



RELOCATION OF GOODS IN THE WAREHOUSE BASED ON ABC/XYZ ANALYSIS

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Abstract:

The paper deals with possibility of relocation of goods at the wholesale warehouse on the basis of ABC and XYZ analysis of goods assortment. Consequently the physical checking of actual location of goods in the warehouse was done. There is the proposal of new location of goods for each type of group of items in the conclusion of this article.

Key words:

Warehouse, ABC analysis, XYZ analysis, location

1 INTRODUCTION

Wholesale is an independent business (not a manufacturer) making the business operations and organizing of supply lines. The majority of customers in Slovakia imagine that the wholesales are the distribution warehouses of foods or drugstore which own and supply network of retails. Wholesale fulfill functions of a broker to support the flow of goods from different producers to the final consumer [1].

In practice, the wholesale represents a wholesale warehouse in many cases, where there are goods flows connected with purchase, transportation, warehousing, sorting and picking and selling of goods. The wholesale warehouse operates on the principle of a distribution warehouse [2]. Goods are stored here only for a short time necessarily related to distribution to customers.

In these warehouses there is great product diversity and it requires short response times of goods, resulting in targeted distribution of goods in the warehouse space and efficient logistic operations. These two facts play an important role in determining the competitiveness of firms and they impact on logistics costs resulting to the overall profit of the company [3].

Problems from goods allocation in the warehouse are defined already in the design phase of the warehouse, and they are influenced by several factors such as: the location of

income and dispatch gates, the size of storage areas, their location and dividing, picking method, the method of searching items, the technical equipment, the incompatibility of goods, etc. [4, 5].

There are currently several methods - methods of allocations of goods in a storage area. There are given two basic ways listed in the literature:

1. Stable (dedicated) allocation, each item has predetermined place (address of allocation).
2. Random allocation, place for storing goods is chosen at random, e.g.: goods is located to the nearest empty place in a warehouse (it requires good information system), the advantage is better utilization of storing capacity.

2 METHODOLOGY AND METHODS

The basis for the methodology consists of the main inputs:

- Statistics from the available evidence of operative records of items in stock for the selected time period.
- The existing storage areas.
- The existing places of reception and shipment in the warehouse.

The methodology is made up of steps:

1. The creation of representative groups of goods in the warehouse based on selected criteria.
2. The implementation ABC analysis and breakdown of product groups in category A, B and C.
3. The implementation XYZ analysis and breakdown of product groups in category X, Y, and Z.
4. Physical control of storage of goods groups in the space of the warehouse.
5. Assessment of existing state of items storage.
6. Proposal for a new location of product groups, based on identified priorities.

2.1 ABC Analysis

Method of ABC analysis comes out of knowledge, that only a small part of total purchased material represents the major value ratio of purchased material inputs. The use of the method is consisted by dissection of purchased material inputs according to their ratio of total value of purchased material of groups A, B and C. If there is a wider scale of purchased material, then the number of groups can be higher. ABC Analysis procedure:

1. Determination of absolute total costs.
2. Determination of relative proportions of the total costs.
3. Sorting according to relative contribution to total costs.
4. Accumulation of relative contributions to total costs.
5. Classification of materials into three categories A,B,C.
6. Determination of relative quantity proportions.
7. Summation of relative quantity proportions per material class.

The highest attention requires group A, which value ratio is the highest while detailed planning of purchasing and it is truly supposed that there can be achieved the highest effects of managing the costs. On the other hand, there is no needs to provide detailed planning of purchasing the material of group C, which has relatively low value ratio. The experience shows that group A means approximately 70 – 80% of total value of material inputs, but the number of items are usually between 15 – 20% of total number of items. The group B means 15 – 20% of total value inputs and 20 – 40% of total number of items. The group C has the

biggest ratio of number of items: 50 – 70% but the value ratio is only 5 – 15% of total value of material inputs. ABC analysis method, also called Pareth analysis enables to dissect material items into three groups according to the percentage ratio of total value of turnover: fast, medium and low turnover items [4]. The ABC Analysis is often combined with a XYZ Analysis.

