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Operational and Technical issues in Warehouse Optimization Process

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ABSTRACT

Ware house Optimization process are based on modern warehousing and multi-optimization models. Modern warehousing become more typical and complex to handle and this paper highlight the role of operational and technical solutions in the development of today warehousing projects Warehousing optimization studies can be undertaken on the basis of its technical structure and operational framework or its controlling system. Present paper reveals the hurdles and complexities of modern warehousing optimization and also focus on remedies to overcome the constraints in optimization of warehouse. Warehouse management encompasses the planning and management of all activities involved in handling, storage and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. The optimal operation of a warehouse is achieved when each customer is satisfied completely and logistic processes are done within a reasonable timeframe with minimum cost and optimal utilization of resources under dynamically changing conditions. This paper also reveal that the effective use of space within the boundary of warehouse provide the basic platform to solve the problems coming across in the warehouse management. The stability of using steel storage racks depend upon solely on the pallet beam to upright connectors and on the stiffness of base plate to floor connection.

Introduction

In the storage racks, portal beams are typically connected to upright by “tab connectors” which are costly to manufacturer and experiencing initially looseness. By simply bolting the portal beams to upright, bolted movement connectors may represent a cost effective alternative to tab connector .Present paper also describe the best use of existing facilities in warehouse management in delivery of the good in congested place of minor port projects in India. Most of the scientific papers do not take into account the real conditions as the blocking and congestion problems persist in day-today operation of warehouse. Though efficient manpower and use of modern crane and logistic support and multiple block warehouses provide some solutions in warehouse operation but the real world conditions and theoretical aspects differ in application.

The idea of how to apply this optimization is to apply the shop scheduling techniques combined with Vehicle Routing Problems solving techniques. The shop scheduling techniques can be employed when the work is scheduled in the warehouse, even when the work must be scheduled dynamically. Warehouse management should focus on consolidation, checking, packing, shipping and cross-docking.

A warehouse is a commercial building for storage of goods and they are used by manufacturers, importers, exporters, wholesalers, transport businesses customs etc.

They are usually large plain building in industrial areas of cities and towns and villages. They usually have loading docks to load and unload goods from trucks. Sometimes warehouse are designed for the loading and unloading for goods directly from railways, airports, or seaports. They often have cranes and forklifts for moving goods which are usually placed on ISO standard pallets loaded into pallet racks. Stored goods can include any raw materials, packing materials, spare parts, components, or finished goods associated with agriculture, manufacturing and production. Warehouse management is one of the important aspects of 3rd logistics companies where companies are storing their stock in large warehouses in proper manner.

Warehouse Optimization problems are those problems which arise due to its faulty design structure, its sizing and proper space allocation and its dimensions. Ware house structure determines the material flow pattern within the warehouse, the specification of functional departments and the flow relationships between departments .Department layout is the detailed configuration within a warehouse department, for example, aisle configuration in the retrieval area, pallet block- stacking pattern in the reserve storage area and configuration of an automated storage/Retrieval System. Warehouse management come across many problems in equipment selection and for that they determine an appropriate automation level for the warehouse and identify equipment types for storage, transportation. order packing and sorting.

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The selection of the operation strategy determines how the warehouse will be operated for example, with regards to storage and order packing. Operation strategies refer to those decisions about operations that have global effects on other design decisions and therefore need to be considered in the design phase. Some detailed operational policies such as how to batch and route the order picking tour are not considered as design problems.

Warehouse operation fail when workers move goods without work orders or when a storage position is left unregistered in the system. Material direction and tracking in a warehouse can be coordinated by a Warehouse Management System (WMS), a database driven computer Program which is exclusively used by Logistics personnel to improve warehouse efficiency by directing pathways and to maintain accurate inventory by recording warehouse transactions.

Warehouse Optimization Literature Overviews

Literature study reveals that in 1971, 1982 and 1983, Miebach , Matson and White and Ginnis et al. reviewed the operations research and material handling literature. They concluded that there is a gap in the research fields and most of the research normally concentrates on limited problems. In 1992, Goedschalckx created some related research works with an extensive list of publications. In 1996, Van den Berg , surveyed the literature on planning and organization of warehouse systems.

Optimization on Design Based Methods

Ashayeri and Geldel's review the literature concerning warehouse design and concluded that a pure analytical approach, as well as an approach that solely uses simulation, will in general not lead to practical general design method.

The outcome of their study was to combine the concept of two approaches which can lead to a good design method. Ashayeri and Goetschalckx, provide a step-wise general design structure procedure.

Duve and Boeker , propose a step-wise design method for warehouse design and provide several examples. Fragile and Hack man provide an empirical study concerning the evaluation method based on zero defect based analysis method. Rup et a. suggest an hierarchical design method and describe the application of their method by all example design. Rink and Waibel et al. describe German Decision support system for warehouse design.

