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Importance of Warehouse Layout in Order Fulfilling Process Improvement

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Abstract: The warehousing layout has strategic importance in the firms' supply chain management strategy and service level. Usually, firms design their warehouse, which can increase service level, reduce order fulfilling process time and cost. This research discussed the warehouse layout for improvement in order fulfilling process time. Researchers discussed the case study of Mury distributor, which deals in plastic pipes and some electric products. The results indicate that Mury distributor's employees were not well-trained in their work and several times they deliver wrong products, which also become a cause of delay in customer's orders. The findings also show that shelves and racks were not as per the requirement of the items and after model building and layout changes increased to the efficiency and service level.

Keywords: Distributor, Order Fulfilling Process, Warehouse, Supply Chain

1. Introduction

In today's world warehouses can create significant value addition for the organizations, but if management knows how to use effectively and efficiently another wise warehouses only can add a huge cost only in whole system of supply chain management [1]. The order fulfillment process has a significant role in warehouse management. Companies give importance to order filling process for enhancement of customer services. The biggest reason of switching customer is "unsatisfactory services". In today's competitive world customers are demanding immediate (in short time) accurate deliveries in terms of right quality and right cost. That's why companies are more focus over "delighted customer services" but challenge which companies face is cost. The bottom line of every company is earned a healthy profit, so companies least preferred to add cost in the system in terms of hiring more workforce and buying any automated system. The priority of top management is to minimize the system's cost and achieves to the following objectives: provide delighted services to the customers, building good and long term relationships with customers and earned healthy profit. Usually handle to the fulfillment process, there are two different methods: The first is in-house (using company self-infrastructure) and the second is outsourcing (fulfillment services provider) [2-4].

The process of order fulfillment initiate from the "point of sales inquiry" and end at "delivery of product to the customers" According to [5-6] for every warehouse the most labor intensive activity is order picking and as per the estimation the order picking expense is 55% of the total warehouse operation cost, because the travel time, finding and selecting the right item and transport towards point of shipping. The picking the items from the storage area for the purpose of to fill customers order is called order picking. As per [7] the order picking is up to 60% of the total labor activities in the warehouse because majority warehouses are taking human services for the "order picking". In simple term order fulfillment is how seller responds after receiving orders from customers till delivery [8]. In this research will identify the problems face during the order fulfillment process and how companies can minimize their cost and improve their order fulfillment process.

Mury distributors established during 1876 in U. S. Majorly Company deal in plastics pipes and electronics related items. Company has 48 employees, and has 1750 active industrial account as well annual sales of almost $ 16.5 Million; it is considered a large size distributor. Company which started as

a small partnership between Louis and Juli, now has become a giant in the industry.

2. Warehouse Role in Modern Supply Chain

Role of warehouse in the supply chain is not new, before usually warehouses were using only storage purpose. But from last few decades it is become broader horizon. According to the [1] following activities are commonly use in today's warehouse; same day shipment (its common in many warehouses), postponement, late configuration, Cross-dock, Transshipment facility, Returned Goods, Make Bulk or Break Bulk, Consolidation, accurate deliveries to customers, flexibility, timeliness, respond quickly over customer's request, labeling and tagging is also very important and play vital role in tracking and selecting the right material on the right time during fulfillment of the customer's order [9]. Usually, Customers do not care "warehouse is company owned or it is operating by third party" in modern SC (supply chain) warehouses are contributing 99% accurate and perfectly respond over customers' request [1, 10]. According to the overview of warehousing in North America [1] "contract warehousing" in U.S is 60% of commercial US market. Third party role in the warehouses are growing, and firms would like to take advantages of third party in terms of cost minimization, storage space, flexibility, specialized labor and technology. As well firms also can change the warehousing network without burden of fixed (warehouse) expenses, but interesting retailers and distributors are not willing to use of third party [10]. Usually the common characteristics for the successful warehouse operations are; investment in the people by the training and provide them more skilled regarding their job responsibilities, measure performance of individual employee and use evaluation process to gage the service level and cost, usage of latest technology (software & hardware) as per the warehouse requirement to increase the visibility and velocity (speed) of the operations.

In the process of order fulfillment the important part is "Order Picking". And usually in the warehouses many time waste in finding and selecting the right material. Order picking can be done by several methods. Commonly uses are; Batch or picked by article, to fulfill the multiple orders the multiple products selected and then products sorted in the area of staging and consolidate with other products to fulfill the customer's order, Discrete Order; on the basis of per customer's order only specific products selects, Waves; in the method products are gathered on basis of specific routing or shipping criteria, Reverse-Order; it is used when portion of order held to consolidate with other order. Reverse order are somehow related with cross docking.

3. Problem in Warehouse

Warehouse of the Mury distributor was 12000 square feet approximately. And company was dealing in 44700 items, and there were many items which were very expensive and some was very low cost items. Major problem of which company was facing are delaying in order filling process. There were few basic reasons which we analyzed after the visit to the warehouse and observed activities in warehouse. All picking and selecting the products works has been done by labor force (no automation), waste many times in finding the right products and sometimes the picker transport wrong products towards shipping department, which was also caused of delaying in filling customer orders. Due to the delaying in customer deliveries, customers were disappointed from the services provided by the Mury distributor. And in last few years company has lost many customers, one more reason what we have identified is that "height of shelves" is not as per the labor are working there, and it was also one major reason in delaying in finding and picking. As per the [11] the top shelf in the warehouse should be as per the short height worker. Who will work there because a person height of 5 foot and 5 inches can pick to the material and items as high as 6 feet and 11 inches.