2.2 XYZ Analysis

The XYZ classification is a modification of ABC analysis and consists in classification of products, based on the structure (rate), of their selling [6]. The XYZ analysis is a method to classify products according to their variance of demand.

Analysis based on the dynamics of consumption means the calculation of a variance coefficient of consumption or sales in a specific time horizon. Procedure for XYZ Analysis [5]:

1. Determine the relevant items.
2. Calculate the variation coefficients of each item.
3. Sort the items by increasing variation coefficient.

Categories[7]:

X – very little variance (regular - continuous consumption). X items are characterized by a constant, non-changing usage over time. The requirements fluctuate only slightly around a constant level so that the future demand can basically be forecast quite well.

Y – some variance (with variable consumption). The usage of Y materials is neither constant nor sporadic. With Y materials, we can often observe trends, for example, that the usage increases or decreases for a while, or that it is characterized by seasonal fluctuations. For these materials, it's harder to obtain an accurate forecast.

Z – the most variation (with conveniently consumption). Z materials are not used regularly. The usage can strongly fluctuate or occur sporadically. In these cases, we can often observe periods with no consumption at all.

Simple, XYZ analysis is more used in relation of the customer demand for goods X is high demand, Y medium demand, Z very low or exporadic demand.

3 RESULTS AND DISCUSSION

This methodology was applied to wholesale store. The wholesale collects a broad range of goods from to manufacturers. It provides the distribution of goods according to customers' orders. For this reason, it has decided to revise the existing allocation status of goods in the warehouse and it proposed a method that would get the process of picking more effective. The plan view is in figure 1.

3.1 ABC/XYZ analysis of stored goods

It has been coming out of statistics of goods sold during the year while executing of the analyses. Analyses were performed under the said steps given above. Table 1 shown the input data for analyses. The results of the ABC analysis are shown in Table 2. The results of the XYZ analysis are shown in Table 3.

It is proved, from the results of ABC analysis, that 80,44% of items are from the group A, so this group represents goods with high turnover, ratio of these goods in store are 18,52 % (5 items). The group B, average storages are 15,26 % of total items, with 29,63 % ratio of these goods in store (8 items). Low-turnover storage, the group C, represents only 4,3 % of items

and the ratio of these goods in store are 51,85 % (14 items). The results of the analysis are summarized in figure 2, too.

