METHODOLOGY OF DETERMINATION OF THE LOCATION OF THE LOGISTIC STEELWORKS PRODUCT DISTRIBUTION CENTER

One of the modern methods of distribution management is distribution center. A combination of ABC analysis, discriminatory analysis and customer classification are a basis in this article for the determination of a strategic group of customers and location of a logistic distribution center for a steelworks.

Key words: *distribution, distribution center, steelwork products, discriminatory analysis location*

Metodologija određivanja lokacije logističkog distributivnog centra proizvoda čeličane. Jedna od modernih metoda upravljanja distribucijom je distribucioni centar. Kombinacija ABC analize, analize diskriminacije i klasifikacije kupaca su u ovom članku osnova za određivanje strateške grupe kupaca i lokacije distribucionog centra za neku čeličanu.

Ključne riječi: *distribucija, distribucioni centar, čelični proizvodi, diskriminatorska analiza lokacije*

INTRODUCTION

The sales of its own products to achieve profits are a basis for the functioning of an industrial enterprise. It has been long known, however, that an agent achieves the greatest financial benefits in distribution processes. This is due to the fact that the agent does not engage capital in many-year investments (or does it to a lesser extent than a production enterprise), and the rate of his stock rotation is only limited by the agent's merchandising capabilities, his convincing abilities, or sometimes the capacities of flow of goods to the end user.

All over the world, steel manufacturers strive for conducting mercantile activity within their own structures so as to maximize profits and achieve the highest possible profitability. A link commonly occurring in the distribution structures of the world's steelmaking concerns are steel trading centers, or steelworks product distribution centers, which provide the highest quality and a wide range of offered products and services and their constant availability to customers.

Such units assure full control of the steel market, and owing to the direct contact with the end customer, allow better identification of market needs and flexible adaptation to those needs.

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The Polish steel market enjoys high attractiveness to the world's concerns [1].

This is due to the fact that the average consumption of steel in Poland is 180 kg per capita, while in the European Union this index amounts to nearly 400 kg, which, on the verge of Poland's accession to the EU, creates great possibilities of steel distribution. In this situation, it becomes purposeful to focus steelworks activities on creating a developed product distribution structure.

Taking over greater control of the market by steelworks, organizing trading centers or making use of aggressive marketing measures is also one of the ways towards limiting the imports of steel products to Poland and an opportunity for improving the Polish metallurgical sector.

The characterization of the present distribution system, identification of the group of strategic customers and determination of the logistic center of steelworks product distribution are the first steps to be taken within the transformation of the steel manufacturer distribution system.

THE DISTRIBUTION CENTER AND ITS TASKS

When observing the development of distribution structures in the world's metallurgy, steelworks (or metallurgical concerns) making endeavors to take over commercial functions can be noticed. This is associated with the size of profits that a production enterprise can gain by giving up the agents and developing its own distribution structures.

A logistic distribution center is a unit that deals, above all, with the sale of a steelworks' products and their distribution to customers.

The tasks of a typical distribution center include, on the one hand, receiving materials designed for production in its parent company and, on the other hand, servicing of customer demand (turnover and storage of material goods outside the processing centers). Moreover, the functions of receiving materials and products, and their service, selection, completion and dispatch [2].

The central role of the distribution center in the logistic system is to conduct activity-making products available, and to optimize the time of the order delivery cycle (by maintaining a specified level of stocks and connections with transport problems).

Associated with the proper operation of the steelworks product distribution center are the following functions: unloading, receiving, storage, sorting materials according to orders, completion of orders, preparation of dispatch and loading.

Steel trading centers, in addition to the above-mentioned tasks, are also involved in the processing of metallurgical industry products. These may include: coiling, warm and hot plastic working treatments, stamping, application of coatings, punching, shot and sand blasting, painting of sections, straightening and cutting of sheets, rods and wire rods to dimensions, assembly of finished reinforcements, laser cutting out of shapes, etc.

The purpose of establishing a distribution center is, on the one hand, to overcome gaps occurring between the manufacturer and the customer, which limit the sales volume, and on the other hand, to increase customer satisfaction.

CHARACTERISTICS OF THE STEELWORKS PRODUCT DISTRIBUTION CENTER

The metallurgical enterprise under study is the manufacturer of continuous castings and rolled products. The final products of the steelworks are delivered to the market through the organized distribution system. The sale of products is affected through sales offices, respective for particular groups of products.

Main links occurring in the steelworks distribution channels are: the manufacturer, a dealer, a sub-dealer and processors being the steelworks' end users (see Figure 1.).

Particular distribution channels are distinguished by different requirements from customers, and a different length and width. Depending on the purchasing power, market position and order volume, customers can negotiate more advantageous contract conditions, e.g. product prices (discounts) or delivery times.

