WAREHOUSE OPTIMIZATION BY USING LINEAR PROGRAMMING METHOD.

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ABSTRACT

This research was a study of increasing efficiency in warehouses by using linear programming methods. The research aimed to reduce the distance to pick up the products. The company was used to do this research was a company located in Nakhon Pathom province. The company is a small and medium sized company (SMEs), plastic manufacturing factory. The population were used to study were the total number of products. The sample groups were used in this study were bag and roll product groups. The data were used in the study would collect the data on the demand for pallets during January 2019 - May 2019. After that, follow the steps: to calculate the product segmentation by ABC, to calculate the position of the product using Linear Programming and comparison. The results ABC analysis showed that Roll type products were classified as Group A. Next, calculate the linear programming equation. The objective equation is to have the smallest distance traveled. There were 2 conditional equations: 1. Set the number of pallets to be placed and 2. Set the variable named Area code as Binary. This research can reduce the distance from 1170 to 1116, with a distance of 54 meters. Accounting for 4.25 percent.

Keywords: linear programming method, Excel solver, ABC analysis.

INTRODUCTION

This company is a manufacturer and distributor of laminated plastic bags, with color printing and modern automatic printers. Products will be covered in all laminated plastic bag. Examples of plastic film products such as OPP//CPP, OPP//LLDPE,Nylon//LLDPE, PET//LLDPE, PET//Alu//LLDPE, OPP//Alu//LLDPE, OPP//MPET//LLDPE, PET//MPET//LLDPE, OPP//MCPP etc. These films can be used for packing fresh food, dried food, chilled food, frozen food, chemicals, fertilizers, lids, cups of drinking water etc. All products can be grouped into 2 groups, Bag and Roll products. The warehouse has one entrance door. There is 1 forklift truck with 8 rows of pallet racks. Each row has 3 floors. The Managing Director wanted the researcher to reduce the distance to pick up the products. The researcher therefore proposed a way to reduce the distance to pick up the products using the linear programming method.

OBJECTIVE

This research aimed to reduce the distance to pick up the products.

METHODOLOGY

Population and sample groups

The population of this research is all pallets that are used for bag and roll product groups.

The sample group is the number of pallets used for bag and roll products between January 2019 to May 2019

The research tools

The research tool is Excel Solver.

RESULTS

1. Results of warehouse data

The warehouse has one entrance door. There is 1 forklift truck with 8 rows of pallet racks. Each row has 3 floors, as shown in Figure 1and Figure 2.

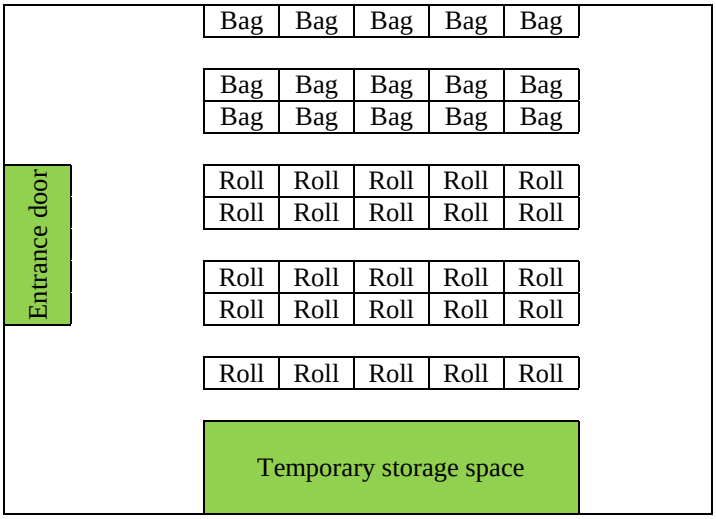

Figure 1: Warehouse layout

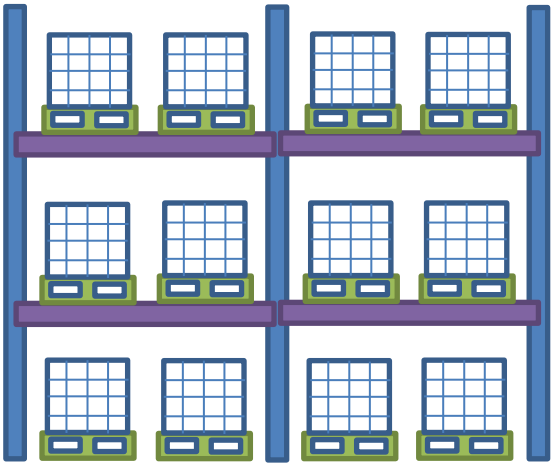

Figure 2: Example of rack

2. Results of the demand for pallets

From the data collection, it was found that during 5 months, January 2019 - May 2019. There were 21 customers and there was a need to use maximum pallets, as shown in Table 1.

