to your specific, unique needs can:

- Save money, time, and space
- Increase safety, capacity
- Decrease downtime and the number of damaged materials or lost products
- Improve ergonomics, flexibility, and the work environment

Elements of consideration in material handling

Material handling includes four dimensions: movement, time, quantity, and space. How efficiently you can move products from receiving to shipping, length of time products remain in storage, amount of product that fits into an allotted space, and actual amount of available space are the areas in which material handling can improve efficiency.

- 1) **Motion**: parts, material and finished product must be moved from location to another. Material handling is concerned with moving them in the most efficient manner and at the lowest cost. Time: each step in any manufacturing process requires that supplies are on hand the moment they are needed. Material handling must ensure that no production process or customer need is hampered by having material arrive on location too late or too early.
- 2) **Place**: material is of little value in any industrial activity unless it is in the proper location. Material handling has responsibility of delivering the desired material to the right place.
- 3) **Quantity**: rate of demand varies between steps in the manufacturing process. Material handling has the responsibility of making sure that each location continually receives the correct quantity of material.
- 4) **Space**: storage space, both active and dormant, is a major consideration in any building. Since space cost money, space requirement is greatly influence on material handling process.

Why companies should incorporate Material Handling into their planning?

For many large companies, their warehouse is the hub of their operations. The success of their business depends on the safe and efficient transport of their product from one area of the warehouse to another. Many companies depend on warehouses as part of their daily operations. Warehouses contain thousands of items, and the lack of a good material handling system in place can severely affect operations.

Because so many industries and applications rely on material handling, creating and implementing the most appropriate system or process should happen sooner, not later. Companies offers complete, end-to-end warehouse infrastructure solutions and has in-

house design, engineering, and project management teams ready collaborate. There are many reasons to justify incorporating material handling processes.

1. Avoiding Workplace Accidents/Workplace Compensation Costs

About 21% of permanent disabilities and over 25% of temporary disabilities can be attributed to workplace accidents due to the mishandling of materials. The key to avoiding this is having the correct equipment and machinery along with the well-trained staff. This will greatly reduce employee injuries and lost sick days.

2. Efficiency Saves You Money

A well-organized warehouse with the most efficient materials handling tools will translate into fewer misplaced items. Employees will waste less time searching for products. This will save you money.

3. Reduces Product Loss

No company wants to incur product damage and loss in their warehouse which will decrease your profit margin. Implementing good materials handling practices in your warehouse will go a long way to preventing product damage and loss.

4. The Importance of Warehouse Layout

Smart storage solutions will create a safe environment for your employees. An open plan of your warehouse will facilitate easy materials handling while minimizing hazardous conditions.

5. Customer Service Matters

A consumer typically choose a company based on the quality of their customer service. The faster employees can find the products in your warehouse, the faster you can deliver them to your customers. Correct materials handling contributes to streamlining the coordination of your warehouse operations. Better customer service gives your company the edge over your competition.

CONCEPTUAL FRAMEWORK

INPUT /PROBLEM	PROCESS/SOLUTION	RESULT /OUTCOME
<p><u>POOR HANDLING METHODS</u></p> <ul style="list-style-type: none"> • high rate of damages • time consuming • high cost of labour • risk of health/safety • loss of customers 	<p><u>BETTER SYSTEMS</u></p> <ul style="list-style-type: none"> • modern mechanical methods • staff trainings • provision of safety /health equipments. • insurance services • effective communication 	<p><u>IMPROVEMENTS</u></p> <ul style="list-style-type: none"> • reduced damages • skilled workers • increased safety • increase morale • reduces cost of operation • effective service delivery • retention of customers

Table 2.1 Showing the conceptual framework of material handling systems.

In order to have proper material handling systems, the organization should have to minimize the rate of damages, improve on time consumption, should minimize the cost of labour, and should set aside health and safety measure and also improving customer relationships. Use of modern material will reduce the rate of damages in the work place and reduce the cost of operation. Training of staff through seminars will result in skilled workforce. Introduction of provision of health and safety equipment will result in increased safety and also increase staff morale. Introduction of instant services and effective communication will lead to effective service delivery and retention of customers.

