Next Big Thing: Voice Centric and RFID base Warehouse Management System

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Abstract
Warehouses are those commercial buildings which are used by the manufacturers, exporters and other companies which are providing warehouses solutions and using new technologies in material handling and following ISO standards to maintain the efficiency of the operations of the warehouse.

In this paper, we investigate impact of information technology on the warehouse management system and study focus on the implementation of voice centric and Radio Frequency identification (RFID). Rest of the paper explain the basics of warehouse management system starting from type and nature of warehouses along with study of which type of warehouse management system are available to supporting manufacturing process proactively.

Keywords
RFID, Warehouse management, Information Technology, Voice Centric

I. INTRODUCTION

Economy of any country is the basic foundation of its development and progress. Business is the integral part of the economy for the last thousand years. With the passage of time the businesses have adopted new ways for a further expansion. The companies have developed new infrastructures and they generate new ideas to earn more profit and cause reduction of cost due to the acceptance of modern techniques. Recently the world is facing extraordinary competition in the field of manufacturing and all over in the business environment. To overcome these issues the companies developed strategies to reduce cost and to make the whole process more efficient and effective in the long run. Similarly in the industry of warehousing an amazing use of technology has enabled the business to compete in the current business environment.

Warehouses are the basic function of supply chain management where most of the goods are sorted and packed and some value addition in the products is also done in the warehouses. Warehouses are called the nodes of the supply chain during the replenishment of the stock. Before the revolution in logistics functions manufacturer used to produce with the ‘Push Production concept but in the 21st century with the introduction of just in time technique it has enhanced the working capacity in all the operations of working environment the manufacturers have reverted towards the ‘Pull production Concept’. In Push strategy the manufacturer produces without the prior demand and then puts its products into the market while in pull strategy demand is expressed by the customers and production is done based on the market demand [1]

Just in time is a technique which ensures low cost production and delivery of the goods in an appropriate quantity and with high quality standards at the right place and right time with the efficient utilization of resources. During Inventory management lead time to replenish the stock is uncertain because demand can be higher any moment. Although buffer stock is available to cover this uncertainty yet it is not that efficient to manage the inventory. JIT reduces this uncertain situation and enables the manufacturers or suppliers to manage the inventory according to the demand. In warehouse JIT helps in managing suppliers schedules, managing the orders of the customers and providing the frequent deliveries to the customers [2]

Today the manufacturer are directly approaching the customers and reducing the supply chain by the use of warehouse near the customers like wall mart suppliers have built their warehouses near wall mart to ensure the delivery in time and to consequently reduce the cost of logistics.

A. Types of Warehouses

Warehouses can be classified into the following categories:

1) Field Warehouse

These types of warehouses are normally constructed near to the manufacturing concerns. The geographical location of field warehouses is near to the customers so that the supply of goods can be quicker to the customers. This approach enhances the supply of goods at the right time and becomes the competitive advantage to compete in the market. Field Warehouses are used to store goods for long period and mostly used by the whole sellers and retailers[3].

2) Public Warehouse
Public Warehouses are the warehouses which are used by the genuine customers like retailers, whole sellers. These warehouses can be used on monthly rent basis and have more location flexibility. Moreover there is no requirement of a huge investment in such type of warehousing. The customer can get self storage service in these warehouses. But the issue with these public warehouses is that there is an availability of a limited space as customers are more in number who needs space. But unfortunately opening hour of these warehouses are not much flexible. Public warehouses are mostly owned by the government and the customer’s control is very limited in such warehouses.

3) Private Warehouse

Private Warehouses are those warehouses which are owned by the private owners. These warehouses are built by private owners. In this type of warehousing the total control of the warehouse is given to the customer and the customer can manage according to the requirements. These warehouses are given to the customers for a longer period of time in the form of annual rent or lease hence the customers have to face high fixed cost due to the long time period [4].

