# 2.9. ACHIEVEMENTS ECONOMIC EFFICIENCY OF MACHINE-BUILDING ENTERPRISE BASED ON INDICATORS COMPETITIVENESS OF ITS PRODUCTS

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First of all, to make a decision about what kinds of products and quality should be produced, at what prices to sell them, what kinds of after sales services should accompany it, is necessary to evaluate and analyze the existing level of competitiveness of the types of products that the company produces; solvency of potential consumers taking into account the capacity of the market of the product and its segmentation.

Therefore, a reasonable choice of the above listed indicators of the enterprise will affect its financial position. But it should be noted that consumers of products pay much attention to its high-quality and price characteristics. The quality of products is a set of indicators that meet the specific needs of consumers of products. There are indicators of product quality, which include technical specifications (power, labor productivity), etc.

Quality is being developed when marketers implement the stage of strategic marketing. After that, the designers create a new design of products, new equipment; if the theoretical questions regarding the principle of its action have not been resolved, then applied scientific research works are executed, and in case of the emergence of theoretical problems of a more general scale, fundamental research works [1, c. 132].

To provide sufficient level quality of products and lower costs for its production, enterprise should use the criteria for choosing innovations that will promote the release of competitive products. To forming prices for a technical product, it's rational to use its dependence on demand and quality indicators. In the presence of a steady tendency to increase demand, the market subsequently reacts to a rise in prices, which causes an increase in supply and at some time there is a balance, that is, the saturation of the market with the product.

At this stage development of society the main price directions of the company is the maximum increase in sales and leadership in quality, which allows maintaining a leading position in the market. The volume of profits is one of the main criteria for choosing a pricing policy for the enterprise. To correctly set the price of a product, that is, setting a price so that this product could be used by consumers and bring profit to the producer, the latter should analyze what prices for the manufactured product can be set on the market, and only then determine which quantity to provide and what markets to go with it.

These times, when a comparatively high level of quality of industrial products is achieved by different producers-competitors and convergence of prices for similar products, as well as reinforcement of goods of various kinds of services, the types (factors) of competitiveness of products are already insufficient. On market environment, a business strategy requires evolving certain commodity and pricing policy, which depends on its financial performance and further activity, as well as on the market.

In order to achieve greater profitability in a segment with low solvent demand, products do not always require high quality and price, and therefore may have a lower level of competitiveness. Estimation the competitiveness of products, reflected in modern economic literature, mainly takes into account quality and price factors. But in market conditions, other factors, which will be taken into account objectively when assessing the level of competitiveness of the machine-building enterprise, are also valid.

Should be noted that there are some areas for estimation the competitiveness of products, taking into account its non-price factor, but so far in the formula for competitiveness of products it is absent. First of all, it is important for the manufacturer of the product to have a correlation between its results (profit from sales of products) and costs, although in the market conditions the company is focused on the consumer who needs to be interested in choosing a particular product. This, in our opinion, can only be achieved by reducing the operating costs of the company's products, as well as providing the consumer before and after production services, that is, the actual ones are the non-price factors of the competitiveness of products.

At the current stage of development of both foreign and domestic enterprises, the convergence of their level of competitiveness due to these factors. Therefore, the logistic factor of the competitiveness of products is used abroad.

Some authors refer to non-price factors as well as product quality. This cannot be accepted, because the quality of products ensures the satisfaction of the needs of

potential consumers and influences the price. But it should be noted that for the competitiveness of the company's products important and non-price factors to which some authors attributed product quality, brand image and reputation of the manufacturer. As known, the price of products affects its quality, therefore, to attribute the latter to non-price factors do not seem possible, cause there is a differentiation of quality relative to market segments [2, p.112].

Therefore, both factors - quality and price - should be highlighted when assessing the competitiveness of products, and their impact on meeting the needs of potential consumers should be taken into account. In this case, there is a need for segmentation of the goods market. And when the product is already purchased, there is a need for the manufacturer's services for the effective operation of the product.

Thus, the quality of non-price competitiveness cannot be attributed to non-price competitiveness factors. In our opinion, it is advisable to include pre - and after sales services of the company into non - price factors of product competitiveness. In case of use of four factors of competitiveness of products - quality, prices, non-price and logistic factors, estimation the competitiveness of products in market conditions will be more accurate.