Possible Problems and Challenges related to Material Handling

Systems

Labour Costs

In general, hundreds and thousands of tons of materials are handled daily requiring the use of large amount of manpower while the movement of materials takes place from one processing area to another or from one department to another department of the plant. The forklift operator accounts for 96% of the operating cost over the vehicle life. Whereas, with an automated tugger solution replacing manned forklift travel, the vehicle can operate for approximately \$3 per hour, 24/7. Moreover, high turnover rates result in expensive training regimen as operators come and go. The cost of material handling contributes significantly to the total cost of manufacturing. The cost of material handling contributes significantly to the total cost of manufacturing.

In the modern era of competition, this has acquired greater importance due to growing need for reducing the manufacturing cost. The importance of material handling function is greater in those industries where the ratio of handling cost to the processing cost is large. Today, material handling is rightly considered as one of the most potentially lucrative areas for reduction of costs. Almost every item of physical commerce is transported on a conveyor or lift truck or other type of material handling equipment in manufacturing plants, warehouses, and detail stores. These operators use material handling equipment to transport various goods in a variety of industrial settings including moving construction materials around building sites or moving goods onto ships. There is a shortfall of skilled labour to perform manual material handling. Companies are facing the challenge of solving truck driver shortage. High labour wages (in part due to low availability of labour) and medical costs add to skyrocketing costs of labour.

Material Management

When manufacturers don't have full visibility to their inventory, they face the problems of either running out of stock at the wrong time or carrying too much stock and thus decreasing cash flow while increasing expenses to warehouse extra materials. Inventory shortage can lead to unfulfilled orders and unhappy customers. Figuring out where to store inventory to meet demand quickly — while staying within profitability margins —

is a growing challenge as the retail marketplace struggles to balance online and in-store sales channels. Today, 50% of manufacturing expenses are tied up in materials, reinforcing the critical nature of efficient materials movement and management.

Productivity

Lower unemployment rate coupled with ever-higher hourly compensation makes it difficult for materials handling executives to retain best workers. Variable labour is a cause of concern in manufacturing as well as distribution facilities, which operate on extremely thin margins. 25% annual personnel turnover in warehousing and distribution has a negative impact on productivity.

Safety

Forklifts cause about 85 fatal accidents per year; 34,900 accidents result in serious injury; and 61,800 are classified as non-serious. Fatal forklift accident causes and where they occur: Implementing a forklift safety program and effective training can prevent many of these accidents. Training can also prevent or reduce the severity of an accident related to the stability of a lift truck traveling with an elevated load.

Downtime

Downtime due to equipment damage can have devastating result. There are numerous costs associated with downtime. These not only include upfront and visible costs, but also hidden costs, such as overtime, loss of revenue, emergency service calls. Machinery that continuously breaks down has an extremely negative impact on the business. New survey of auto industry manufacturing executives shows stopped production costs an average \$22,000 per minute. Manufacturers say they need better machine maintenance. While one minute of stopped production, or downtime, costs an average of \$22,000, some survey respondents cite the figure to be as high as \$50,000 per minute. With such high costs at stake, keeping production machinery operating smoothly is critical to a factory's bottom line.

Ensuring that all the machines are regularly serviced is an effective tool in preventing downtime. For most manufacturers down time is the single largest source of lost production time. It can be triggered due to material issues, a shortage of operators, or unscheduled maintenance.

Problems/Challenges

Delivery Precision

- by eliminating unnecessary movements of products within the facility, products can be delivered at the right time, at the right place and in the right sequence.
- Insufficient material handling would cause production delays and increase production times.

Inventory Levels

- Holding the right amount of material both in manufacturing and distribution
- Just-in-time inventory management
- Decreased work-in-progress material

Operation Costs

- To ensure possibly lowest operation costs the system should be designed in a way that it can enhance revenue rather than be a cost contributor

Delivery Quality

- quality on the shop floor can be achieved by receiving right material, in right condition, and with right methods

Information Flow

- providing proper material and information flow
- accurate material identification systems
- real time information

Safety

- minimize employee injury
- Protect products from getting damaged or being contaminated

FACTORS TO ELIMINATE MATERIAL HANDLING PROBLEMS

The nine factors that are essential to be fulfilled in order to eliminate material handling problems from shop floor: -

Right Amount

The concept of just-in-time inventory management emphasizes the importance of holding the right amount of material both in manufacturing and distribution.