4) Contract Warehouse

Contract Warehousing is mostly called 3 PL warehousing. In this type of warehousing those companies which provide warehousing solution devise a contract with their clients. In this way the risk shared between the client, the solution provider and the warehousing is fixed and at a decrease in this type of contract warehousing. The customer can focus on its core competencies and third party can focus on its warehousing [5].

5) Centralized Warehouse

The warehouse which provides centralized services to one customer regarding warehousing is known as Centralized Warehouse. The entire functions of the warehousing are controlled centrally at a central location which makes the warehousing services more efficient.

In this centralized system customer can maintain its production flow and the whole process IS uniform. The overall control over the warehouse is effective and the service provided to the customer is at highest level of satisfaction.

6) Decentralized Warehouse

Decentralized Warehouses are those warehouses which are operated independently by individual business. The individual business can implement its own strategies adhering to its needs and wants which can enable to achieve the required level of customer satisfaction and quality ,can reduce its cost an can make adjustment when needed [6].

II. WAREHOUSE MANAGEMENT SYSTEM

The rapid technology evolution in the recent times has increased the efficiency of the logistics process. Formation technology helps in wise and efficient decision making and forecasting throughout the logistics process. A lot of information system has been introduced like EDI, WMS, and GPS which make the logistics activities more efficient.

The first system which is mostly used in operations of material planning and used in the manufacturing is material requirement planning (MRP) which is helpful in the capacity planning of the products. This system has been currently replaced by MRP II which is more effective than the previous one and has some additional features to facilitate the material requirement. This system has evolved ERP which contains all the functions like customer management, vendor management, financial management, and marketing. ERP has also been modified according to the warehouse needs but ERP is a multifunctional system which is more complex than WMS. Warehouse Management System contains the same functionality but the basic purpose of the WMS is to identify the continuous replenishment of the goods in the warehouse, monitoring the picking and shipping tasks of the products in the warehouse [8].

Warehouse Management system is an important part of logistics and supply chain management. Its basic functionality is the storage of goods in warehouse and distribution of goods to its customers. Warehouse Management System provides the real time information and makes real time transactions.

WMS provides and environment which enables the suppliers, whole sellers and retailers in this network environment and act as a proper communication network which helps the suppliers and its customer in communication. This system contains information about the suppliers and customers and has data storage function. As the warehouse management system implements it reduces the overall cost and gives some economic benefits to the business [9].

WMS is a computer based system which mainly depends on automated data technology sources such as bar code scanners, computers. RFID technology makes the process of flow of products more efficient and a central database is further created which keeps the real time information and monitors the transactions. This Warehouse Management System helps in picking of products, packing and shipping and automates the entire process of logistics.

III. WHY TO ADOPT WAREHOUSE MANAGEMENT PAPERLESS INVENTORY MANAGEMENT

Warehouses usually managed their inventory manually which was quite difficult and the rate of error was high in the manual work. With the implementation of Warehouse Management system all that paper work has ended and the inventory is managed in a computerized way and the error in the inventory management has decreased [7].

A. Space Allocation

Warehouse Management System is used for a proper allocation of space to the products in bins and due to
proper implementation of this system the space is reduced. The allocation of space is according to the categories like received goods, packed goods and the goods which need to be shipped are contained at their specific places and proper space is allocated to them.

B. Customer Satisfaction

Customer satisfaction is the key factor in the success of any business in warehouse management. The delivery of products is important to customer and this delivery process can only be efficient due to the implementation of the warehouse management system. As due to WMS the products are placed at its allocated storage space and WMS identifies the product immediately which can be further delivered to the customer within specified time.

C. Quick Inventory Returns

WMS is such an efficient system that it reduces the lead time of the inventory and removes the error and implies the just in time technique to make the inventory payback well organized.

D. Labour Management

WMS helps in labor management in the warehouse and can check the start and ending time of receiving and picking of the products and can manage time in compliance with the orders and can prepare a report on the lines of the products picked in one hour by one person.