In the analyzed enterprise, short distribution channels, being typical for industrial goods, characterize the distribution structure.
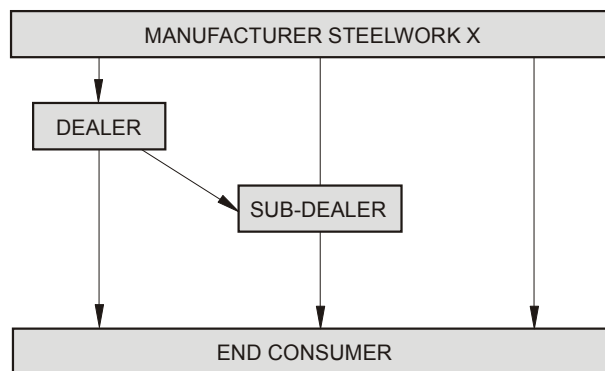

Figure 1. **Steelwork products distribution channels**
Slika 1. **Lanci distribucije proizvoda čeličane**

METHODOLOGY OF DETERMINATION OF THE LOCATION OF THE LOGISTIC STEELWORKS PRODUCT DISTRIBUTION CENTER

In order to determine the location of the logistic steelworks product distribution center, a strategic group of customers was separated, for which a forecast of the volume of purchases in the following period was made. Then, based on this forecast and the geographical position of customers, the location of the distribution center was set (Figure 2.).

For the identification of the strategic group of customers, the classification of customers was used, within which two divisions were made: the first, by customer size – the basis was ABC analysis; and the second, by customer importance to the steelworks – here the basis was the class of customer importance, defined by using discriminatory analysis.

ABC ANALYSIS

ABC analysis is used in the evaluation of the effect of different customers on an enterprise's sales volume. By using ABC analysis, we can estimate the share of customers in the sales and their contribution to the company's profits.

The aim of ABC analysis was to divide the purchasers of the steelworks' products into the following three basic groups:
- group A -customers, whose purchase volumes, as measured quantitatively, are very high and account for 70 - 80 % of the shares in the domestic sales of a given product; this group is of the greatest importance for the existence and functioning of the manufacturer;
- group B - customers, whose purchase volumes are medium, accounting for 15 - 20 % of the shares in the domestic sales of a given product; this is a group of intermediate importance;
- group C - customers, whose purchases of the steelworks' products make up the remaining several percent (5 - 10

%) of the sales of a given product; they do not present significant importance for the steelworks' product distribution process.

The basis for the division into the groups A, B, C is the share in the volume of annual domestic sales of a given product. With the assumed ranges of percentage shares in the annual domestic sales volume, the number of customers in particular groups was subjected to checking.
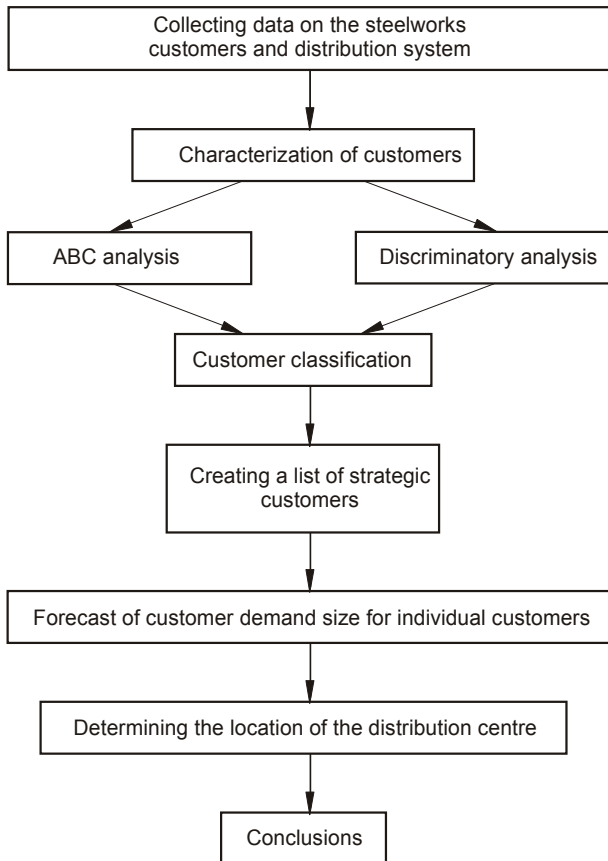

Figure 2.   **Procedure of carrying out examinations and analyses**
Slika 2.   **Postupak provođenja ispitivanja i analiza**

DISCRIMINATORY ANALYSIS

Operating in the conditions of market uncertainty, enterprises should acquire every available information on customers. This knowledge enable them to assess customers, plan future activities oriented to fuller satisfaction of customer needs, and adjust the customer service level to potential profits which may be achieved by the enterprise thanks to the sales of its products (activities undertaken in this area should be based on the analysis of costs incurred for servicing and profits brought in by particular customers, in accordance with the principle which says that the level of profits is to be higher than the level of costs).