Right Material

An accurate identification system is necessary in order to pick and deliver the right material to the lines.

Right Condition

The quality of the delivered material should fulfil the desired expectations without damages/defects.

Right Sequence

The impact of the sequence of activities performed in a material handling operation is very evident. Therefore, it is important to move, store, protect, and control materials in the right sequence.

Right Orientation

Physical orientation of materials represents a significant portion of people's activities both in manufacturing and distribution. Therefore, regaining the orientation of material will save valuable time.

Right Place

The necessary material should be delivered at the point of use which can save undesired movements.

Right Time

The need for the material handling system to move, store, protect, and control materials at the right time is increasingly important due to time-based competition.

Right Cost

Right cost does not necessarily mean that a firm should decrease the cost of MHS. On the contrary, the system should be designed with competitive advantages, so it can be a revenue enhancer rather than a cost contributor.

Right Methods

To perform all the mentioned points above in a right way, it is necessary to use the right methods. A well-designed MHS production could encounter delays, production time and

cost could increase owing to unnecessary movement of products within the facility, and also products could get damaged or contaminated. On the other hand, a well-designed MHS would improve manufacturing and logistics operations, enhance delivery performance and quality on the shop floor, and also reduce work-in-progress inventories.

EFFECTIVE MATERIAL HANDLING PROCESSES

The organization devoted to improving the material handling industry through education and research, material handling uses a variety of automated, semi-automated and manual equipment and systems to support the supply chain. The right material handling processes enhance logistics and efficiency. In addition, good material handling processes can improve customer service, reduce inventory, lower costs and shorten delivery lead times. Poor material handling processes add cost and reduce throughput, while good processes and equipment help with almost every aspect of the business.

10-step approach can help you develop effective material handling processes

1. Plan

Use a team approach to design the material handling system, taking into account the organization's objectives.

2. Standardize

Be consistent in your choice of storage equipment, including bins, shelves and racks, as well as equipment used to transport materials. Also, be consistent in your processes to minimize confusion and errors.

3. Simplify

Reduce, combine or eliminate as much movement as possible. For example, move finished goods directly to the shipping dock rather than through the warehouse.

4. Consider Ergonomics

Design your processes to eliminate repetitive motion, reduce manual labour and adhere to safety standards.

5. Unitize

Wherever possible, move full pallets or containers to improve efficiency and reduce effort.

6. Organize

Working in an organized space is more efficient than working around clutter. Many of the 5-S principles from lean manufacturing relate to the need for a clean, organized workspace. This applies as much to material handling as it does to manufacturing. It also means effectively using space, including overhead space.

7. Systematize

Coordinate material handling across the entire enterprise. Consider all material movement when you plan and systematize.

8. Go Green

Reuse and recycle equipment to reduce the environmental impact of your material handling. Reusable packing, returnable containers and recycling packing materials can all contribute to more effective operations.

9. Automate

Employ automation wherever possible. Think of automated picking and put-away technologies. Invest in conveyor systems. Automation boosts efficiency, consistency and responsiveness while increasing accuracy.

10. Evaluate Life-cycle Costs

When considering investing in material handling equipment, don't simply look at the initial capital outlay. Account for the cost of consumables, training, installation, setup, maintenance and repair.

Sometimes a material handling solution that appears less expensive upfront will actually result in higher costs overall. In addition to costs, evaluate the improvements in efficiency and productivity.

EVALUATION OF MATERIAL HANDLING SYSTEM

The effectiveness of the material handling system can be measured in terms of the ratio of the time spent in the handling to the total time spent in production.