IV. FUNCTIONS OF WAREHOUSE MANAGEMENT SYSTEM

Products reach the warehouse in a quite a bulk quantity and the very first activity which is performed in the warehouse is the unloading of goods and receiving in warehouse. This unloading of products is done manually mostly in the warehouses, conveyors are also used to unload the products which increase the efficiency in the movement of the products. After the unloading of goods from the vehicle there are at least three movements inside the warehouse this movement is done through the forklifters in the form of pallets and then these pallets are diverted towards the initial assembly area of the warehouse and finally these products moved towards selection of picking area where orders are being full filled. (Bhatnagar, 2000)

A. Picking Goods Order

Picking of goods is the most important function of the warehoused management operations. This function involves a large scale of manpower due to which it is considered as high cost function in the warehouse. This low service level in this function can cause the substandard of other operations in the warehouse. Warehouses are being focused on cutting cost and perk up the productivity level in the picking of products from the buffer areas of the warehouse. In this competitive business environment distribution centers are willing to take the orders from their customers and provide them on time delivery of their products in a very short time span.

Order picking is a centralized function between suppliers and its customers. It involves the selection of the appropriate product in a certain quantity which meets the customers demand, and handling over stock to order lines removal of the picked products. These order lines of the stock contains distinctive SKU with definite level of quantity [8].

The picking area is divided into different zones and a picker is assigned to each zone which manages the orders lines. The picking zone are operated by different tools like pallets are picked by aisle, broken cases are picked from static shelves and cases which are picked from selective racks. High storage racks are picked by the crane. The picking system will identify the picking location and crane will automatically pick the appropriate product from the shelves.

Batch picking is a part of the picking process and pickers pick in the groups from one line and the entire quantity is picked at a same time. The productivity can be increased if the picker is able to manage more orders at a time and can pick from order lone. The picking lead time decreases as the picker increases it efficiency. Warehouse Management System manages this picking productivity and reduces the risks and errors. Radio frequency enables the WMS to control with real time information. This information is displayed on the terminal and location of SKU is confirmed which is finally picked and order is fulfilled accurately.

Static shelving is an important apparatus in picking of goods and the depth of these shelves is about 12 to 24”. These shelves contain plastics bins which are used for the storage of products. It is less expensive method of picking SKU while in carton flow rack picking is done in front of the rack as the carton is emptied is replaced by another filled carton by the help of conveyor and in this way high number of SKU can be picked easily.

Picking system can be more efficient by the use of the ASRS which contains load and this load is transferred to pallet store but its retrieval time is high while automated picking machines can pick huge volume of products with appropriate accuracy. In warehouses LED lights are also used in picking function. The system software gives the information about the picking product and highlights the products which have to pick to increase the accuracy and SKU can be picked at its highest level. But nowadays bar code scanners are a useful system in the warehouses in picking operations. Voice picking technology is also used in the picking area of the warehouse. Automated conveyors and sorter are also installed in the warehouses which are mostly used in the large level of picking operation. (Chan et.al, 2011)

B. Shipping

Shipping has its important role in the warehouse management system. It follows the Just in time technique. By the use of this technique elimination of all the wastes are reduced and there will be improved level of the productivity in the operations of the warehouse. The
primary function of the JIT is to have the required quantity which should reduce the lead time and inventory should be at its zero level. Pull system is involved in the efficient warehouse management. The delivery of the product to the customer is possible on time by the appropriate involvement of transportation system. The transportation manager of the warehouse should know about the regulation, about the changes in fuel prices, other government regulations and environmental effects due to transportation of goods so that the delivery of the products can be ensured at its given time by the customer.

First of all the shipping manager of the warehouse has to select the appropriate mode of transportation. It mostly depends upon the nature of the product and distance level. If the product has to distribute at the national level the transportation mode will be different as compared to in case of international distribution.

Trucks are the most common carriers used for the distribution of goods and very economic than the other modes of transportation. These trucks are easily accessible at any time to give the delivery to the customer on time but trucks can only deliver in a limited distance level as compared to others while rail is the best mean of delivery of goods in a quicker and no matter that how much the quantity is as it can carry big pallets easily at long distance with a very low cost.