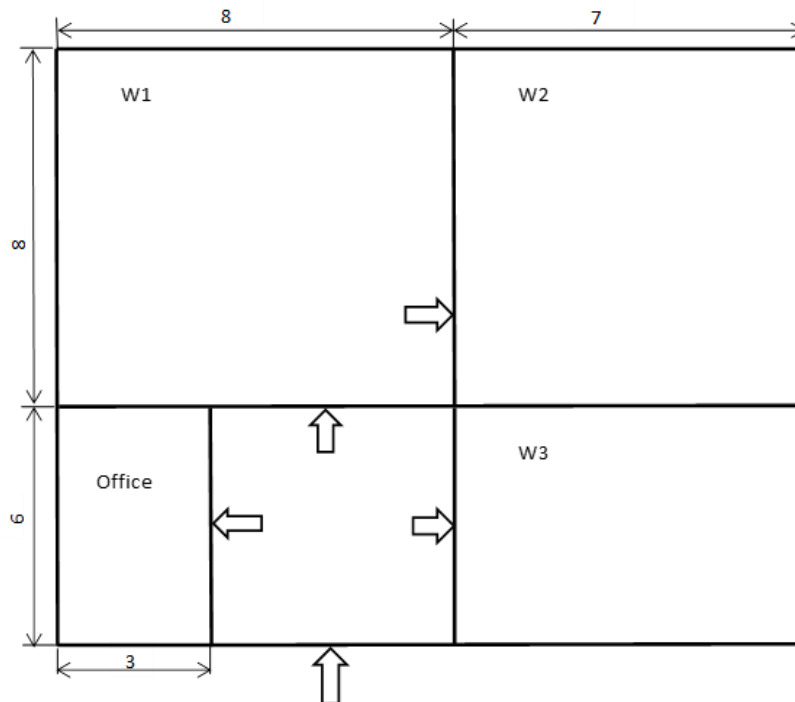


Fig. 1 Warehouse plan view

Tab. 1 Input data

Number of item	Consumption (pcs/month)												Annual consumption (pcs)	Annual turnover (EUR)
	1	2	3	4	5	6	7	8	9	10	11	12		
1.	40	32	45	69	64	72	96	87	58	51	50	45	709	18197,66
2.	21	18	12	21	21	21	26	27	25	9	8	7	216	13089,6
3.	20	22	24	27	29	30	30	27	21	10	9	6	255	10021,5
4.	220	226	173	298	312	355	540	515	293	213	245	156	3546	197866,8
5.	3	6	6	27	36	33	49	39	17	15	16	11	258	9709,4
6.	3	8	6	20	12	15	23	21	6	9	8	7	138	12972
7.	6	9	0	5	6	9	17	9	15	15	10	11	112	6742,4
8.	35	31	39	65	59	67	79	67	60	54	52	40	648	23716,8
9.	9	8	15	15	27	22	29	25	14	11	10	11	196	7291,2
10.	70	81	41	129	113	138	181	173	90	78	62	59	1215	69255
11.	65	79	40	120	111	139	179	172	95	75	64	60	1199	44722,7
12.	0	2	3	4	5	10	13	13	5	3	2	1	59	3150,6
13.	0	0	0	4	2	2	9	13	3	0	1	1	35	1207,5
14.	99	121	140	243	485	545	540	551	402	132	115	85	3458	3250,52
15.	75	81	104	168	220	293	350	271	145	92	84	69	1952	1385,92
16.	51	60	69	76	119	210	255	271	184	98	75	57	1525	1082,75
17.	51	53	62	70	99	112	120	98	84	73	69	61	952	932,96
18.	140	155	190	417	648	690	701	709	514	348	240	124	4876	2145,44
19.	99	124	197	364	395	489	568	678	591	554	398	122	4579	2426,87
20.	69	81	120	199	324	405	541	642	632	240	101	57	3411	1876,05
21.	201	225	301	302	505	702	904	988	685	405	315	245	5778	3986,82
22.	42	51	66	74	99	135	146	175	145	99	75	50	1157	752,05
23.	40	40	57	69	84	134	135	164	131	100	55	49	1058	1121,48
24.	35	40	51	68	95	105	102	175	145	75	50	50	47	592,8
25.	40	42	58	75	132	142	158	172	121	84	76	55	1155	681,45
26.	32	30	45	54	72	88	92	127	100	95	59	49	843	733,41
27.	39	41	48	54	69	81	106	138	157	100	81	55	969	843,03

Tab. 2 ABC analysis

Number of item	Annual turnover (EUR)	Annual turnover (%)	Number of item	Annual turnover (%)	Annual turnover cumulative (%)	Group
1.	18197,66	4,14	4.	44,99	44,99	A
2.	13089,6	2,98	10.	15,75	60,74	A
3.	10021,5	2,28	11.	10,17	70,91	A
4.	197866,8	44,99	8.	5,39	76,3	A
5.	9709,4	2,21	1.	4,14	80,44	A
6.	12972	2,95	2.	2,98	83,42	B
7.	6742,4	1,53	6.	2,95	86,37	B
8.	23716,8	5,39	3.	2,28	88,65	B
9.	7291,2	1,66	5.	2,21	90,86	B
10.	69255	15,75	9.	1,66	92,52	B
11.	44722,7	10,17	7.	1,53	94,05	B
12.	3150,6	0,72	21.	0,91	94,96	B
13.	1207,5	0,27	14.	0,74	95,7	B
14.	3250,52	0,74	12.	0,72	96,42	C
15.	1385,92	0,32	19.	0,55	96,97	C
16.	1082,75	0,25	18.	0,49	97,46	C
17.	932,96	0,21	20.	0,43	97,89	C
18.	2145,44	0,49	15.	0,32	98,21	C
19.	2426,87	0,55	13.	0,27	98,48	C
20.	1876,05	0,43	23.	0,26	98,74	C
21.	3986,82	0,91	16.	0,25	98,99	C
22.	752,05	0,17	17.	0,21	99,2	C
23.	1121,48	0,26	27.	0,19	99,39	C
24.	592,8	0,12	26.	0,17	99,56	C
25.	681,45	0,15	22.	0,17	99,73	C
26.	733,41	0,17	25.	0,15	99,88	C
27.	843,03	0,19	24.	0,12	100	C