The cost factors include investment cost, labour cost, and anticipated service hours per year, utilization, and unit load carrying ability, loading and unloading characteristics, operating costs and the size requirements are the factors for evolution of material handling equipment. Other factors to be considered are source of power, conditions where the equipment has to operate and such other technical aspects. Therefore, choices of equipments in organisation will improve the material handling system through work study techniques. They usually result in improving the ratio of operating time to loading time through palletizing, avoiding duplicative movements, etc. Obsolete handling systems can be replaced with more efficient equipments.

MATERIAL HANDLING EQUIPMENTS

Broadly material handling equipment's can be classified into two categories, namely:

- A. Fixed path equipments**
- B. Variable path equipments**

Fixed path equipments which move in a fixed path. Conveyors, monorail devices, chutes and pulley drive equipments belong to this category. A slight variation in this category is provided by the overhead crane, which though restricted, can move materials in any manner within a restricted area by virtue of its design.

Overhead cranes have a very good range in terms of hauling tonnage and are used for handling bulky raw materials, stacking and at times palletizing.

Variable path equipments have no restrictions in the direction of movement although their size is a factor to be given due consideration trucks, forklifts mobile cranes and industrial tractors belong to this category.

Forklifts are available in many ranges; they are manoeuvrable and various attachments are provided to increase their versatility.

Material Handling Equipments may be classified in five major categories.

1. CONVEYORS

Conveyors are useful for moving material between two fixed workstations, either continuously or intermittently. They are mainly used for continuous or mass production operations—indeed, they are suitable for most operations where the flow is more or less steady. Conveyors may be of various types, with rollers, wheels or belts to help move the material along: these may be power-driven or may roll freely. The decision to provide conveyors must be taken with care, since they are usually costly to install; moreover, they are less flexible and, where two or more converge, it is necessary to coordinate the speeds at which the two conveyors move.

2. INDUSTRIAL TRUCKS

Industrial trucks are more flexible in use than conveyors since they can move between various points and are not permanently fixed in one place. They are, therefore, most suitable for intermittent production and for handling various sizes and shapes of material. There are many types of truck petrol-driven, electric, hand-powered, and so on. Their greatest advantage lies in the wide range of attachments available; these increase the trucks ability to handle various types and shapes of material.

3. CRANES AND HOISTS

The major advantage of cranes and hoists is that they can move heavy materials through overhead space. However, they can usually serve only a limited area. Here again, there are several types of cranes and hoist, and within each type there are various loading capacities. Cranes and hoists may be used both for intermittent and for continuous production.

4. CONTAINERS

These are either ‘dead’ containers (e.g., Cartons, barrels, skids, pallets) which hold the material to be transported but do not move themselves, or ‘live’ containers (e.g., wagons, wheelbarrows or computer self-driven containers). Handling equipments of this kind can both contain and move the material, and is usually operated manually.

5. ROBOTS

Many types of robots exist. They vary in size, and in function and manoeuvrability. While many robots are used for handling and transporting material, others are used to perform operations such as welding or spray painting. An advantage of robots is that they can perform in a hostile environment such as unhealthy conditions or carry-on arduous tasks such as the repetitive movement of heavy materials. The choice of material-handling equipment among the various possibilities that exist is not easy. In several cases the same material may be handled by various types of equipments, and the great diversity of equipment and attachments available does not make the problem any easier. In several cases, however, the nature of the material to be handled narrows the choice.

GUIDELINES FOR EFFECTIVE UTILISATION OF MATERIAL HANDLING EQUIPMENTS

1. Standardise the handling equipments to the extent possible as it means interchangeable usage, better utilisation of handling equipments, and lesser spares holding.
2. Install a regular preventive maintenance programme for material handling equipments so that downtime is minimum.
3. A very important aspect in the design of a material handling system is the safety aspect. The system designed should be simple and safe to operate.
4. Non-productive operations in handling, such as slinging, loading, etc., should be kept at a minimum through appropriate design of handling equipment.
5. Sequence the operations in logical manner so that handling is unidirectional and smooth.
6. Weight of unit load must be maximum so that each 'handling trip' is productive.

SELECTION OF MATERIAL HANDLING EQUIPMENTS

Selection of Material Handling equipment is an important decision as it affects both cost and efficiency of handling system.

