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Analysis of Model of Regional Correlation Degree Based on Order Characteristics

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Abstract*:* Based on the ABC classification method, this paper presents a method of storage spaces based on regional correlation analysis. First according to the variety of goods between the relevance, volume library and frequency library, the goods are divided into core products, related products, auxiliary products. According to the characteristics of the three items, so we can divide core product regulation storage area, associated product regulation storage area and unbundled area, and re-planned the fist layer of storage spaces, so the initial distribution of warehouse cargo storage spaces can be formed.

Keywords Order characteristics; Regional correlation degree; Storage planning

INTRODUCTION

Relevance order refers to the presence of different levels and types of correlation between the order items, quantity, time and other factors. Correlation analysis including time relevance analysis, items relevance analysis and number relevance analysis. For example, two or more items appear in the same order at a certain frequency, or The amount of a library items with a library of another quantity of items associated with each other, it was proportional, or inversely proportional relationship between them. There exists stability with a certain amount of items, number and lead time within a certain time. This Order Correlation analysis can be used to guide the allocation of goods storage spaces and storage spaces layout, and so on[1]。

Based on the ABC classification method, this paper presents a method of storage spaces based on regional correlation analysis, for an enterprise storage spaces inside the warehouse planning optimization. According to the association, the volume library, and the library frequency between the various goods, obtained the core product regulation, associated product regulation and related supplements regulation, under carts running speed constant. So we can divide core product regulation storage area, associated product regulation storage area and unbundled area, and re-planned the fist layer of storage spaces, so the initial distribution of warehouse cargo storage spaces can be formed.

TRADITIONAL METHODS OF STORAGE LOCATION PLANNING

ABC classification is more commonly used, the basic idea of this method is: Stock material according to the number of species and occupation of funds is divided into important class A, general important B class and not important class C, this is a method for the management and control of different grades, respectively[2]. Table 1 is the specific classification.

Table 1 The Fact Sheet of ABC Classification

Stock Material category	Variety proportion	Amount of annual consumption
A	5%-15%	60%-80%
B	15%-25%	15%-25%
C	60%-80%	5%-15%

Although the ABC classification method is widely used, but there are many deficiencies, such as: (1) classification standards are too simple, classified mainly by the number of inventory items share funds, without taking into account the difficulty of sourcing, procurement lead time, the monopoly supplier, production-dependent, and other factors, with a certain one-sidedness. (2) ABC classification did not do the the correlation analysis after classifing goods regulations regional, but by value and volume for a simple classification.

Therefore, based on the above problems, this paper based on ABC classification method, proposed storage location planning method based on region correlation analysis.

MODEL ANALYSIS

Stock piles situation

$$x_{ij} = \begin{cases} 1, & j \in i \\ 0, & else \end{cases}$$

$$z = \frac{\sum_{i=1}^{n} x_{ij} y_{ij}}{pq}$$

Z: Number of each cargo should heap points

x_{ij}: If the order i contain the goods j

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y_{ij}: The volume library of goods j in order i

j: types of goods (j=1，2，……，m)

i: order number (i=1,2，……，n)

q: the number of pallets per pallet stack can be placed

p: the number of goods each tray can put

Define the core product

$$x_{ij} = \begin{cases} 1, & j \in i \\ 0, & else \end{cases}$$

$$I = \frac{\sum_{i=1}^{n} x_{ij} y_{ij}}{\sum_{i=1}^{n} \sum_{j=1}^{m} x_{ij} y_{ij}}$$

I: concentration coefficient of each of the goods

x_{ij}: If the order i contain the goods j

y_{ij}: The volume library of goods j in order i

Define the associated product and auxiliary product

$$x_{ia} x_{ij} = \begin{cases} 1, & a \ and \ j \in i \\ 0, & else \end{cases}$$

$$G = \frac{\sum_{i=1}^{n} x_{ia} x_{ij} X_{iaj}}{\sum_{i=1}^{n} x_{ij} X_{ij} + \sum_{i=1}^{n} x_{ia} X_{ia} - \sum_{i=1}^{n} x_{ia} x_{ij} X_{iaj}}$$

a: core product

G: the rate of correlation

X_{ij}: The frequency of the goods j in the order i

X_{iaj}: The frequency of a and j Co occurring in the order i

CASE ANALYSIS

Ⅰ is an enterprise warehouse, it is floor warehouse, one layer of perennial storage of 15 kinds of goods, storage methods to achieve the entire storage. Warehouse I main handling equipment for the forklift, one layer of the warehouse exist 8 forklift, and there is a fork lift on the platform, that is, each vehicle can only be loaded by a forklift truck, each operation can only fork to take a tray. Each shipment area from A..... J can be stored in a pallet position are 119 pallets, the forklift from a layer of the library to each of the 8 platform loading.

stock piles situation

Take all the order of the day as an example, the following analysis and calculation. A cargo of goods can be put up for the number of goods is 119*30=3570, and from the order can be seen a goods storage capacity greater than 3570 pieces, which can be concluded that some of the goods need to be divided into piles. Preliminary calculation results are shown in table 1.