Discriminatory analysis was used for assessing customers in respect of some attributes essential from the manufacturer's point of view, other that the volume of purchases made (Figure 3.). Discriminatory analysis re-
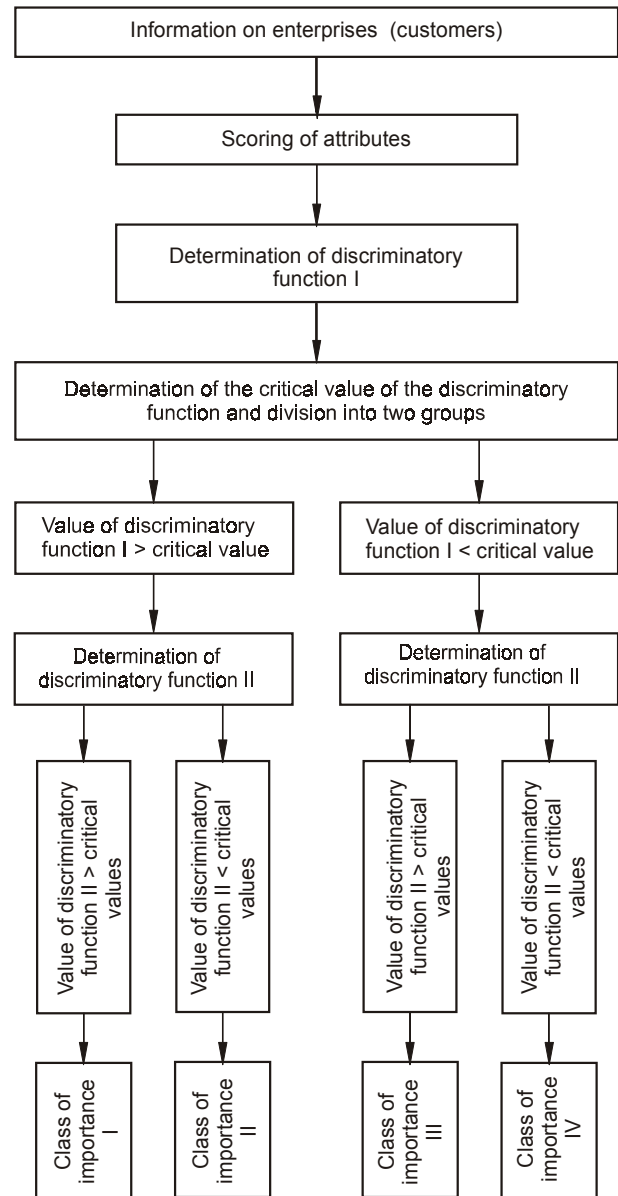

Figure 3.   **Schematic diagram of carrying out discriminatory analysis**
Slika 3.   **Shematski prikaz provođenja diskriminatorne analize**

lies on the assumption that the entire inhomogeneous population of customers can be divided into subsets, which will be characterized by specified characteristics reduced to the form of linear mathematical functions. This means that the whole population of customers can be divided into homogeneous segments, and the interfaces between particular segments will constitute the critical values of the discriminatory function.

Discriminatory analysis was carried out based on information concerning customers and essential for the steelworks. Particular steelworks' customers were subjected to assessment, while using as the factors determining customer importance the following five features recognized as the most important for the steelworks [4]:

- share in the company's supply process,
- regularity of purchases,
- connections with foreign partners,
- the company's renown seen as an outstanding brand or reputation, and
- the company's importance in the trade or processing of a given range of products.

The list of features (attributes) based on which the assessment of importance and discriminatory analysis are carried out may change, depending on the amount and type of information available to marketing functions.

The assessment of enterprises does not take into account the financial aspect of the enterprises, since the policy of payments for purchased products, developed by the steelworks, is that most of customers have no possibility of obtaining a credit or prolongation of payments for those particular products. A small group of customers enjoying the right of prolonged payments are processors, who cannot take the liberty of failing to pay for goods by the deadline, since the steelworks might refuse them further deliveries, thus depriving them of materials necessary for their own production.

After establishing the list of features, two-step division of the customer population was made using discriminatory functions, resulting from the assumed objective of dividing the whole customer population into the following four segments:

- very important purchasers,
- important purchasers,
- purchasers of medium importance, and
- purchasers insignificant for the process of steelworks functioning.

Since the determined function values define the belonging of particular customers to determined segments, they are decisive to the positioning of a customer as a result of division, so the fitting factor is equal to 1.