The following factors are to be taken into account while selecting material handling equipment.

1. Properties of the Material

Whether it is solid, liquid or gas, and in what size, shape and weight it is to be moved, are important considerations and can already lead to a preliminary elimination from the range of available equipment under review. Similarly, if a material is fragile, corrosive or toxic this will imply that certain handling methods and containers will be preferable to others.

2. Layout and characteristics of the building

Another restricting factor is the availability of space for handling. Low-level ceiling may preclude the use of hoists or cranes, and the presence of supporting columns in awkward places can limit the size of the material-handling equipment. If the building is multi-storeyed, chutes or ramps for industrial trucks may be used. Layout itself will indicate the type of production operation (continuous, intermittent, fixed position or group) and can indicate some items of equipment that will be more suitable than others. Floor capacity also helps in selecting the best material handling equipment.

3. Production flow

If the flow is fairly constant between two fixed positions that are not likely to change, fixed equipment such as conveyors or chutes can be successfully used. If, on the other hand, the flow is not constant and the direction changes occasionally from one point to another because several products are being produced simultaneously, moving equipment such as trucks would be preferable.

4. Cost considerations

This is one of the most important considerations. The above factors can help to narrow the range of suitable equipment, while costing can help in taking a final decision. Several cost elements need to be taken into consideration when comparisons are made between various items of equipment that are all capable of handling the same load. Initial investment and operating and maintenance costs are the major cost to be considered. By calculating and comparing the total cost for each of the items of equipment under consideration, a more rational decision can be reached on the most appropriate choice.

5. Nature of operations Selection of equipment also depends on nature of operations like whether handling is temporary, floor space, floor conditions and structural strength.

6. Engineering factors

Selection of equipment also depends on engineering factors like door and ceiling dimensions in selecting material handling equipments.

7. Equipment reliability

Reliability of the equipment and supplier reputation and the after-sale service also plays an important role, whether the flow is continuous or intermittent and material flow pattern-vertical or horizontal.

REVIEW OF LITERATURE

Henry Fayol (1912) It is a system of auxiliary equipment that improves flow of material which intern reduces stoppage in production machines and thus increases productivity of machine. These equipments are designed in order to supplement the production machines.

J.J Hyani, (1972) defines material handling as a total approach to the movement of raw materials and finished products, the systematic physical movement of goods with in those conceptual frame work.

Jessop and Morison (1994) define material handling as having been defined in many ways but the activity is rather neatly summarized by British standard institution as the techniques employed to more transport, store or distribute material with or without the aid of mechanical appliances.

Magad and Amos (1995) states that Material Handling System is the art and science of moving, storing, protecting and controlling material.

Tompkins et al. (1996) emphasize the importance of understanding the requirements of a Material Handling System before coming up with different solutions to improve it. To be able to find out what can be the potential problems or which factors can cause inefficiency in an internal MHS, it is essential to know how a well-functioning internal MHS operates and what sorts of internal and external factors can have an impact on the system.

J.R. Bright (1996) Materials handling may be defined as the art and science of movement, handling and storage of materials during different stages of manufacturing considered as material flow into, through and away from the plant. It is in fact, the technique of getting the right goods safely, to the right place, at the right time and at the right cost.

P. Tesha (2000) Material handling has been defined as the art and science involving the moving, packaging and storing of substances in any form. Thus, there are elements such as motion, time, place, quantity and space which need be considered.

J.R. Bright (2000) Material Handling is the act of creating Time and Place utility, as distinct from Manufacturing, which creates form utility. The proper application of

Material Handling knowledge will result in the smooth integration of all the process in an enterprise into one efficient Production Machine.

Groover (2001) highlights that despite its importance, materials handling is a topic that frequently is treated superficially by the companies.

Asef-Vaziri & Laporte (2005) states an important proportion of manufacturing expenses can be attributed to material handling and the most critical material handling decisions in this area are the arrangement and design of material flow patterns.