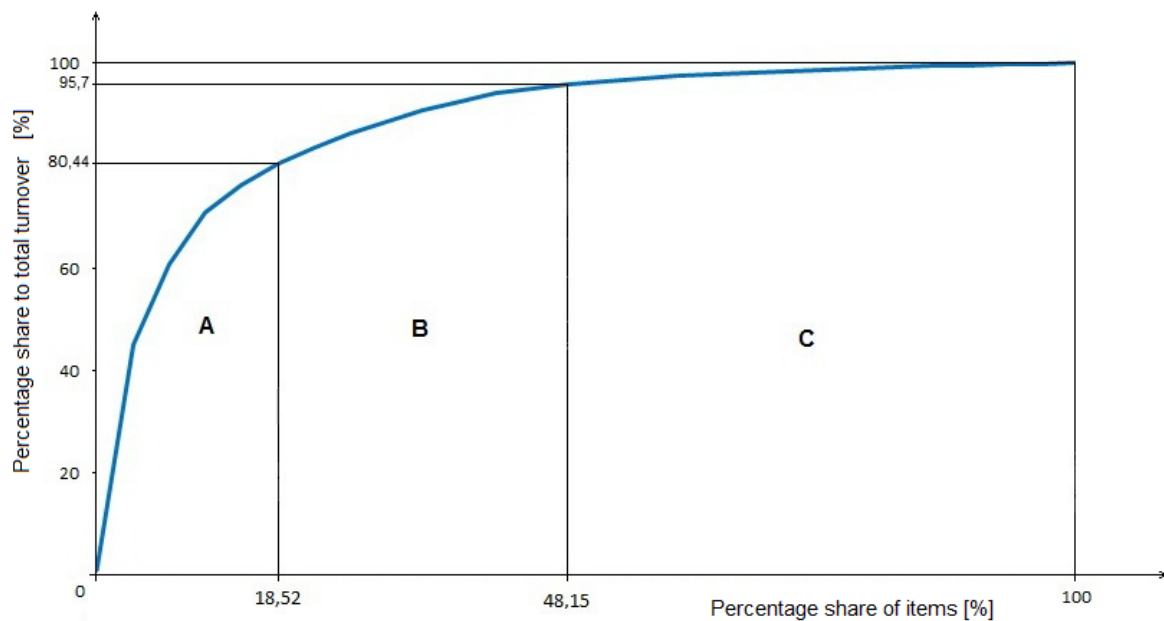


Fig. 2 The Lorentz diagram – interpretation of the results from the analysis

Tab. 3 XYZ analysis

Number of item	Annual consumption (pcs)	Average consumption (pcs)	Dispersion	Standard deviation	Coefficient of variation	Group
1.	709	59,08	159,73	12,52	21,19	Y
2.	216	18,00	21,85	4,67	25,97	Y
3.	255	21,25	30,70	5,54	26,07	Y
4.	3546	295,50	664,04	25,77	7,84	X
5.	258	21,50	94,65	9,73	45,25	Z
6.	138	11,50	18,88	4,35	37,79	Y
7.	112	9,33	9,79	3,3	33,53	Y
8.	648	54,00	6,14	2,48	7,32	X
9.	196	16,33	15,72	3,6	24,27	Y
10.	1215	101,25	98,03	9,90	9,87	X
11.	1199	99,92	856,88	29,27	29,30	Y
12.	59	4,92	8,5	2,91	57,34	Z
13.	35	2,92	7,04	2,65	90,94	Z
14.	3458	288,17	16674,6	129,13	44,81	Z
15.	1952	162,67	72,88	8,54	8,49	X
16.	1525	127,08	2769,11	52,62	41,41	Z
17.	952	79,33	23,68	4,87	7,58	X
18.	4876	406,33	23872,87	154,51	38,03	Y
19.	4579	381,58	3661,18	60,51	24,76	Y
20.	3411	284,25	20771,78	144,12	50,70	Z
21.	5778	481,5	31708,19	178,07	36,98	Y
22.	1157	96,42	529,73	23,02	24,99	Y
23.	1058	88,17	794,22	28,18	31,96	Y
24.	47	82,33	813,18	28,52	34,64	Y
25.	1155	96,25	916,09	30,27	31,45	Y
26.	843	70,25	387,39	19,68	28,02	Y
27.	969	80,75	615,86	24,82	30,73	Y

The proposed classification for groups X, Y and Z are based on the coefficient of variation: X - (0-20) , Y - (20-40), Z – over 40.

The results of ABC/XYZ classifications are presented in Table 4.

Tab. 4 Division of goods according to ABC/XYZ classification

	A	B	C
X	4, 8, 10,		15,17,
Y	1,11,	2,3,6,7,9,21,	18,19,22,23,24,25,26,27
Z		5,14,	12,13,16,20

3.2 Physical control of storage of goods groups in the space of the warehouse

There was executed physical control of reception and allocation of each group allocation in the warehouse, after the dissection of the goods into the certain groups. Wholesale area is 210 m² and it is divided into 3 storage sectors, figure 3. Reception and distribution of goods is carried across one unloading ramp. The table 5 shows the results of control found in the warehouse.

It was concluded the following from the carried out analysis and a physical inspection of the goods groups:

