CONSTRUCTION OF CONTACT POINTS NETWORK FOR ECOMMERCE

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Abstract

Internet represents easy way to access global shopping opportunities. E-shops offer their customers various goods and services and after buying, they try to quickly distribute them to their clients. Some customers have a problem with electronic way of communication and distribution of goods. They want to pick up their goods directly from the seller or they should know where is the place for goods claim. These places are contact points of e-shops.

This paper is dedicated to construction the real e-commerce contact points network through discrete allocation models. The contact points network consists from the nodes and links. The information about the orders of existing customers was used as a weight of the network nodes and network shortest road distance was used as a value for the links. The three variants of location of e-commerce contact points were found by using the facility location method (p-median). The all variants represent the opportunity for the best location of contact points in the conditions of Slovakia. The selected variant that will be applied in practice depends on company management.

Keywords: Network design, ecommerce, contact points network

1. INTRODUCTION

Nowadays, the customer wants select goods without having to go to a shopping center or a classic shop, he wants to participate on ecommerce. It means that the brick and mortar shops are replaced with a virtual space where sellers are presenting goods and services in the form typical for the electronic environment. In most cases, ecommerce is mainly understood as sales or provision of services in the Internet environment. Despite the fact that sales in brick and mortar shops are currently declining also due to the development of electronic shopping, a large number of online sellers still consider them very important. For many e-shops, brick and mortar shops represent so-called showrooms, where they can display their products [1]. This allows for better interaction with the customer and that is why the majority of on-line retailers combine their business with traditional brick and mortar shops. When setting up a brick and mortar shop, first, it is necessary to understand, where are our potential consumers and related suitable placement of contact points with customers [2]. Distribution logistics serves to find answers and solutions to these logistical issues (construction of contact points network for e-shop).

Distribution logistics, also known as logistics of distribution, ensures the physical, organizational, and informational interconnection between the source of the enterprise and the consumer, its entrance warehouse or point of receipting the goods [3]. Its task is to ensure the most suitable method, analysis, selection, and implementation of all activities, strategic and other decisions related to providing products to the customer in a way, where smooth operation of the market is ensured [4]. Distribution logistics solves how to determine the topology of the company's distribution system, distribution networks system, and using the placement of distribution elements, it solves the design of the distribution region. All of these issues solved by distribution logistics form the whole distribution system of the enterprise [3]. We can use this distribution logistics theory not for construction distribution network, but for construction e-shops´ contact points network.

2. ANALYSIS

Ecommerce gained worldwide popularity in recent years. The connection of an e-shop with a classic brick and mortar shop has existed for some time, however from the customer's perspective, brick and mortar shops are perceived differently today than they were in the past. Graduate interconnection of the electronic and the classic brick and mortar shop create three combinations of the two ways of selling [5]:

- e-shop with a classic brick and mortar shop,
- e-shop as a superstructure of a classic brick and mortar shop,
- e-shop cooperating with a network of existing brick and mortar shops.

Alza is one of the most successful e-shops in the Slovak market in terms of turnover, volume of offered goods, and quantity of offered range. Alza.sk is an example of an e-shop with classic brick and mortar shop operating in the Slovak market. It uses these brick and mortal shops (11 contact points and 6 delivery boxes in Bratislava) as a contact points with the customers that prefer personal contact with the seller.

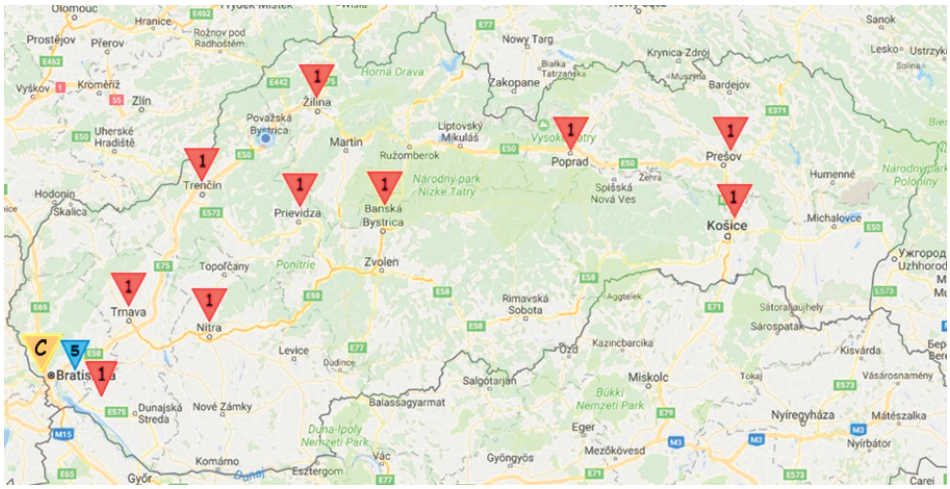

Figure 1 Network of contact points of e-shop Alza.sk [5]