Table 1: The demand for maximum pallets in each month**.**

Month	The demand for maximum pallets		Total
	Bag	Roll	
January	87	176	263
February	65	134	199
March	104	89	193
April	67	154	221
May	83	198	281
Total	406	751	1157

3. Results of ABC analysis

Based on the data in Table 1, the demand for maximum pallets in each month, researcher used the data to calculate the classification of ABC products as detailed in Table 2.

Table 2: The demand for maximum pallets in each month**.**

Group	Pallets requirements	Percentage	Cumulative percentage	ABC analysis
Roll	751	64.91	64.91	A
Bag	406	35.09	100.00	B
	1157			

4. Results of product position by using Linear Programming

4.1 Area code assignment

The researcher determined the area code in the rack, as shown in Figure 3.

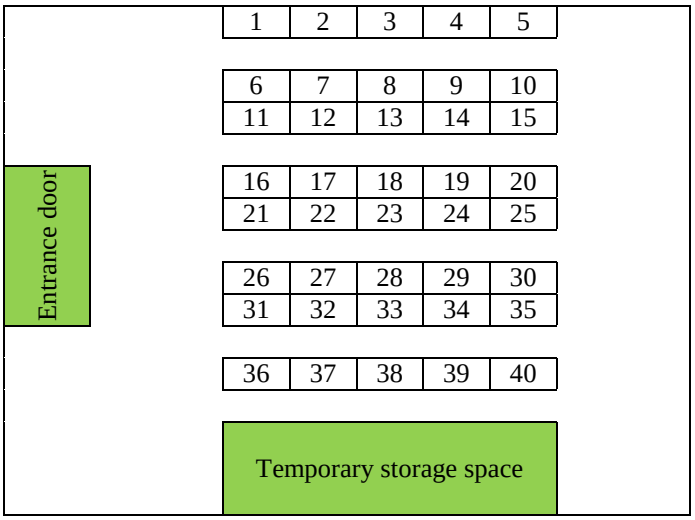

Figure 3: Rack code assignment.

4.2 Determine the number of pallets to be placed

When the code was already on the rack. The next step was to determine the number of pallets to be placed, as shown in Figure 4.

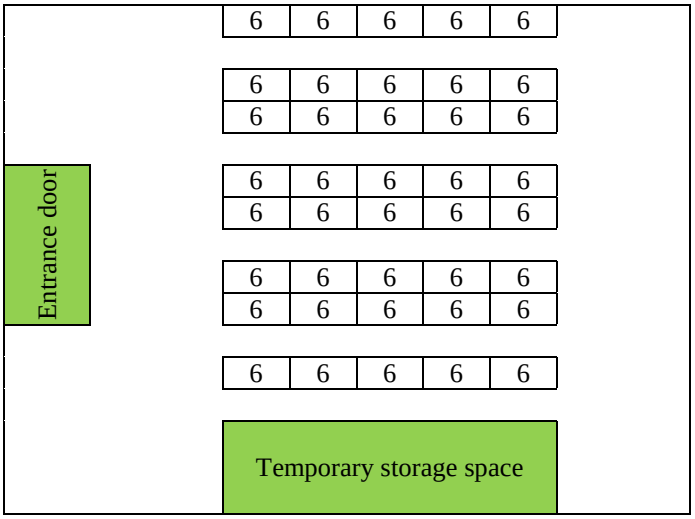

Figure 4: The number of pallets.

4.3 Finding the distance from the door to each area code

The distance was determined by measuring from the actual distance in the warehouse, as detailed in Table 3.

Table 3: The distance from the door to each area code.

Area code	The distance from the door (meters)	Area code	The distance from the door (meters)	Area code	The distance from the door (meters)	Area code	The distance from the door (meters)
1	60	11	42	21	24	31	42
2	66	12	48	22	30	32	48
3	72	13	54	23	36	33	54
4	78	14	60	24	42	34	60
5	84	15	66	25	48	35	66
6	60	16	42	26	24	36	42
7	66	17	48	27	30	37	48
8	72	18	54	28	36	38	54
9	78	19	60	29	42	39	60
10	84	20	66	30	48	40	66

4.4 Determine Linear Programming Equation

Minimize $Z = \sum_{i=0}^{40} D_i C_i$

$[\sum_{i=0}^{40} C_i](6) \geq 150$ (150 = mean (176,134,89,154,198))

C_i = Binary

Z = Total distance

D_i = Distance from the door to area code i

C_i = Area code i

4.5 Run Excel Solver

The result of positioning with Excel Solver was shown that the distance was 1116 meters, the details were shown in Figure 5 and Figure 6.