- ✓ Groups of goods from **A** category are located in the sector W2 and W3.
- ✓ Groups of goods from **B** category are located in the sector W1 and W3.
- ✓ Groups of goods from **C** category are located in sectors W1.
- ✓ Groups of goods from **X** category are located in all sectors.
- ✓ Groups of goods from **Y** category are located in the sector W1 and W3.
- ✓ Groups of goods from **Z** category are located in sectors W1.

Tab. 5 *The results of the warehouse control*

Sector	Area [m ²]	Area [%]	Storage items	Groups	
W1	64	30,47	5,6,9,12,13,14,15,16,17,18,19, 20,21,22,23,24,25,26,27	B, C	X, Y, Z
W2	56	26,66	4, 10	A	X
W3	42	20	1, 2, 3, 6, 7,8, 11,	A, B	Y, X

It was found out from the physical check that sectors still have a spare capacity.

3.3 Proposal of new location goods

Based on the results from the analyses, from the physical stock control and mutual communications with management, there was created a new proposal of arrangement groups of goods. Proposal for a new location of the goods is based on Table 4. The new arrangement of goods is in Table 6. A comparison of the current situation and the new proposal is shown in Figure 3.

Tab. 6 *Proposal of new location*

Sector	Area [m ²]	Storage items	Groups
W1	64	1,11	AY
		2,3,6,7,9,21	BY
		15,17	CX
W2	56	5,14	BZ
		18,19,22,23,24,25,26,27	CY
		12,13,16,20	CZ
W3	42	4,8,10	AX

4 CONCLUSION

The paper describes one of the possible approaches for rationalization of the allocation of goods in the warehouse. Proposal for a new location of the goods brings new solutions other partial problems, such as particular allocation of specific groups of goods in each sectors of the warehouse, evaluation of logistic activities carried out in warehouses, regular monitoring of the capacity usage of storage positions and warehouse operations performance by using selected indicators, such as indicators of productivity, efficiency, quality, etc. [8]. It is necessary to evaluate and forecast the consumption of goods in a warehouse at regular intervals [9].