Dr. Aized (2007) Material handling can be defined as an integrated system involving such activities as moving, handling, storing and controlling of materials by means of gravity, manual effort or power activated machinery. Moving materials utilize time and space. Any movement of materials requires that the size, shape, weight and condition of the material, as well as the path and frequency of the move be analysed.

Mattsson (2012) defines in-plant Material Handling System as a system that has material and immaterial exchanges inside a factory where different departments and features are involved and working together to create value for the end-users. He points out that despite suppliers and customers are not involved in an in-house MHS, they do belong to the system's environment and can have huge impacts on its effectiveness.

CHAPTER- III
RESEARCH METHODOLOGY

Title of the study

A study on “Role of Material Handling in Logistics Industry”.

Introduction

Materials handling refers to an efficient short-distance movement that usually takes place within the confines of a building such as a plant or a warehouse and between a building and transportation agency.

The business logistics speaks of “having the right item in the right quantity at the right time at the right place for the right price in the right condition to the right customer”. Business logistics incorporates all industry sectors and aims to manage the fruition of project life cycles, supply chains, and resultant efficiencies.

The basic function of material handling and storage system includes inventory control, bill of material processing and elementary scheduling. Material handling helps organizations to maintain low inventory levels. It is used to plan manufacturing, purchasing and delivering activities. Companies need to control the types and quantities of materials they purchase, plan which products are to be produced and in what quantities and ensure that they are able to meet current and future customer demand, all at the lowest possible cost. Making a bad decision in any of these areas will make the company lose money.

Statement of the problem

Material handling, is an indispensable element in most production and distribution systems. Yet, while it is generally considered to add nothing to the value of the materials and products that flow through the system, it does add to their cost. Therefore, it is essential that material handling systems be designed and operated as efficiently and cost-effectively as possible. Hence, the need to examine the role of material handling in logistics industry.

Scope of the study

The study will look critically and brings light to the role of material handling in logistics industry. It provides an understanding of the concept, so as to generate information that companies could face the challenges ahead. The study will therefore be beneficial in area of material handling systems.

Objectives of the study

General objectives:

To study the role of material handling in logistics industry.

Specific objectives:

- To explain the significance of material handling.
- To identify the various challenges of material handling in LSCM.
- To identify the ways to overcome the material handling challenges in LSCM.

Research design

Descriptive research is used to describe characteristics of a phenomenon being studied. This research design is descriptive in nature.

Data collection

Secondary method of data collection is used. Second hand information is collected from:

- Journals
- Articles
- Research reports
- Case studies
- Website etc

Limitation of the study

- Lack of relevant and up to date material
- Inaccessibility of information

CHAPTER- IV
DATA ANALYSIS

Interpretations

The data which were collected through the research study process are here in organized, processed and analysed for easy understanding and interpretation in order to make conclusions and suggestions from specific findings of research.

➤ **Material Handling Systems used**

The most of the materials are handled manually in the organizations by the use of the forklifts as the commonly used equipment, followed by manual method and there is also other material handling equipment used such as cranes, pallet trucks and conveyors etc.

➤ **The role of material handling systems**

The state the contribution of material handling systems on enhancing the attainment of supplier's efficiency in an organization. The role of material handling systems includes the loading of goods on trucks, the offloading of materials from trucks, facilitation of activities in the garage, store's function, and movement of materials within, out of and into the warehouse are among the main areas of application.

➤ **The merits of using modern material handling systems**

The advantages of using the modern materials handling systems in a transport industry.

- Time saving
- Save material damage
- Labour saving
- Less fatigue
- Increased safety
- Reduced handling costs
- Saving space

➤ **Significance of materials handling system**

Materials Handling System eliminate redundant work, eliminate accidents, reduce stress and effort, and also minimize time spent on distribution, storage, etc. In the Production Function Mechanism, the concepts are directly related to a production analysis focus. A process analysis consists of an observation of the production flows that turn raw

materials into final products. When making this distinction, it is possible to perceive the relevance of materials handling.

➤ **Challenges that face the manufacturing organization in reduction of materials handling costs**

Materials handling cause unnecessary costs. When a forklift leaves its workplace to transport a container between pavilions, delays in machines setups are generated, causing unnecessary costs and stress on the forklift operator. All workers are exposed to the risk of carrying or moving heavy loads for at least a quarter of their working time.