The NAY Company is the largest retailer of consumer electronics in the SR with a market share of about 25%. Nay.sk is an example of an e-shop as a superstructure of a classic brick and mortar shop operating in the Slovak market. Firstly, they built the network of brick and mortar shops (36 traditional shopping stores) and later, they constructed e-shop to use Internet as a new distribution channel.

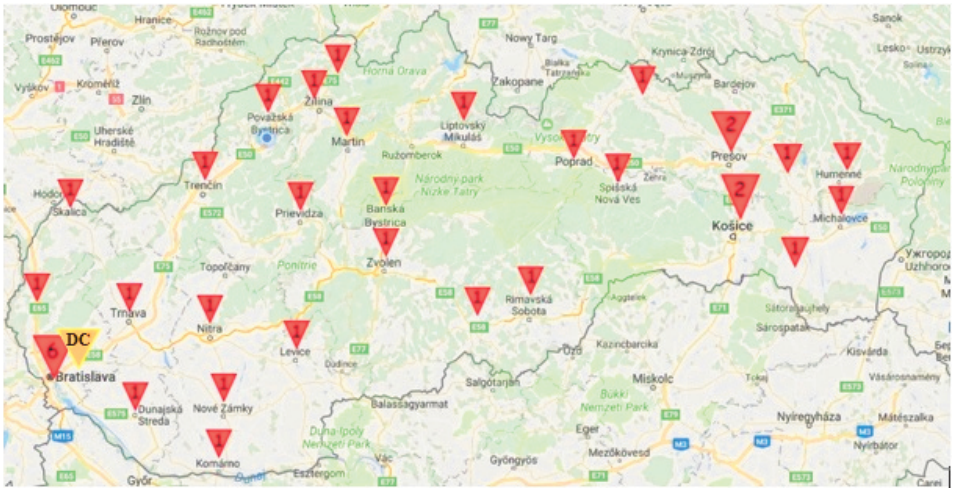

Figure 2 Network of contact points of of e-shop Nay.sk [5]

Another possibility how an e-shop can get closer to customer, who prefer personal pick-up of goods is the cooperation with a network of existing brick and mortar shops. One of the reasons for the cooperation is high cost for building own brick and mortar shops. The method of cooperation is characterized by various shops, which have their own network of brick and mortar shops, provide e-shops their operations as distribution or pick-up points (gas stations, grocery stores, newsstands, etc.). In Slovakia, e-shops without their own classic brick and mortar shops or without own pick-up place use delivery companies to deliver their goods [6]. The largest company authorized to provide services in operations owned by another company, so-called franchising, and the largest number of distribution points in Slovakia is the DHL company (more than 600 parcelshops and 6 depots).

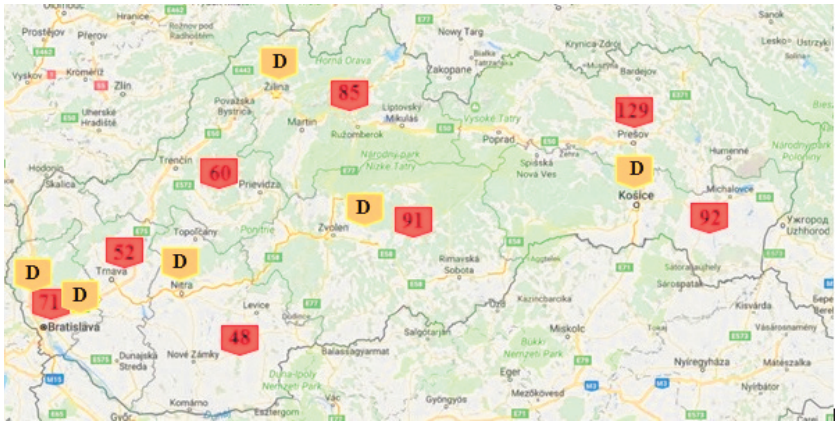

Figure 3 Network of contact points (distribution network) of DHL Slovakia [5]

3. OBJECTIVE AND METHODOLOGY

The main goal of this paper is to propose a specific position for the placement of contact points network for real e-shop in the territory of Slovakia using the methods of operational analysis. The result of this goal is to achieve a suitable position of the e-shop´s points of contacts with customers in a specific space, which has a significant impact on sales. For this reason, we need to created new network, that is based on the idea: “to be as close as possible to the customers”.