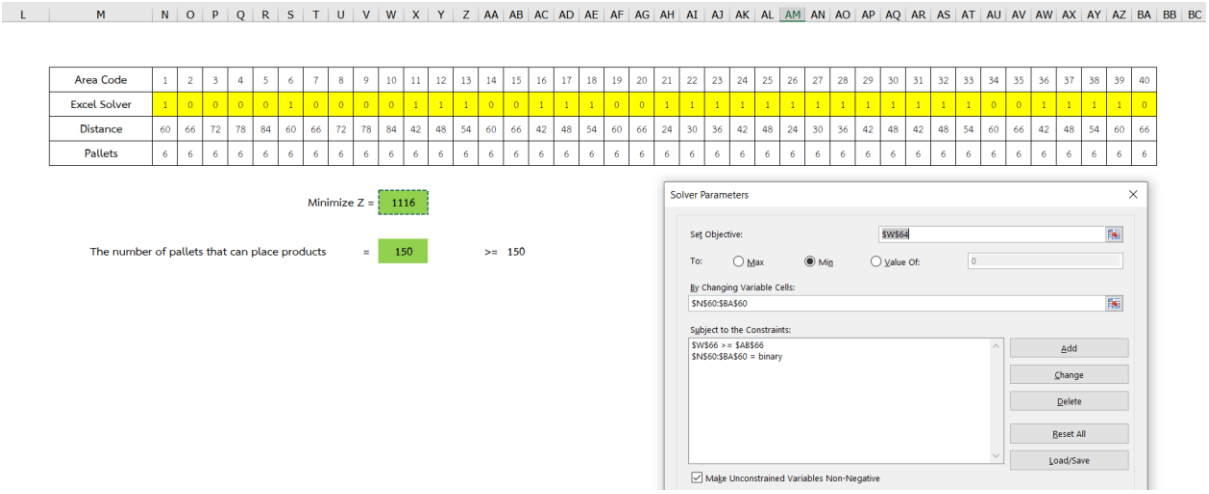

Figure 5: Run Excel Solver

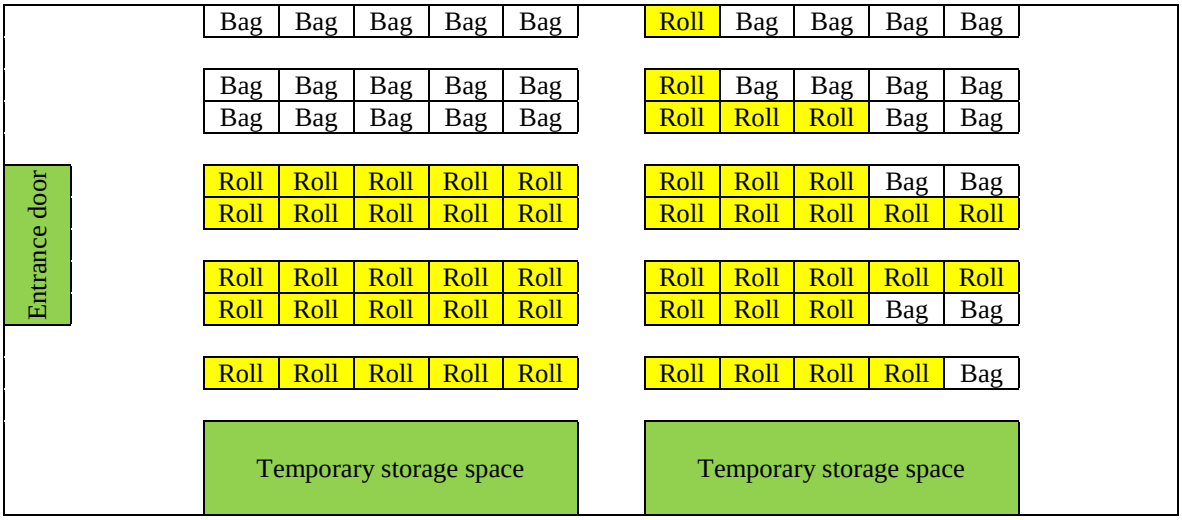

Figure 5: Comparison

CONCLUSION AND FUTURE WORK

From the result of Excel solver, can reduce the traveling distance from 1170 to 1116, which is 54 meters. Accounting for 4.62 percent. If the managers focus on management, finding product position by using Linear Programming Method is not worthwhile because it can reduce the distance by only 4.62%.

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