

Warehouse decisions, storage systems, material handling equipment and packaging strategies used in context with supply chain digitalization & design

Anuj Modgil

Research Scholar

Doctoral Research Center

Chitkara University, Chandigarh, India

anujmodgil@gmail.com

Dr Sumit Sakhuja

Professor

Chitkara Business School

Chitkara University, Chandigarh, India

sumit.sakhuja@chitkara.edu.in

Abstract—

Of any business infrastructure, a warehouse is the most important part and one of the key initiators for the success of business. Warehousing strategies face various challenges due to dynamic exposure of digitization. This has led to an extremely high rise in demand and expectation of the customers with respect to their service quality. To remain compatible in the market for any company in today's scenario, the organization needs to achieve their supply and delivery capabilities. Transparency is the most important factor which decide by the customers. Due to these reasons logistic sector has become more important for any business and overall economy, as its scope and challenges are increasing with time. Growth in digitization must two extremes. This will provide new areas of growth and opportunities for the business to expand the market, on the other hand it will completely vanish traditional processes from the market. India is still in developing stage. A large part of the country is still in need of development, does giving number of Unity for construction of a logistics network which will help in in meeting the growing demand of the customers. Development in digitization and automation is greatly influencing the logistics and transportation processes which are expected to result in cost reduction and improvement and environmental and social conditions. Operations of warehouse is a labor-intensive process and constituted of various manual operating processes.

Keywords— *Warehouse decisions, storage systems, material handling equipment, packaging strategies, supply chain digitalization, warehouse design.* (Keywords)

I. INTRODUCTION

A. *Driving forces of digitalization*

Globalisation has lead the companies or organisations to spread their roots in the global market along with local market. One of the major reason to this is presence of various kind of limitations in domestic market.

With increase in globalization of companies, they have a need for logistics partners which can help them to adapt to the growing pace of global market. A good logistic partner will also help in improving the benefits from tariffs, rules and new trade zone standards. Now companies don't go for opting multiple logistics partners, instead they look for few trusted and well-established logistic partners on which they can rely on. Companies are also looking for logistics partners which are experts in local services so that it can handle all the local as well as upcountry logistics.

Globalization is an integral part of success in any sector for today's market. Establishment of more and more manufacturing companies is occurring which will require development of logistics sector to improve the customer service level. This will include anticipation of dynamic market and upgradation in the field of IT technologies. In order to sustain and grow in the market, logistics companies have to be updated and efficient in working according to the dynamic market scenarios and adapting the changes.

II. REVIEW OF WAREHOUSE RACKING SYSTEMS

To improve efficiency of a warehouse, the kind of storage racking system adopted by the warehouse very important. Everywhere house in today's scenario is facing a problem of shortage of Storage Area. These challenges can be faced or reduced by adopting proper tracking system according to the categorisation of products to be kept in the warehouse. By adopting the proper tracking system an efficient use of space can be done and standardized process of FIFO could be achieved.

There are various types of racking systems such as:

A. *Flow Racks*

These are also known as gravity racks. The product is loaded from the stocking side and can be unloaded from the picking side. In this type of storage and retrieval system it becomes easier to follow first in first out procedure. This kind of stacking system makes sure that the oldest product is present in the first picking side. The carton decide the first cotton is supported by some kind of Herbs to prevent them from falling.

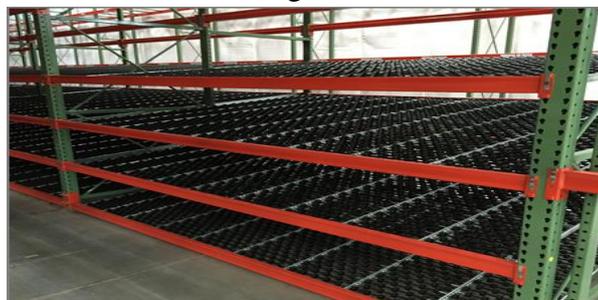


Figure 1 – Flow Rack

B. Adjustable pallet racking system

This is the mostly used kind of racking system which gives access to every pallet to be moved. The most preferred design of adjustable pallet racking system includes a deep row in a single column adjusted according to the product height in adjacent to another same kind of row. Like this, multiple rows can be made which will give access to both the rows and need of only one aisle instead of having two aisles.



Figure 2 – Adjustable racking system

C. Powered mobile racking

These racks are like the adjustable racking system having an electronic base. In this type of system, the racks are connected to an electric sources and can be moved as per requirement. This helps in reducing the aisle space or the air space in the warehouse giving full space utilization.



Figure 3 – Powered mobile racking

D. Drive in - Drive through racks

These are the racks like that of the block racking system. It involves storage of only one product line in each row. Here the product selected should be of a high stock product type. This system of racking should be adopted for the variety of products in which first in first out concept is not very necessary to be followed. For The drive-in drive through racking system the pallet loads should be enough to carry the superimposed weight of the product. (Jitendra S. Patil, 2016)

Within increase in automation of warehouse operations, now there are evolving material handling equipment that can be controlled and operated through different software's. Sum of material handling equipment's which are trending in today's era of digitalization are:

ASRS (Automatic storage and retrieval system) helps in reducing the floor space area and effectively utilising the storage space. The ASRS is linked with a software from which input for

the desired activity is fed either of storing or retrieving any pallet. The location of pallet where it is to be stored or from where it is to be retrieved is commanded in the software. It results best in cutting all the extra storage required for manual handling of stocks in the warehouse.



