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Designing the Logistics Center Structure Using the Systematic Layout Planning

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***Abstract*— The Systematic Layout Planning (SLP) method is widely used for the design of production systems within industrial enterprises. At the same time, the use of this method is rather limited in the sphere of service provision. Due to the fact that the logistics center (LC) is a set of interconnected units, this method can be implemented to design the optimal location of all logistics structures. In accordance with the neighboring relationship of logistic and non-logistic (administrative) interrelations of the logistics center's work units, the article authors solve the problem of locating structural units and propose an optimal plan for their placement for more efficient logistics activities. This method implementation is illustrated by the example of a logistics center, the construction of which is planned in the Orenburg region, Russia.**

Keywords*— *Project; Systematic Layout Planning; Layout; Logistics Center.

1. Introduction

The effectiveness of the logistics center depends on its reasonable planning and design besides the other factors. Optimal layout of functional areas using the appropriate method is the basis for the design of logistics centers. It is necessary to use a method in these situations, known as the Systematic Layout Planning (SLP) method; it was proposed by R. Muther [1].

The method involves the development of a matrix of mutual relations, reflecting the degree of preference for each production object on relation to all the others separately. A scheme of mutual relations (relationship) between individual objects is developed on the basis of this matrix; it is similar to the graph of material flows. Then, this scheme is corrected until a satisfactory arrangement of objects is obtained.

Mostly this method is used at the designing the location of the work units of industrial production. However, the logistics center also consists of divisions that support its work. Many researchers [2–21] used this method of equipment placement to obtain positive results in certain areas of logistics.

2. Research Method

The construction of a large logistics center in the Orenburg region seems to be necessary in connection with the increase in the volumes of transit trade flows. Produced and implementing common consumption goods are transported, processed and stored by several major regional distributors for retail sale and two distribution centers of federal trade networks.

Planned logistics center consists of (1) office space (including for rent), (2) service areas, (3) security service, (4) server service, (5) place of acceptance / sorting, (6) heated warehouse, (7) cold warehouse, (8) platform for packing, (9) place of delivery.

The intensity of the work units is divided into five levels: A, E, I, O, U and X, where A is the absolute importance of interaction, E is especially important, I is important, O is preferable, U is unimportant, X is undesirable.

3. Results and Discussion

Application of SLP method provides for the implementation of a number of stages:

1) analysis of logistical (Table 2) and non-logical (Table 3) relationships between the various work units.

Let's define values of ranging of intensity of logistical and non-logistical relationships. We take A = 4, E = 3, I = 2, O = 1, U = 0, X = -1.

Table 1 provides an analysis of the logistical relationships between the main divisions.

Table 1. Matrix of logistical relationship of work units.

Unit	1	2	3	4	5	6	7	8	9
1. Office space		U	U	U	U	U	U	U	U
2. Service areas			U	U	U	U	U	U	U
3. Security service				U	U	U	U	U	U
4. Server service					U	U	U	U	U
5. Place of acceptance / sorting						A	A	O	U
6. Heated warehouse							O	O	U
7. Cold warehouse								O	U
8. Platform for packing									A
9. Place of delivery									

The greatest degree of correlation is claimed between the premises serving the logistics flow (Table 2). Also it was determined the necessity of separation of such premises as the place of acceptance / sorting and platform for packing; this is due to the need of monitoring received and delivered products.

Table 2. Matrix of non- logistical relationship of work units.

Unit	1	2	3	4	5	6	7	8	9
1. Office space		E	I	I	U	U	U	U	U
2. Service areas			O	O	U	U	U	U	U
3. Security service				I	U	U	U	U	E
4. Server service					U	U	U	U	U
5. Place of acceptance / sorting						O	O	O	U
6. Heated warehouse							U	U	U
7. Cold warehouse								U	U
8. Platform for packing									A
9. Place of delivery									

2) determination of the relative importance of logistical and non-logical relationships. The ratio of this logistics center is 1:1; since only the joint work of all units will be able to provide a high level of logistics services;

3) total matrix of relationships between the work units of the logistics center after the calculations is presented in Table 3.

Table 3. Total matrix of relationship of work units.

Unit	1	2	3	4	5	6	7	8	9
1. Office space		E	I	I	U	U	U	U	U
2. Service areas			O	O	U	U	U	U	U
3. Security service				I	U	U	U	U	E
4. Server service					U	U	U	U	U
5. Place of acceptance / sorting						A	A	I	X
6. Heated warehouse							O	O	U
7. Cold warehouse								O	U
8. Platform for packing									A
9. Place of delivery									
Total									

The matrix shows the relationship degree of work units taking into account both logistical and non-logistic relationships. The obtained result is the basis for forming the internal plan of the logistics center.

Figure 1 shows a relationship diagram of work units of logistics center. Communications degree between units is indicated in the figure by lines.

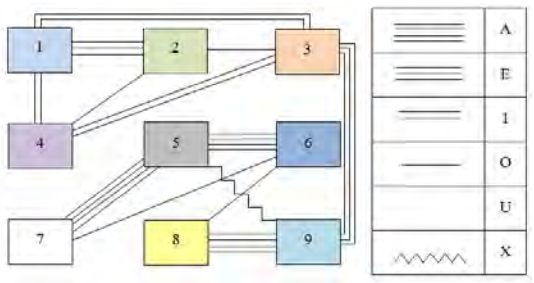

Fig. 1. Unit relationship diagram.

Figure 2 shows the total result of the location of logistics center divisions without taking into account their planned area.

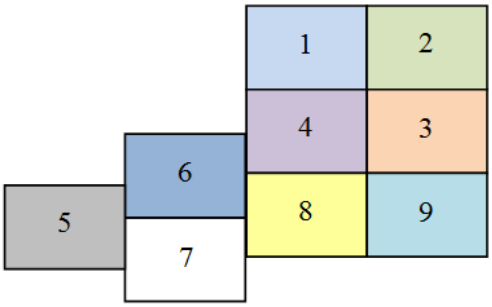

Fig. 2. Location of units of logistics center.

The common goal of planning the internal layout of the logistics center units is to optimally build a combination of material space, equipment and personnel for more efficient work. It is also indispensably to evaluate received plan after its implementation to change the application of individual premises as necessary.

At present, the logistics center in the territory of the Orenburg region is only planned to be built. So there is no information on its planned area. However, this study can be considered complete, since further work should be carried out taking into consideration more complete information and features of the territory of the logistics center.

4. Conclusion

The optimization of the material space, the location of equipment and personnel during the process of implementing logistics functions is the result of the most appropriate allocation of the logistics center with the help of the Systematic Layout Planning (SLP). Effective allocation of work units helps to reduce the overall costs of performing logistics operations, simplify the internal transport routes, reduce the distance between similar work units and avoid the irrational logistical flows.

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