By using the linear discriminatory function, we can both make division and classification of existing customers, and forecast of which segment a contractor with whom we want to enter into cooperation will belong to.

CUSTOMER CLASSIFICATION

The core of customer classification is summarizing the results of the previous ABC and discriminatory analyses in one matrix and assigning priorities determining the quali-

fication of a customer to the group of strategic importance to specific fields (and thus customers).

When establishing criteria, the following two rules are applicable:

- as the volume of purchases increases, the assigned priority decreases,
- as the customer importance increases, the assigned priority decreases [3] (see Table 1.).

Table 1.   **Example of customer priority matrix**

Tablica 1.   **Primjer matrice prioriteta kupaca**

Class of customer importance	Volume of purchases (group acc. to ABC analysis)		
	A	B	C
I	1	2	4
II	3	5	7
III	6	8	10
IV	9	11	12

The use of customer classification allowed a strategic group of customers to be determined. This group includes customers of the lowest priority (1 - 9), which means the greatest influence on the processes of the steelworks' functioning.

The remaining group of purchasers of service priorities from 10 to 12 was omitted in further consideration as being insignificant for the enterprise management process.

The customer classification matrix can serve in the enterprise for formulating the bases of rational distribution policy, and priorities assigned to respective purchasers can determine a specified - justified level of customer service indices.

The strategic group of customers separated as a result of customer classification numbers 41 purchasers. For those purchasers, a forecast of the volume of purchases in the following periods was made by using the Statistica program. These figures were used for determining the location point of the logistic steelworks product distribution center.

DETERMINATION OF THE LOCATION OF THE STEELWORKS PRODUCT DISTRIBUTION CENTER

The determination of the location point was done based on the analysis of the location and concentration of steelworks product purchasers performed by the network methods. The basic task in the determination of the distribution center location was the problem of the best location, or the one that would take account of investment aspects and parameters associated with the logistic service of processes (in this case, only the outlet) in an optimal manner.

An important factor taken into account in calculations related to the location of the distribution center was the volume of purchasers made by particular steelworks' customers.

Methodology of determining the location of the steelworks' product distribution center:

- making a list of the steelworks' strategic customers with a forecasted volume of transactions over the next year's period,
- setting a rectangular coordinate system,
- determining coordinates in the chosen system for towns, where strategic purchasers are based,
- determining the location point of the distribution center according to the rule of gravitation region centre, from formulae (1, 2, 3), and
- formulating findings and conclusions.

The procedure with rectangular distances and with $c = 1$, was reduced to the minimization of the function:

$$K(x,y) = \sum_{j=1}^{n} b_j \cdot \left(\left| x - u_j \right| + \left| y - v_j \right| \right) \tag{1}$$

As the variables x and y are separated, the minimization of the function $K(x, y)$ will be obtained by searching for a minimum for each of its components separately; after calculations and transformations, we obtain:

$$K_1(x) = \sum_{j=1}^{n} b_j \left| x - u_j \right| \tag{2}$$

and

$$K_2(y) = \sum_{j=1}^{n} b_j \left| y - v_j \right| \tag{3}$$

In our searches for the location, we use the following premises:
a) the location of n customers $- A_j$, expressed by the co-ordinates (u_j, v_j), is known, where $j = 1, \dots, n$.
b) for each customer, we have estimated e.g. annual demand $- b_j, j = 1, \dots, n$.
c) the delivery costs are proportional to:
- volumes (weights) of the transported load, and
- the covered path,
- the unit cost of transport is c (e.g. in Zl per ton or kilometer).

We search for the location $K(x, y)$.

As a result of performed calculations and comparisons, a point of location of the logistic product distribution center has been obtained, which is 17 kilometers off the parent steelworks.

SUMMARY

The studies carried out have shown that the change of the existing product distribution structure should rely on broadening the scope of activity of the steelworks' stockyard. Making use of the available infrastructure: the possessed stores, as well as machinery and equipment, should be regarded as purposeful in the process of creating the distribution center. The organization of this undertaking in the areas owned by the steelworks would not entail any additional costs associated with the purchase of tenure of land, construction or renting of buildings, etc., although outlays for the necessary equipment and arrangement of the steel trading center are unavoidable.

The results of studies and analyses indicate a good market penetration within a few dozens kilometers from the steelworks. Launching the center at the determined point will create a possibility of eliminating dealers and agents active in the immediate vicinity of the steelworks and taking the market over by the manufacturer.

The analysis of the sizes of purchase locations (coupled with market analysis) and customers can be a basis for the determination of another center of steelworks product distribution, which, in its activity, would concentrate not only sales functions, but also elements of supplies, particularly with scrap which is the base of the steelworks' functioning.

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