The increasing trend in case of fast delivery is moving towards the use of air transport. Special cargo carriers have been introduced by the airline companies which can carry enough amounts of goods. But still it cannot carry bulk amount of goods and it’s much expensive than any other mode though provides business a competitive edge to give fast speed delivery of its products to its customers and keep the customers loyal to the business. In case of sea transport business can ship their bulk amount of goods in to the vessel but this transportation way is quite time consuming. Warehouses mostly use common carriers like trucks, rails and other vehicles to ensure the delivery of the products to its customers.

Different computerized systems have been introduced in the market which makes the shipping process automated such as the bar code and RF technology is used in this system because the shipped items are being monitored by these bar codes and RF chips. The system gives the information that these packed pallets have to ship on the conveyers and other lifting machines automatically pick the product and put in to vehicle. Transportation Management System is also integrated with WMS which gives enough benefits to the Company [7].

Receiving of products is a detailed process. Receiving of any goods in warehouse is per schedule and all the truckers make an appointment of delivery of the goods. The person in warehouse which has to receive that delivery will confirm to the trucker by verifying the ASN (Advance shipping notice). The delivery driver arrives at the warehouse and put the vehicle at receiving door of the warehouse. Then the carrier representative confirms the seal and the goods are inspected after which the goods are received. The products are unloaded from the truck on the warehouse floor and then counted for final inspection. Finally these received goods are settled at their specified locations.

Cross docking is a part of receiving of products in the warehouse. It is basically used to store products for a very less time. Warehouse cross docking deals with the internal load, sorts the appropriate products and the loading of these products is carried out by vehicles. In the warehouse if the products are identified as damage products then mostly products are returned to the manufacturer or to the merchandiser. Some are repairable like repacking of products make those products resalable but those products which are totally damaged are finally destroyed.

Handling of return of products from customers is an important thing as mostly customers are careless. It needs to be checked that whether these returns are resalable and what next can be done to make these goods again saleable [8].

V. STORAGE MANAGEMENT BY WAREHOUSE MANAGEMENT SYSTEM

The Warehouse Management System provides an automated solution in the storage of goods and managing stock. WMS helps in the inventory management and in proper storage and uses high storage racks and fixed bins to store the products. Material cab adjusted at the storage bin level and this bin is further monitored by the system and can easily access the products in the specified bin. WMS keeps recording the stock level difference in the storage bins and racks and gives the information about the balance stock.

WMS is used to track those products which are stored in the storage bins to assure the receiving of the goods which can be put aside any time and can be further used. Storage location had a problem with manual system and no proper location was allocated to the products but by the management of warehouse system a proper location is allocated to the goods and this space location selection has made the best use of the available space in the warehouse. SKU is the storage unit and WMS gives the real time information to make the decisions which are helpful in the manufacturing and other decisions related to the products which eventually decrease the lead time. The space overflow will definitely decrease and there will be no need for the construction of new space due to the proper allocation of space to the products by WMS [6].

Another method of the storage of goods is the mezzanine storage system which utilizes the space of warehouse more efficiently and it is affordable than the other systems and can be moved to another place by disassembly. This method is only effective at a smaller level of operation.

AS/RS is called the automated storage and retrieval system which was designed for the storage of warehouse
VI. TYPES OF WAREHOUSE MANAGEMENT SYSTEM

Warehouse Management System is such a system which does not fulfill the requirements of all the functions in a warehouse properly. It has to collaborate with other management systems which help in performing function to its desired level of efficiency that’s why warehouse management system is classified into three types.

A. Bar Coding

A WMS is such a system in which stock is controlled manually or by the use of scanning of products with the help of bar coding. The receiving of goods is done by the help of data information stored in the bar codes tagged on the products. Storage location, picking and packing orders are given by the system.