4. Design & Layout of the Warehouse

In the warehouse available space was 12000 square feet approximately, and utilization of the warehouse space is 85%. In simple words, in real case we cannot utilize 12000 square feet space for the storage purpose. The company's policy for the storage and picking is creating significant impact on the warehouse design and layout. Following are the three approaches for pick the items (by hand):

a. The picker can enter from one aisle and exits from the same aisle.
b. The picker can enter from the one aisle and exits from the other aisle
c. The picker can enter from the one aisle and exits from the middle of the aisle.

The third one is very convenient for the picker, because in the third one approach the picker (employee) usually work towards middle of the warehouse as well he can cover much area in little time and can pick many items in very short time. The shipping and receiving work steps play a critical role for the warehouse design. Because from the shipping area after assembling and finalizing the customer orders, it is shipped to the customers, so shipping area should be accessible conveniently for picker to transport the items towards shipping departments.

As we have mentioned before warehouse space was 12000 square feet and firms can maximum utilize 10200 square feet. Before we go towards solutions and recommendation we need to understand the problem from every aspect, so we also conducted couple of interviews with warehouse manager and shift in-charge, and also we observed to the warehouse activities performed by labor specially finding to the products, picking and shipping. After the in-depth analysis we went towards solutions. The major questions which we was facing is "how many

racks, shelves should be for the storage of 44700 products in the available space. As per the nature of the products we have selected the very suitable racks which pair of vertical sides, horizontal beams. We selected this rack because it is most suitable for the products and usually products was in small and medium sizes it is also convenient for the picker, and picker can pick the products from the back side or from the front side so ultimately it will also support to save time during "Picking" work. After the selection of the rack and shelves usually no we need to calculate how many racks we need to stored 44700 products in the given constraint of space. So for the accurate findings and results we are going to use mathematical model by Heragu, [12]. The following is the notation, which will be used in model.

X and Y = number of rows and column in the spaces of rack.

A = multiplier, a (multiple) sum of the horizontal rack spaces, length of the total required aisle.

B = multiplier, a (multiple) sum of the vertical rack spaces, width of the total required aisle.

This mathematical model will minimize the one way travel time by picker to collect to the required products is formulated as follows [12].

$$\text{Minimize} = \frac{X(a+1) + Y(b+1)}{2} \quad (1)$$

Subjected to the following

$$XYZ \geq n;$$

and X, Y are integers

The total space available for storage exceeds the minimum requisite, it will be ensured by first constraint. The number of columns and rows should take on integral values and it will cover by second constraint.

$$Y = \sqrt{n(a+1)/[Z(b+1)]} \quad (2)$$

$$X = \sqrt{n(a+1)/[Z(b+1)]} \quad (3)$$

After run to the mathematical model, now we will apply this model. In this case, in which a = b shows that warehouse is square shape. The warehouse of the company is a rectangle length and width with 125 and 82 respectively. In the model two parameters ratio is a/b = 125/82 or a=1.52b roughly, so here we are using reasonable values which is presented in [12], a=0.45 and b=0.30 we have set these values for further calculation. Then second parameter which we need to decide is "needed shelf spaces" are 585 at an avg. size of 8079 cubic inches we chose n = 2x585 = 1170 (double of the shelves would avoid products cover and make convenient for the storage of received goods and also convenient for the picker). And final parameter of the mathematical model can determine by the given information and the number of levels (measurement is Z). In this model Z = 7. As we have discussed before the normal person can reach as high as 6 feet 11 inches. So now we are going to drive this mathematical model.

Calculations

$$Y = \sqrt{1170(0.45+1)/7(0.30+1)} = 13.63 \quad (4)$$

$$X = \sqrt{1170(0.30+1)/7(0.45+1)} = 12.24 \quad (5)$$

5. Research Findings and Recommendations

As per the research findings, Mury Distributor's employees was not trained and skilled. In fact, many times employees transport wrong products towards shipping area which was the cause of delay in customers' orders, picking all worked was done by manually no technology used (error margin was high). As well shelves and racks were not as per the requirement of the products. This model has shown the accurate number of racks which is required in the warehouse "minimum 14 column and 12 rows" This calculation will help to utilize the storage area in a better way with few and no congestion. This results will also help to solve storage problem "some shelves were over loaded and some was empty" and after implementation of this plan, company will be able to respond quickly to the customer orders.

6. Conclusion

In the today's supply chain management warehouse plays a vital role to fulfill the customers' requirement in terms of delivery to right customer and on time delivery. In short words, warehouse creates direct impact over customer service level and due to the efficient and effective warehouse operations, firms can improve their overall performance and service level. On the other hand, effective and efficient warehousing operations also create positive image and reputation of firms in the customers' eyes. In this article, we have discussed the problem of one distributor and provided couple of recommendations with the help of mathematical modeling and suggested to re-design the layout of warehouse for the better space utilization of the warehouse and to minimize the customer's order fulfillment process time.

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