Problems in Design Methods

At strategic level, there are two problems persist in warehouse design, one dealing with the selection of systems and equipment based on technical capabilities, and the second one dealing with the design of process flow and selection of warehouse system based on economic conditions.

There is no publication that specifically concern design problem. A limited number of publication deals with problems in the second cluster. Roll et al. define a systematic procedure for determining the size of a warehouse container. Kesarla and Peter et al. compare the performance of a standard and benchmarking using analytical expressions and simulation. An amazing study has been published by Sharp et al. on a cost basis and several competing storage and retrieval equipment typed for item picking. In conclusion, a number of publications concerning design problems on a strategic level appear to be limited, despite the fact that at this level the most far reaching decisions are made. Most publications analyze the performance of a warehouse in order to be able to compare the system with alternative ones.

Table No 1. Warehouse Design and Operating Problems Gue et al.2007.

	Design and Operational problems	**Decisions to Be Taken**
Warehouse Design	Overall structure	a) Material flow
		b) Depart identification
		c) Relative location of department
	Sizing and Dimensioning	a) Size of warehouse
		b) Size and dimensions of dept
	Department Layout	a) Pallet block stacking
		b) Pattern for pallet storage
		c) Aisle orientation
		d) Number, length & width of aisle door location
	Equipment Selection	a) Level of automation
		b) Storage equipment selection
		c) Material handling equipment selection(order picking, sorting)
	Operation strategies	a) Storage strategy selection e.g. Random & dedicated order picking method selection
Warehouse Operations	Receiving and shipping	a) Truck dock assignment
		b) Order truck assignment
		c) Truck dispatch scheduling
	Storage	a) Assignment of items to different Warehouse dept
		b) Space allocation
	Zoning	a) Assignment of SKUs to Zones
		b) Assignment of pickers to zones
	Storage Location	a) Storage location assignment
		b) Specification of storage
		c) Classification for class based storage
	Order Batching balancing	a) Batch size assignment
		b) Order batch assignment
Dwell Part Selection(AS/RS)	Routing	a) Routing and sequencing of order picking tours
	Sorting	a) Order Lane assignment

Only one publication explicitly analyze multiple competing warehouse systems.

Tactical Related Issues in Warehouse Design

Most of the decisions at tactical level concern the determination of resource dimensions and design of the organization. Berry and Bassan et al. analyze the layout of a conventional warehouse. They provide an optimization model to determine the optimal dimensions of the layout, in order to minimize distance handling time, space utilization or costs. Rosenblatt and Roll et al. present a design procedure comprising both simulation and analytical method in order to determine the size and layout of a conventional warehouse, concentrating on the storage capacity. Pandit and Palekar study the effect of the layout of a conventional warehouse on the response time, using analytical models and simulation.

De Koster proposes a modeling and analysis method for pick to bolt order pick the item that uses analytical expressions to approximate the maximum throughput. Bozer et al. consider end of aisle order picking systems. They model the performance of a storage system that consists of multiple mini-load systems by deriving analytical expressions and develop a design algorithm to determine the optimal configuration. Stadtler, analyze the impact of the size of Chaotic Direct Sorted (CDS) warehouse, proposing a procedure consisting of simulation and enumeration. Apart from storage systems, some publications concern other systems or are more general by means of a simulation study. Bozer and Sharp and Bozer et al. analyze the performance of a sorting system under variation of the number of output lanes, order characteristics, and control policies. Larson et al. develop a procedure for class based storage, related to both the system dimensions and the layout. In conclusion, most of the papers at the tactical level concern the performance of mostly automated, warehousing systems.

Objectives of the Study

The following will be the objectives of the study.

1) To present the conceptual frame work for optimization of warehouse and its problems.
2) To examine the economy in optimization of warehouse in Indian ports and PSUs.
3) To analyze various techniques of warehouse optimization.
4) To identify the successful factors in warehouse optimization process and weed out the complexities of its operation.

Scope of the Study

The scope of the study is confined to optimization of warehouse and its various techniques. The study covers the problems of warehouse operations and suggests the ways to follow some advanced methods in structural designing, storage, distribution and tactical strategies in warehouse operations.

Research Methodology

Collection the Data

Primary Data: The primary data has been collected by observation of warehouse sites located in shipping ports and private and public sector organization.

Secondary Data: The secondary data was collected from the news paper, journals and websites and Kattupalli port ware house in Chennai region.

Limitation of Research Paper

The study present important finding for warehouse optimization, realized costs reduction, geographical constraints and continuous improvement, knowledge based skills, project management skills, global capabilities, skilled logistic professionalism, real time access to information and route and load optimization are the most important factors which are limiting the success of optimization of warehouse operation .