Table1 Preliminary Stock Piles Situation of the Goods

Goods	The Total Number of Goods	Occurrence Times	Number of Stack
Goods 1	12810	4	4
Goods 2			
Goods 3			
Goods 4			
Goods 5	1760	2	1
Goods 6	5770	1	2
Goods 7	5650	8	2
Goods 8	2610	9	1
Goods 9	74.6	2	1
Goods 10	60	1	1
Goods 11	3340	6	1
Goods 12	16150	3	5
Goods 13	1430	1	1
Goods 14	14460	5	5
Goods 15	1660	1	1

As the goods of 2, 3, and 4 on this day no amount of the volume library, but it does not mean that other time will not be out of the volume library, and therefore the need for sub heap. In addition volume library of goods 12 is most, Divided it into six piles, and this is just in line with the number of stack of reservoir distribution of the case, so the status of the heap is adjusted as shown in Table 2.

Table 2 The final stock piles situation of the goods

Goods	The Total Number of Goods	Occurrence Times	Number of Stack
Goods 1	12810	4	4
Goods 2			1
Goods 3			1
Goods 4			1
Goods 5	1760	2	1
Goods 6	5770	1	2
Goods 7	5650	8	2
Goods 8	2610	9	1
Goods 9	74.6	2	1
Goods 10	60	1	1
Goods 11	3340	6	1
Goods 12	16150	3	6
Goods 13	1430	1	1
Goods 14	14460	5	5
Goods 15	1660	1	1
	65774.6		29

Define the core product

According to the order, the volume library, the coefficient of the concentration of the goods is calculated, as shown in Table 3.

Table 3 Coefficient of concentration of the goods

Goods	The total number of goods	coefficient I
Goods 1	12810	0.194756
Goods 2		
Goods 3		
Goods 4		
Goods 5	1760	0.026758
Goods 6	5770	0.087724
Goods 7	5650	0.085899
Goods 8	2610	0.039681
Goods 9	74.6	0.001134
Goods 10	60	0.000912
Goods 11	3340	0.050779
Goods 12	16150	0.245536
Goods 13	1430	0.021741
Goods 14	14460	0.219842
Goods 15	1660	0.025278
	65774.6	1

From table 3, we can see that only 12 of the goods concentration coefficient I=0.245536⩾0.24, so 12 is the core product .

Define the associated product and auxiliary product

The correlation degree of each type of goods and the core product (12) is calculated, as shown in Table 4.

Table 4 The correlation degree with core product

Goods	Number of Times in the Same Order	Occurrence Times of Goods i	Correlation Degree
Goods 12 and Goods 1	2	4	0.4
Goods 12 and Goods 2			
Goods 12 and Goods 3			
Goods 12 and Goods 4			
Goods 12 and Goods 5	1	2	0.25
Goods 12 and Goods 6	1	1	0.33
Goods 12 and Goods 7	2	8	0.2
Goods 12 and Goods 8	3	9	0.27
Goods 12 and Goods 9	1	2	0.25
Goods 12 and Goods 10	1	1	0.33
Goods 12 and Goods 11	2	6	0.25
Goods 12 and Goods 13	0	1	0
Goods 12 and Goods 14	2	5	0.29
Goods 12 and Goods 15	0	1	0

As can be seen from the table 4, the associated productions are: goods 6, goods 10, goods 14, goods 8, goods 5, goods 11, goods 9; auxiliary productions are: goods 3, goods 2, goods 4, goods 7, goods 13, goods 15.

BASED ON THE REGIONAL CORRELATION DEGREE OF STORAGE PLANNING

Core product of a large volume library, high ratio, so it should be stored in the distance near the entrance or on both sides of the path; Association degree of association product and the core product is the highest, it illustrates that the possible of order core product meanwhile order the associated product. Therefore, associated product should are placed near the core product, and as close as possible to the door or the path; auxiliary product and core product correlation degree is relatively small, and the volume library, and the frequency library are relatively small, So it should be stored in the most remote storage inside the warehouse, The specific reservoir distribution diagram is shown in Figure 1.

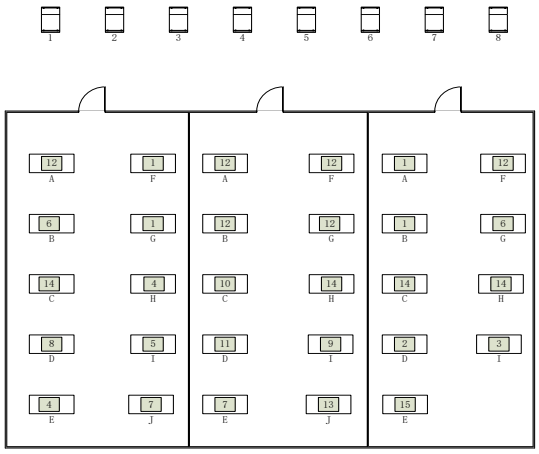

Figure 1 The specific reservoir distribution diagram

CONCLUSION

In this paper, based on the analysis of the regional correlation degree model of order characteristics, put forward the method of the storage and show the specific reservoir distribution diagram.

The advantage of this paper is that the reservoir planning method based on regional correlation degree analysis is put forward on the basis of ABC classification, and the model is universal and can be applied to many enterprises. The disadvantage is that only one day of orders, the data are few, some of the results may not be expected, only to reduce the standard. But in a word, compared to the prior distribution of the storage, shorten the working time out of the outgoing from storage, improve the efficiency of the outgoing of storage.

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