Bar coding is the very first technology which helps in the warehouse management functions and is being used everywhere in warehouses. ASCII codes are used in the bar coding technology. Bar codes were first used in Switzerland in automatic sorting of products, with new developments in bar coding these are used in super markets for security and pricing of the products. Bar code scanners have introduced to get the real time information from barcodes. Barcodes tags are attached on the pallets in warehouse products and information is stored in those tags which give the real time information to perform activities.

By the use of bar coding real time transactions is done and less labor is involved. Scanning devices are used to perform maximum functions and in this way cost of labor has reduced which facilitates the customers in the competition [4][5].

Bar coding is such a technology through which we can keep the information accurate. A load of information is involved in the functions of warehouse management and this system generates real time information regarding the warehouse storage locations, delivery of products, and other movements of stock inside the warehouse. Bar code is a successful tool in generation of accurate information and has lowest error rate.

In the warehouse management the significant benefit of the bar coding is the collection of data and accurate information which cannot be done by the manual inputs which are not error free. So bar coding is the good system for the warehouse management. (News, 2006)

B. RFID Systems

In the modern enterprise system real time information is an important element during the communication. For the real time information there is lot of technology but RFID is the emerging technology which is used for the commercial purpose in 1980s. This technology is much expensive as compared to other technologies because it is more durable than any other technology such as bar codes and environment changes do not affect the performance of the RFID tags. (www.rfidjournal.com)

Due to just in time technique in the production and delivery of goods to the ultimate consumers, in the warehouse more significant operations like picking, receiving storage location are done by the use of RFID system.

Although bar coding technology is widely used in the warehouses but it does not have the capacity to read large amount of information because in warehouses large amount of SKU’s are handled and other activities of supply are involved which all cannot be done by the use of Bar coding. Warehouse managers need to know about the new methods of material handling inside the warehouse and have to think about the receiving and delivery of orders to the customers because in the recent supply chain scenario large amount of SKU are not allowed to store for a longer period of time. In order to address these problems and to collect real time information without errors new technology systems have been introduced which are enabled with the Radio frequency identification. Such systems use radio waves in order to get the data collection of all the functions in the warehouse. They also deal with the other function of logistics and supply chain. By the use of RFID systems the labor production efficiency improvement is about 88% and storage and tracking of SKU has also improved. [5][6].

RFID systems have UHF tags of the products in the warehouse and to read those UHF tags handheld readers are being used by the warehouse staff and appropriate information is transferred through wireless and by RF signals.

In the implementation of RFID system in a warehouse shown in Figure 1, first of all the size of the warehouse as well as other warehouse equipments like aisles, racks, lifting tools, is considered. Main thing is to focus on the nature of the products which are going to be stored in that warehouse. The most commonly used equipments which are available in the market are of two types passive and active RFID technology but in warehouse active RFID technology is used. After the proper evaluation of the need of the warehouse Active 2850 MHz series are used to perform the warehouse tasks. In RFID he data collection sin warehouse for the processing of information is done in two ways one is static and other is dynamic. In case of static data it only gives the information about the types of the SKUs, storage space available in warehouse and goods. While in dynamic data collection it involves the warehouse staff, work allocation to fork lifters, inventory availability in the racks and
order picking and this data collection is done by the wireless network and RF signals [9].

By the use of RFID the efficiency in the warehouse operations has increased and the cost of labor and material tracking has reduced. RFID technology has acquired the information load and provides the real time information to perform the functions properly.

The ERP systems mainly focus on the real time information access to the organizational data which is stored in the organization’s system and it removes all the information systems which are already in use of the organization which can reduce the cost, make the functions more efficient and also lead towards a better and positive decision making.

The implementation of the ERP system in the warehouse has improved the efficiency of the internal functions of the warehouse. ERP systems help in the redesigning of the warehousing functions to achieve the effectiveness of the warehouse processes like better utilization of warehouse space, receipt of goods, value addition in the products, quality controls and finally the shipping lead time has reduced.(Hill,1996.)