Technical Structure Based Optimization of a Warehouse

The layout design of logistic warehouse is the best technical structure which include whole distribution center, the choice and dimensioning of conveyors and warehouse equipment, the design of the physical interface to neighboring systems and other attributes related to technical structure. The layout design of the warehouse is a key component of further optimization tasks and has a significant impact on ordering-picking and travelling distances in the warehouse.

Study shows that the layout design has more than 60% effect on the travel distance, and three basic types of warehouse layout were presented. The layout is usually of rectangular shape and based on pallet manipulation. A few factors should be taken into consideration in the layout design, such as: the number of blocks, the length, the width and the number of picking aisles if they are present. The number of rack levels and the positions of input and output gates in the warehouse. The ware house layout is also connected with the aisle design. The layout is mostly narrow aisle like, which increase the space utilization with minimum costs, but it can lead to higher operational costs and more congestions among workers.

There are many types of warehouse equipment, especially the equipment which should reduce labor cost and increase its utilization. Common storage models cover pallet racks, cartoon flow racks for high –volume picking and shelving for lower-volume picking. All this equipment is standardized according to the dimensions, but the standardization is mostly only for specific continent. While pallet manipulation is demanded in all types of warehouses, conveyors are not used everywhere. A conveyor divides the warehouse into zones, moves a material through a given path, and also restricts the movement of workers and saves their energy.

Sorting system is installed along with conveyor and is based on scanning technology of Bar-Codes, RFID chips, Magnetic strips or Machine vision. The system works on a few principles e.g. push shorter pushes a passing carton to alternative path from the main conveyor, tilt-tray sorter works on the principle of tilting a tray and the object slides into the collecting bin and others. Cranes are assisting to over material over a variable paths in the restricted area e.g. Jib crane, Bridge crane, Gantry crane and stacker crane. Positioning equipment is normally used to handle material at a single location, e.g. hoists, balancers and other manipulators. The automation in this field generally covers the system such as Carousels, A-frames and Automated Storage and Retrieval System (AS/RS). These AS/RS generally replace the human beings by robotic devices deployment in the operation.

Five ways for Technology Driven to boost Warehouse Productivity

1. Collaboration

Warehouse productivity can be increase by integrating the various technologies and working them together. Real time efficiency and productivity of warehouse is possible by collaborating each resource and proper allocation of task, systematic functioning and taking all inputs into accountable.

2. Receiving

Materials must be received and stored with total accuracy. Your database for inventory must be updated as merchandise is received. Having one person in receiving checking off received materials from a list, then sending the materials for stocking, then sending the list for database updating is not efficient. Inbound processing and the right Enterprise Resource Planning (ERP) software can allow one individual to check in materials and record the inventory in one step. Those materials can then be routed to the correct location in your warehouse.

Just-in-time delivery is a method for keeping excess inventory from building up in your facility. The more material you have just sitting on shelves, the more money you have tied up in that inventory.

3. Inventory Layout

Your layout should be designed according to your unique operations. If certain items are ordered and shipped together, that is how they should be stored. If a numerical system works best, then that is the system to use. If your materials are stored on pallets, have the right system in place for easy pallet access. If you use bins, have the racking system to accommodate them. The better your material organization and access, the less time you lose in preparing orders for shipment.

The critical thing to keep in mind is that workers should not have to make several trips around your entire facility to pick orders for shipment. The more time employees spend while traveling around inside your facility, the more productivity that you are losing.

4. Picking procedures

Picking and packing are another area where otherwise efficient warehouses can quickly fail. If the wrong materials are pulled, someone not only has to retrieve the correct merchandise, but also the wrong items must be returned to where they belong.

When your stock is organized and marked with (for example) SKUs or a different system, your employees will be less likely to pull the wrong materials for shipments. With the right software, you can combine pick lists to complete several orders and then sort the individual items directly in your shipping department.

5. Loading and Shipping

When it comes to loading and shipping, first in is not first out. Trucks must be loaded in the reverse order. The last items placed in the truck will be the first items unloaded.

GPS systems can help you optimize your loading, routing and deliveries. This last step will help you ensure customer satisfaction. You will know where shipments are if customers have questions. Make use of the organization, communication, storage and software solutions available to keep your warehouse operations up to date. These implementations will improve your productivity, reduce errors and improve the bottom line for your facility.

Operational Based Optimization of a Warehouse

Operational optimization of warehouse combines different aspects from many areas like business management, inventory management, Organization management, transportation and logistics management and many other areas of management. Warehouse operations efficiency is key to the success of any company that processes, inventories, and ships orders. When efficiency lags, products may not arrive at customer destinations on time, orders can get lost, and low inventory levels can result in stock outs.

