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Design of Polish Logistics Network

Dariusz Grzesica^{a,*}

^a*Institute of Construction and Transportation Engineering & Management, Transport Section,
Cracow University of Technology, Cracow, Poland*

Abstract

On the basis of the assumptions it can be concluded that customers in the selected area procure the nearest center. Each client within the Voronoi diagram cell is closest to the designated center than the other one. Polygons created by dividing differ from Polish administrative division. The Regions resulting from the Voronoi cell division of polish are convex polygons.

Application of Delaunay triangulation divides a network into triangles with as little corners. The result of this procedure is to obtain a minimum distance between centroids. This reduces the transport time and minimizes the costs of delivery. In the work the aspects of client subjective assessment in making decisions about the choice of the distribution center has been omitted i.e. the price of the product, the quality of the offer or the actual transport.

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1. Introduction and background

When designing the logistics network in a specific region, you should consider many factors: economic, financial and technical-organizational, which often contradict each other. The achievement of profitable financial results is determined through the technical specifications related to the definition of entities in the logistics network. The relationship between the entities must be efficient. Therefore, it is necessary to look for new solutions to meet changing economic conditions. Elementary grid and graphic techniques can be used, in certain situations, to determine *where* specific facilities should be located [Magee et al., 1985]. The difficulty in locating this entity is the need for adapting

* Corresponding author. Tel.: +48 12 628 30 49.

E-mail address: dgrzesica@pk.edu.pl

the theoretical results to the economic practice. Facility location is an important subject with numerous practical applications, thus a happy medium must be found between theory and practice. The basic question may be to decide how to choose from the known feasible locations, or coordinates for a location, in which a "facility (facilities)" will be placed, and how to assign the "customers" to this facilities [Sule, 2001].

Therefore determination of the theoretical value, must be strengthened by practical aspects. The choice of location is determined by the following economic criteria:

- volume of the logistics market,
- the attractiveness of the investment project for investors,
- prices and availability of land,
- availability of transport infrastructure and communication,
- labour availability and educational level of workers,
- purchasing Power [Fechner, 2004].

In addition, you should still take into account the expectations of the recipients of the products. Therefore, the following appropriate assumptions must be considered:

- the price of a particular good or service is the same at every site,
- the cost of acquiring the good or service is equal to the price plus the cost or transportation to the site,
- the cost of transportation to a site equals the Euclidean distance to the site times a fixed price unit distance,
- consumers try to minimize the cost acquiring the good or service [Berg et al., 2000].

In light of the above considerations, this proposal will be submitted to the design of the logistics network on the basis of the method which is still not used in the field of logistics management.

The cargo turnover growth in the economy forces entities to organize supply chains in a manner that ensure product availability in the selected region. The location of cells in the network guarantees product availability in a particular market. An important issue from the point of view of spatial distribution is the location of distribution centres in order to ensure an efficient flow of goods. The use of such methods is justified solves the issue. This article shows how to design the logistics network of Poland, taking into account administrative division. Highlighted specifically were the issues of determining the center of population gravity of some parts of the country and areas with the largest proximity in relation to it. In the first place the centres should be determined on the basis of individual voivodships of Poland, using the method of center of population gravity. You must then specify the area, which relies on data center distribution using the Voronoi diagram. In turn, on the basis of the dual graph of Voronoi diagrams, it is necessary to create a supply network of Poland. Methods fit properly into the perspective of the functioning of supply chains. The main result of the methods used in the article is the division of Polish territory into zones with clearly delineated center and make connections between them, about the structure of the triangle, characteristic for network logistics. The proposed approach may find application in various fields of knowledge, at micro and macro scales. In the case of logistics networks subject to the application of this approach in the micro scale projection is in fact the route between centroids designated theoretically.

2. Methodology

For the design of the logistics network, the entire territory of Poland has been used. In each region were defined coordinates of the districts and towns on the rights of the districts, which represent a possible point of receipt of goods. It also defines the level of the population of each of them. In total, the database includes 380 districts and covers the entire territory of the country. The proposed method is able to serve all residents through the placement of sale points in each region, representing the distribution centers. In each of 16 voivodships, depending on the population of certain districts and cities with the rights of the districts, designated the center as the point of greatest availability of the cargo. When regions are in consideration, an important aspect is the way of measuring the distance between a demand region and a facility [Kara et al., 2015]. For this purpose, the method of center of population gravity was used. The data required for this are shown in the matrix (1).

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