Figure 4 – Drive In – Drive through racking system

III. REVIEW OF PACKAGING STRATEGIES

Packaging plays a very important part in the logistics process while shifting products from one place to another and storing the products. Packaging machine is used in the warehouses to pack the various products in the warehouse. This machine performs a series of steps which includes feeding the cartons with required product, sealing the carton, strapping, and wrapping of the package followed by labelling of the packed product. Steps of packaging are: (Santarelli, 2013)

- Cartons are fed with products
- Cartons are transferred to sealer
- Complete sealing of cartons by the machines is done
- Polypropylene is then used to wrap and strap cartons
- Palletization and labelling of cartons with coding is done

Due to various trends emerging in the market, warehousing operations are also going through continuous changes in their adopted tools and techniques. The areas where warehousing operations are impacted greatly are because of: (Hill, 2017)

- Continuous increase in amount of data
- Automatic guided vehicles and equipment
- Devices that are Mobile
- IoT
- Cloud system
- Real time tracking of processes
- Increase in demand and expectation of customers
- Requirement of automation in every phase
- Authors and Affiliations

IV. REVIEW OF PERFORMANCE FACTORS IN VARIOUS TRANSPORTATION MODES ADOPTED BY LOGISTIC CARRIERS.

Transportation is the field in which maximum cost is incurred in the logistics and supply chain process. To keep a proper track and minimizing the incurred cost during transportation of products via different kind of transportation mode some factors should be kept in mind. These factors are calculated, and they give an idea of performance efficiency of the transportation system. Some of these key performance indicators of transportation sector in terms of logistics sector are: (Anon., 2017)

- **Per unit cost of freight:** This factor is used to analyse the cost of per unit transportation of the product. It can be calculated by dividing the total number of units shipped by that of the total cost of freight transportation. It is useful only in the situation when either the weight or the products are identical or same. The ideal condition or value differentiates in different mode of transportation.
- **Capacity utilization (in percentage):** This factor indicates the efficiency of the transportation as per the average capacity of the mode being used. It is calculated by dividing the weight of freight by maximum ideal capacity carried by the respective mode of transport. Greater capacity utilization will result in increase in profit and reducing the extra cost incurred during transportation.
- **Cost of outbound transportation (in percentage):** This factor is used to measure the financial performance based on sale of products in a particular time. It can be calculated by dividing total cost of freight by total sales revenue incurred during given period.
- **Cost of inbound freight:** This factor is used to compare the products which are purchase by same freight type that is either paid fully by the company or by the supplier. It can be calculated by dividing total cost of freight occurred by total amount of goods purchased during a particular period.
- **Transit time:** Enter refers to the number of days in which product remains in transportation process. It can be calculated by counting the number of days from the time freight is leaves the company until it reaches to the customer. It is calculated so that a comparison can be done from a different company which provides transportation for same kind of product. The transit time varies based on the mode of transportation selected.
- **On-time pickups:** This factor indicates the performance of a carrier service company, hence deflecting performance of the company. It is calculated by dividing total number of vehicles by number of loads transported in each of time.
- **Turnaround time:** This factor is inversely proportional to the time taken by the vehicle during transit. If turnaround time is hi, it indicates that there is a need of improvement in loading unloading and handling of the product. It is calculated by measuring the time from which vehicle comes to the dock to the time it is being loaded and leaves the dock area.

There are various factors which indicates the performance of a logistic service provider based on their transportation mode selected. These indicators include:

- **Effectiveness:** This is measured by analysing the revenue generation, incurred profit, utilisation of capacity, total productivity, east profession in process of packaging, storing and transportation.

- Efficiency: Receptor is based on minimum distribution cost, high level utilisation, minimum expenses, minimum absenteeism in employees and minimum cost incurred in various other areas of transportation. If These areas of a company are achieved, then it is said to be efficient.
- Satisfaction: When orders are delivered on time, drivers and employees feel motivated to work, least or no complaints from customer and fulfilment of customer expectation is achieved then the company can satisfy the demand of customer.

V. CONCLUSION

Associations of today are battling to manage the digitalization of the business biological system as still a large portion of them are dependent on information sources that are obsolete. Top to bottom examination is expected for associations to see how in an advanced world they can utilize and carry out cloud-based computerized arrangements alongside logical apparatuses which can accomplish tasks arranging capacity that would be exemption based. Having such kind of ability can assist associations with testing situations progressively before the real plans are gotten rolling. In this way, utilizing digital innovations can assist with guaranteeing that reality based, and continuous, prescriptive, and prescient independent direction can be executed.

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