Proposed to assess the level of competitiveness of industrial products based on the group indicators, which are based on the factors of competitiveness: qualitative, price, non-price and logistic. As non-price indicators of the competitiveness of products can be used [3, p. 79]: the image of the enterprise; the image of the product; before and after sales (service) services of the enterprise; differentiation of production relative to market segments; enterprise's susceptibility to innovations; innovative character of product differentiation. The Group Competitive Index of Non-Pricing ($I_{non-price}$) will look like this:

$$I_{non-price} = \frac{I_{non-price_i} \times R_i}{\sum R_i} \quad (1)$$

Where $I_{non-price_i}$ – single indices for *i*-th indicators of competitiveness of non-price products;

$R_i$ – Coefficient of importance of *i*-th indicator.

First by means of expert assessments the index of non-price competitiveness of products for the products of the Private Joint-Stock Company "Kharkov Tractor Works" was calculated. So the products of the enterprise are grouped according to the main types of nomenclature into three groups and for each of them the separate integral index of the competitiveness of products according to the nomenclature ($K_i$) is calculated. That index is calculated on the basis of group competitiveness indices of quality, prices and non-price and logistic its factors. Indicator of competitiveness of non-price products of the enterprise under investigation is calculated by means of expert assessments with use simple ranking method. Minimum number experts ($n_{\min}$) is determined using the method shown in [4, c. 126]. The average error in the exclusion of one expert is set at 15%. Then the minimum number of expert group will

be ten persons $(16{,}65-13{,}05)/25=0{,}144<0{,}15$. An expert assessment of the non-price competitiveness factor of the product under investigation is given in [3, p. 79].

The evaluation of indicators of relative importance of factors of non-price competitiveness of products shows that the group of experts preferred mainly fourth, second, first and third factors (differentiation of production relative to market segments, image of goods and enterprises, before and after sales services) and less prone consider it expedient to include other factors in the non-price competitiveness of products.

Defined, that the most important factors for calculating the non-price competitiveness of products is the differentiation of products relative to market segments ($x_4$), image of goods ($x_2$), before and after sales (service) services ($x_3$) and image of the enterprise ($x_1$). Other factors - the company's susceptibility to innovations and the innovative nature of product differentiation - are not very significant for their inclusion in the calculation of the coefficient of non-price competitiveness of products.

Estimation the degree of consistency of expert opinions on all factors is carried out with the help of the coefficient of concordance. The coefficient of concordance ($W$=0.9), testifies to the high consensus of expert opinions. Due to the fact that the evaluation of the factors influencing the non-price competitiveness of products by their degree of significance for consumers, the results obtained are meaningful and can be used in further studies and calculations. On the basis of the received sums of ranks the indexes of weighting of the considered factors for consumers for their consideration are considered at estimation of non-price competitiveness of products.

Indicator of non-price competitiveness of products ($I_{non-price}$) calculated for three groups of the product under investigation range. $I_{non-price}=3{,}8\times0{,}177+2{,}6\times0{,}193+3{,}1\times0{,}1183=1{,}77$.

Adapting to the interests of consumers in conditions of intense competition requires companies to improve the quality of service, reduce the time frame for the execution of orders and unconditional compliance with the agreed schedule of supplies; the factor of time and the decrease in the cost of goods movement, along with the quality and price of products, began to determine the success of the operation of the enterprise in the modern market.

In connection with this, the importance of using logistics for the formation of competitive advantages of the enterprise in the market becomes relevant, that is, the definition of certain logistical results and substantiation of the ways of their achievement.

In a situation where the growth of production volumes and the expansion of internal and external ties led to increased costs in the sphere of circulation, the attention of entrepreneurs focused on finding new forms of optimization of market activity and reduction of expenses in this area. Based on the essence and typology of logistics, a formula is proposed for the calculation of the competitiveness index of logistic products [3, c.78].

Logistic factor of competitiveness of products, according to the author of this work, contains four components: Purchasing, Transport, Warehouse, Distribute logistics. Because for an enterprise that produces products an important task is to reduce (minimize) the costs of purchasing raw materials and materials, transporting and storing them, and distribution (spread) manufactured goods among consumers in the market.

Therefore for each direction of logistics, the most important evaluation factors are selected.