4. RESULTS

The network of contact points can be defined as a set of elements interconnecting the customers space, which includes all the contact points, transportation means, and the transportation network representing a model of the solution. The transportation network consists of two basic objects. The first are network nodes, which in our case are represented by cities and towns, where customers originate, who use the e-shop the most often [7,8,9,10]. The second are segments connecting two nodes of the network, which represent the existing road infrastructure between two places, city and town or two towns.

The management of the e-shop provided data on all possible cities and towns, from which they had orders in the past three years. Together there are as many as 473 potential nodes for the placement of contact points, therefore it is necessary to reconsider whether specific nodes are suitable for this placement as soon as possible. When optimizing the number of nodes, it is necessary to consider the weight of individual node. Therefore based on statistical characteristics the arithmetic mean method seems to be the most suitable and most useful [6]. Using the calculated value of the arithmetic mean, it is possible to accurately determine, which nodes of the contact points network are below this value, which determines unfitting cities and towns for the placement of a warehouse and contact point of given electronic store [10]. Nodes, which are below the value

of the arithmetic mean, need to be optimized. The optimization of these undersized nodes can be done in two ways: the proposed node of the network for optimization is assigned to the neighboring node, which is closest to it or two or more neighboring nodes proposed for optimization are merged to create one new node of the network.

Performed optimization re-evaluated all nodes and the total number of nodes, i.e. 473, was reduced to 83. These 83 cities and towns represent nodes, which are suitable for the placement of an e-shop contact points. The transportation network is an edge and node weighted graph G (V, H, c, w), in which elements of the V set are called graph nodes and elements of the H set are called graph edges. For each node is assigned a w number, so-called weight of the node and each edge is assigned a c number, representing the length of the edge [7,8,9]. Model of the e-shop´s contact points network consists of 83 nodes and the nodes will be connected by 206 edges. The model of the electronic shop network created by the designated and calculated values of the parameters of the G (V, H, c, w), graph is depicted in **Figure 4**.

Figure 4 Model of e-shop's contact point network [5]

After creating the model of network, it is possible to address the localization tasks using discrete allocation models, which will be used to look for the optimum placement of contact centers of given electronic shop. Before we begin to find such best location and optimal number of contact centers, it is necessary to select the correct allocation model. Since the goal is to find the minimum number of contact centers, which under set criteria would serve all peaks with minimum costs, or all cities and towns with the highest number of customers of given e-shop, the p-median model seem to be the most suitable [10]. After defining input and decision variables of the p-median allocation model, it is possible to address the application of chosen model to find the exact number of contact centers under chosen covering distance [7,8,9]. The covering distance is the maximum distance that e-shop customers are willing to travel in order to pick up the ordered goods or buy the necessary goods at the e-shop´s contact points. Because such data does not have a given e-shop, we have concluded that we will consider 50 km, 70 km and 100 km in three options for the location of e-commerce contact points. This decision was consulted with e-shop management.

Option A

The formulated p-median model shows that it is necessary to place 37 contact centers to cover all requirements of the nodes and under the covering distance of 50 km. (See **Table 1**). Contact centers placed in this way will serve all 340.590 nodes requirements representing revenue from sales of products. The average weighted

distance between the distribution centers and covered nodes of the transportation network of the electronic shop is 6.01 km.

Option B

In Option B, we will look for such an optimal number of contact points and their location to cover all requirements of the e-shop's nodes at a cover distance of 70 km. To cover all requirements nodes at covering distance of 70 km should be placed 17 contact centers, while the average weighted distance between the nodes and covered allocated local node is 16.06 kilometers. In the resulting network model, the total number of allocated contact centers has been reduced compared to the A variant. This can lead to optimization of the cost of building a network of e-shop contact points.

Option C

Option C will look similar to the previous two alternatives for finding an optimal number of contact centers at a distance of 100 km. By using the p-median allocation model, we found that for the Option C, eight contact centers are needed at a covering distance of 100 km to cover the demands of every node. The average weighted distance of all covered nodes is 28.25 km.