Suggestions on the suitable materials handling systems

On how the system would be improved, on what they perceive as the most suitable and necessary material handling methods appropriate for the organization.

- Introduce mechanical system
- Staff training on the system
- Proper health and safety equipment
- Regular maintenance equipment
- Create enough space for movement
- Insurance for staff
- Avoid manual handling

✓ **The safety factors**

Safety is of paramount importance in material handling because it involves moving equipment in a plant or a warehouse. To avoid accidents, technical, infrastructural and organisational measures must be effectively interlocked.

✓ **Automation and skill upgradation**

Machines operate optimally if they have a skilled operator manning them. Therefore, it is essential to impart proper operator training to use the equipment to its full potential. Without the right skill sets, using the machines to the optimum level becomes difficult.

When it comes to utilising automation technology for material handling, automation for the sake of automation does not work. There needs to be a use case that justifies the costs for the derived benefits. The primary skill upgradation is required.

✓ **The role of digitalisation**

Digitalisation and IoT (Internet of Things) are touching every facet of manufacturing and operational activity, helping companies ensure smooth functioning of operations. Forklifts are already doing quite a bit of the data collection. They are prepared with wireless connectivity and sensors that permit them to gather information from their own internal systems as well as from their environment, and then transmit this data to management systems.

CHAPTER - V
FINDINGS, SUGGESTIONS
& CONCLUSION

FINDINGS

1. From the above analysis, it is found that the workers might recommend the change of handling materials from the manual method to modern mechanical material handling systems which would increase the efficiency and satisfactory service delivery to its customer with high rate of return and at a reduced risk of injuries.
2. It is observed that introduction of automation in material handling machinery can boost the market growth.
3. It is being noticed that automation aids in reducing costs and delivering high-quality products. It eliminates the need for manpower to check-in, sort goods, or to move bins and totes containing materials.
4. It seems to be that Lithium-ion technology is another trend in the material handling industry, more efficient, fast charging, and being environment-friendly and accomplish the same level of control of operations using electrical drives.
5. It is found that development in storage facilities can assist in material handling and to increase the speed utilization in the warehouse.
6. It is noticed that a good layout will results in easy retrieval of materials when needed, ease in movement of both staff and handling equipment through provision of spacious gangways.
7. It is evident that mechanical handling can lift and transport sizable load more quickly than it is possible with manual laborers and thereby saves time.

SUGGESTIONS

- Every organization is required to provide training programs (off-the job training programs) to the employees on the materials handling applications frequently and thereby can be properly used in the production activities.
- Using of modern skills on handling materials mechanically can improve the health and safety positions.
- The company is required either to out-source or build international units for regular maintenance of their material handling equipment's including machines, tools, lorries and trucks for transporting goods.
- Professional engineers and maintainers should be used for the maintenance of materials handling system.

CONCLUSION

The research aimed at determining the importance of material handling in logistics industry. Materials handling are lifeblood of any industry as it can increase the efficiency and effectiveness of the manufacturing organization since, it has many significant contributions which is finally result the reduction of production costs. By using materials handling, the organization can save the time, reduce the number of labours, save the space, improving working condition etc. Not only materials handling increases the efficiency and effectiveness that result the reduction of costs in the production process but also have the great impact toward the improvement of industries in the country which leads the government to increase its income from those industries that influence the economic development. In order to achieve efficiency in store functions for effective performance, there must be in place good and modern techniques especially mechanical handling systems in the ware house for orderly stores layout which conforms to current technological advancements. The core element in an effective and efficient Material Handling System was pointed out as real-time information sharing. The latter fact enables companies to rapidly react to different requests and changes and thereby, to obtain increased delivery performance and decreased buffer levels. Another vital element in developing a new MHS was pointed out as interaction between the new system and its surroundings, particularly, the interaction between the system and people, who are utilizing and operating it. Thus, companies should focus on and implement a MHS that is cost effective and is able to function at the present time without any obstacle and failure.

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