The storage locations are often organized somehow on class based storage, where the goods are clustered according to frequency of orders. This policy assigns the most frequently requested goods to the best location from input/output gates. Another possibility is to use family grouping where the goods are clustered according to relations or similarities.

The routing policies applied in warehouse operation should ensure an optimal travel path through the warehouse for order-picking. One of the first algorithms for optimal order-picking path design was introduced warehouse operation. Since the algorithm can be applied only for conventional warehouses, the problem is mostly solved by heuristic methods.

If the order is small and is far from exceeding the picking capacity, it is possible to pick more orders in a single order picking tour. This is known in the literature as order batching or simply batching. Since this is a job with sub-tasks (a picking tour with several orders) it is considered a NP-hard problem. It was proved in that batching has a significant impact on the performance of order-picking. Therefore, researchers pay attention to the problem of batching and the heuristic methods are still under investigation. It is also possible to divide an order-picking process into zones. Goods belonging to the same product group are stored in the same zone. In comparison with batching, zoning does not have a significant impact on the performance of the order-picking system.. The advantage of zoning lies in reducing the congestion in the aisles and when the goods are really in one small area, the traveling is also reduced. The main disadvantage is the consolidation of order when it is completed by more pickers from different zones. The following are some strategies are followed in ware house optimization:

Minimize the number of touches

Manual operations slow movement through the warehouse can introduce errors. Automate picking, packing, and shipping processes to minimize the number of times humans touch products and orders.

Offload some Warehouse Management System (WMS) processes to a Warehouse Control System (WCS)

WCS solutions help to manage materials handling equipment in real time, which will maximize system throughput and performance, and provide visibility to potential logjams.

Stock materials using logical sequencing that is meaningful for workers

Prevent goods from being misplaced by storing them where workers will intuitively look for them.

Gather real-time operations intelligence on warehousing processes

Ever-changing customer demands dictate the flexibility requirements of existing facilities. To support continual warehouse process improvement, and ensure business goals are being met, gather and analyze real-time data from order fulfillment technology and materials handling equipment. Benchmarking performance and analyzing collected data can facilitate more informed decisions about how to respond to changing customer requirements and business goals.

Upgrade selectively

Don't just implement the latest, greatest module from your Warehouse Management System vendor. The added complexity may slow operations, befuddle staff, and generate unnecessary work.

Gain end-to-end visibility throughout the facility and processes

Eliminating silos in the warehouse—from the loading dock through delivery and transport operations—removes barriers to growth and innovation. In many organizations, supply chain executives and corporate operations plan independently, often negatively impacting corporate goals. Maximize profits and establish competitive advantage with cross-functional organizational plans.

Align warehouse operations with key business goals

Even if facing pressure from customers to implement changes, don't ignore your overall business objectives. Focus on actions that meet strategies.

Implement equipment to automate warehousing processes

Warehouse automation increases throughput, eliminates errors, and heightens shipping, picking, packing, storage, cross-docking, and labor performance.

Establish flexibility and agility in the warehouse

You want to be able to make changes fast when you face competitive pressures. Select a WMS that seamlessly integrates with your ERP and supply chain systems.

Establish key performance indicators

Measure results, and implement changes to improve your business performance.

Conclusion

Warehouse optimization focuses on customer satisfaction. Real world conditions applications in warehouse optimization provide the best outcome and this paper reveals how to apply warehouse optimization by realizing the various combinations of techniques, logistic inputs and proper human resource management.

Operational manager uses various techniques like scheduling, vehicle routing and proper lifting hand pallet truck, fork lift low truck data hand pallet. Employee has to unload a pallet from a lorry, go through the ware house and store it on a shelf. This job is composed of sub operation like tasks. A task is to be known as single operation of job e.g. receiving unloading, put –away, moving and storing etc. These tasks can be done by several workers. So try to spread job in few machines working in sequence in the language of shop scheduling problems.

Transport moving and routing of trucks in ware house could be inspired by automated guided vehicle technique transformed from operation space vehicle routing problems techniques to ware house This way we can reduce the blocking and congestion as well as cost minimization operation.

They save on maintenance and enjoy greater quality and operational efficiencies that allow them to better run their warehouse operations. When warehouse owners, operators or facility managers ask the question on saving the money about warehouse running business they over look on the expenditure of lighting. With today's LED solutions and other advanced lighting technologies, the cost of lighting a warehouse can be cut as much as 80 percent over traditional sources. Savvy warehouse owners are investing in these technologies so they have more capital to finance other parts of the business. And cutting lighting cost is just one of the advantages

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