5. CONCLUSION

By modelling individual variants for the optimum placement of the contact points center of the electronic store we have obtained sufficient information for the proposal of a new contact network of an electronic store, which will be beneficial especially for given e-shop (see **Table 1**).

Table 1 Results of allocation contact points centers with different covering distances

Covering distance	**50 km**	**70 km**	**100 km**
Number of contact centers	37	17	8
Locations of contact centers	Košice, Bratislava, Žilina, Banská Bystrica, Bytča, Nitra, Piešťany, Martin, Trnava, Prešov, Štvrtok na Ostrove, Poprad, Levice, Prievidza, Pezinok, Bardejov, Brezno, Humenné, Nové Zámky, Michalovce, Spišská Nová Ves, Zvolen, Čadca, Dunajská Streda, Senica, Ružomberok, Púchov, Lučenec, Sereď, Rožňava, Dubnica nad Váhom, Malacky, Komárno, Partizánske, Krompachy, Tvrdošín, Kráľovský Chlmec	Košice, Bratislava, Žilina, Nitra, Prešov, Poprad, Levice, Prievidza, Dolný Kubín, Nové Zámky, Michalovce, Zvolen, Púchov, Sereď, Rožňava, Michalová, Myjava	Košice, Bratislava, Žilina, Nitra, Poprad, Michalovce, Zvolen, Myjava
Average weighted distance of all covered nodes	6.01 km	16.06 km	28.25 km

After consulting the e-shop management, we concluded that given the financial difficulty of building 37 or 17 contact centers, it is preferable for the e-shop to build an eight contact centers. That is because the average weighted distance (the average distance between the contact center and the weighted nodes) under this placement of the center is higher (but acceptable), and the contact centers are situated in main centers of Slovakia, where the e-shop has most of its customers. Similarly, it is also with operating costs, so at the eight contact points it is necessary to spend less of the costs associated with their operation and operation, as in Option A - 37 centers.

Figure 5 Proposed allocation of e-shop's contact point network [5]

For all three variants, the e-shop could use the option of a business franchise model based on cooperation with businesses with their own network of sites. Nevertheless, e-shop would rather have its own customized contact centers this option was rejected. Proposed contact points network constructed in this way is a prerequisite for further successful existence of the e-shop in the market place.

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REFERENCES

[1] COREJOVA, T., IMRISKOVA, E. Convergence at the postal market. *Eksploatacja i niezawodnosc-Maintenance and reliability*. Vol. 1, No. 3, 2008, pp. 74-76,

[2] VACULÍK, J. & KOLAROVSZKI, P. & TENGLER, J. Possibility of RFID in conditions of postal operators, *Radio frequency identification from system to applications*. 2013, Rijeka, p. 397-450

[3] STRAKA, M. & FILL, M & BESTA, P. Methods Designing As Support of Logistics Systems Activity. In: *CLC 2015: Carpathian Logistics Congress - Conference Proceedings*, 2016, p. 497-501

[4] DROŹDZIEL P. & KOMSTA H. & KRZYWONOS L.: An analysis of unit repair costs as a function of mileage of vehicles in a selected transport company. *Transport Problems*, nr. 4 vol. 9, issue 3, Politechnika Śląska, Gliwice, 2014.

[5] HOŠTÁKOVÁ, D.: *Design of the contact and distribution centers of electronic trade*. Diploma Thesis. University of Žilina, 2017

[6] MADLEŇÁK, R., MADLEŇÁKOVÁ, L., ŠTEFUNKO, J. The optimization variants of postal transportation network. In: *Proceedings of International Conference "Reliability and Statistics in Transportation and Communication*". Riga: TSI. 2014. pp. 34-41

[7] DASKIN, M. S. *Network and discrete location: Models, algorithms and applications*. Hoboken: John Wiley & Sons, 2013

[8] HAKIMI, S.L. Optimum Location of Switching Centers and the Absolute Centers and Medians of a Graph. *Operations Research*. 1964. Vol. 12, pp. 450 - 459.

[9] DRESNER, Z., HAMACHER, H. W. *Facility Location; Applications and theory*. Berlin, Germany: Springer. 2002, pp.81-107.

[10] MADLEŇÁK R., MADLEŇÁKOVÁ L., PAVLIČKO M. *Postal Transportation Network: Design and Construction*. Žilina. Žilinská Univerzita, 2014