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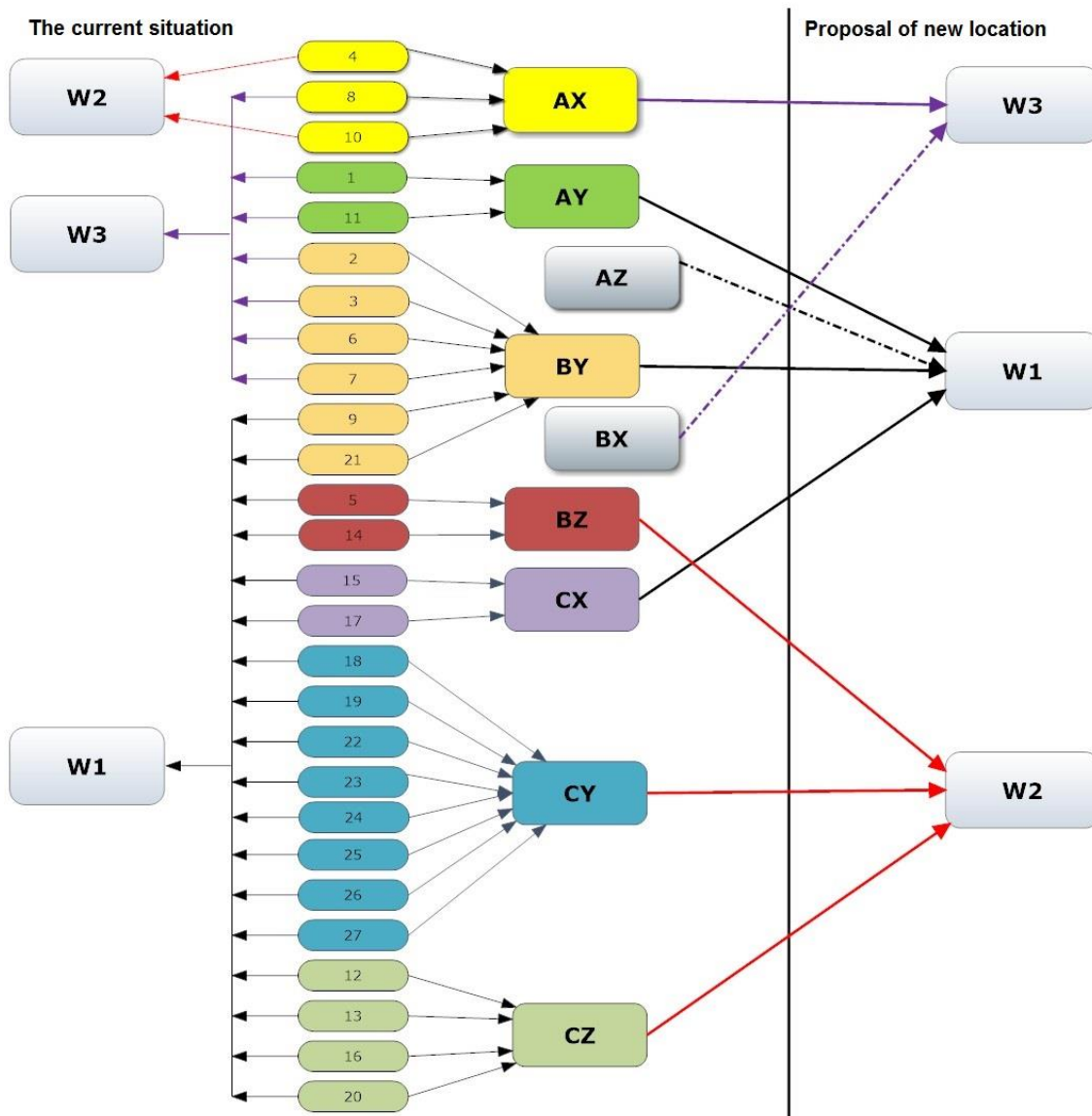


Fig. 3 A comparison of the current situation and the new proposal

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