Enterprise resource planning is packaged software of all the functions of the warehouse is the sole application. The architecture of the ERP is the client server. There is a unique database which is stored in Server and required clients are attached to this server which can access data from the database. By this centralized database the data duplication has been removed and updates are done on the central database which automatically updates the clients [11].

Heavy investments are required for the implementation of the ERP systems in the form of purchase of software and high training cost. But after the implementation of the ERP the automatic data transmission manages the receipt of goods, stock control, inside movement of goods in warehouse, storage locations, updating of inventories which is done by the data transmission module of ERP and clients can access this data from server. ERP terminals are used in the warehouse for data entry; these terminals access the RF tags on the products and directly send the data to the server.

D. Voice Centric Warehouse Management System

Quality of Voice is correlated to a higher performance in Product Distribution since last two decades but in the industry of supply chain it is still thought to be a new technology. A survey has revealed the findings that five supply chain managers have shown their knowledge about voice. Supply Chain and distribution managers encounter various challenges in the industry. These challenges include business contraction, an SKU base consisting of a product mix which is not uniform rather diverse in its characteristics. They are struggling to bring an improvement in the quality of their distribution.

Most extensively used method for voice in warehouses is of order selection. In this method voice is introduced in the arena and then progresses towards the voice customers. This is the area where the main segment of employees is present in the warehouse and where the company gets the most profit due to a prompt impact. In this type the workers are prone to commit fewer mistakes as they are more concentrated towards their environment rather than looking at the paper or screen which further ensures their safety.

This particular technology has been introduced in market about 20 years ago which has enabled various warehouses to increase its productivity and profits. The warehouses are thus enhancing the mode of safety and also cutting the cost of employee training.

Its not that the workers just listen to instructions being given in fact it is a well-managed system of interaction. Speed and accuracy are two key essentials which determine the return on investment. If more products pass a system there is more productivity which in many cases compels the companies to expand their infrastructure. Since the last decade the systems of distribution has shifted from “Paper Centric” to “RF-Centric” and currently the shift is towards to a “Voice-centric” approach. Warehouse managers have now explored the fact that voice leads towards a work process driven environment which can allow them in maximizing human and computer interactions[10].

Due to voice system employees do not require carrying heavy RF scanners and they can work without any burden. Voice guarantees a consistent system of operations which can also be introduced in every branch of the company at a global level. Language is also not a barrier as any dialect of language can be supported by this new technology.
In most companies it has become an easier process to estimate Return on Investment due to the application of voice. Due to voice the warehouses can save their labor costs which include salary and benefits. The satisfaction of the employees leads towards the increased satisfaction of the customers.

As far as this technology is concerned there are many companies which have not yet fully understood it. Many professionals think that they are aware with voice, how it functions and how can it be applied to the operations. Some of the companies have discovered that voice is a limited technology but this concept was about two decades ago. At present it is as an emerging technology and has been quite beneficial in improving productivity by cutting the overall cost of warehouse [11][12].

Another important feature which is important while the functioning of the voice technology is the environment in which the systems of voice function as it has a great impact over the quality of delivery. While dealing with the technology there is always a challenge as there are chances of error. The motive of any sort of speech recognition system is to interpret the speech very precisely in a very systematic way. The Recognition Systems should apply to every language and in various environments. Achievement of targets can be an issue though companies make use of the visual information. Vococlect is the company and have introduced the software which is accepted all over the world and is being used by the all the warehouses.

CONCLUSION

To sum up the implementation of the warehouse management system is a critical issue for the business. They need a team to launch this project and this team should comprise of board of management, senior managers and experts of I.T and warehouse functions. This team would work on the need of the WMS and what features should be included in the new WMS. This project team would also evaluate the deficiencies of the old system and will give recommendations for the new WMS. The cost of WMS implementation is very high for the small and is not at all cost effective. But big businesses can afford the high quality and extraordinary functional system and is currently used by these businesses with the use of which they are becoming competitive in their industry and are providing credible services to their customers.

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