- In evaluating procurement logistics, the most important, in our opinion, factors are the price of material and the price of delivery of this material, taking into account the distance (tariff×km).

$$B_{зм} = \sum_{i=1}^{n} \sum_{j=1}^{m} (T_{ap\,ij} \times L_{ij} + Ц_{ij} \times Q_{ij}) \to \min, \quad (3)$$

Where $C_{pl}$ – costs of procurement logistics, UAH;

$i$ – Types of materials; $i = \overline{1,n}$; j – the number of suppliers $j = \overline{1,m}$;

$T_{del}$ – Tariff for delivery, UAH/km;

$L_t$ – Distance of transportation of *i*-th type of material from the *j*-th supplier, km;

$P_{ij}$ –Price of *i*-th type of material from the *j*-th supplier, UAH;

$Q_{ij}$ – Volume of delivery of *i*-th type of material in the *j*-th supplier, UAH.

The choice of the supplier of steel of grade У2, which is used in production of products of company under investigation and other enterprises of mechanical engineering on the basis of calculation of its rating, which were chosen for the choice of the supplier, is considered [6, c.119]. Three companies were selected for the selection of the supplier: OJSC «Zaporizhstal» ($П_3$); PJSC «MMC named Ilyich» ($П_1$); PJSC «Azovstal» ($П_2$). It should be noted that one of the topical factor in choosing a supplier in market conditions is the price at which he can deliver the material to the consumer enterprise. The total cost of transportation is calculated as follows:

$$B_{трансп_{\Sigma}} = V_{пост} \times Ц + B_{трансп}. \quad (4)$$

To evaluate generalized measures consistency expert opinions for all factors of the supplier's choice the coefficient of concordance is used. It should be noted that the consistency of expert opinions is moderate: $W_{П_1} = 0{,}35$; $W_{П_2} = 0{,}4$; $W_{П_3} = 0{,}44$. Consequently, the highest rating has the first supplier who offers the material at the lowest price and is closest to the investigated company (PJSC «Azovstal») [6, c.119]. Such work should be carried out throughout the nomenclature of materials used in the production of products, so the average rating must being calculating, to which its maximum value. In this case, the indicator of competitiveness of products with purchasing logistics will have average more than one. Therefore, the average value was taken at the level of one.

($\overline{\Pi} = \frac{3{,}48 + 3{,}621 + 3{,}302}{3} = \frac{10{,}41}{3} = 3{,}46$ → equals 1). Then, $I_{purch} = \frac{3{,}48}{3{,}46} = 1{,}01$.

- Transport task in its classical form, apply using the criterion minimizing costs, now lost topicality, because in it staging there were n suppliers and m consumers. There are *m* consumers of products and *k* suppliers of raw materials, materials and only one company that being investigated. In this connection, the method of choosing variants of the type of transportation is offered [7, c.120]. Important factors are: time, delivery interval, reliability of compliance with delivery schedule, raw material price, shipping cost. The delivery interval is specified in the supply contract. There is a system in Ukraine providing «to the warehouse», so the delivery time and reliability of compliance with the delivery schedule is not important. Failure to comply with delivery schedules can be eliminated by providing insurance reserves.

The minimum price of raw materials is determined by comparing prices in the supplier's competitors. The cost of transportation tons-km is a defining indicator that can be used as a logistical factor of the competitiveness of products for the system of supply of materials and raw materials «to the warehouse». In table 1 provides initial data on the conformity of the mode of transport with possible criteria.

Table 1

**Evaluation the factors that influence the choice type of transport, point's evaluation**

| Transport's type | Factor | | | | |
|---|---|---|---|---|---|
| | delivery time | delivery frequency | reliability of compliance with the delivery schedule | the ability to deliver goods to any point in the territory | transportation cost |
| Railroad | 3 | 4 | 3 | 2 | 3 |
| Automobile | 2 | 2 | 2 | 1 | 4 |
| Pipeline | 5 | 1 | 1 | 5 | 2 |
| Air | 1 | 3 | 5 | 3 | 5 |

Importance one or the other criterion when selecting the type of transportation is given in the table 2.

Table 2

**The importance of the criterion in the particular case of the choice of the type of transportation of products**

| Criterion | delivery time | delivery frequency | reliability of compliance with the delivery schedule | ability to deliver goods to any point in the territory | transportation cost |
|---|---|---|---|---|---|
| Criterion's weight | 0,2 | 0,09 | 0,1 | 0,11 | 0,5 |

Depending on the importance of this or that factor, the data in table 2 can be changing and receive acceptable choices for each particular case. For its solution, weights of alternatives criteria are recognized. For each level of the hierarchy, a

matrix of pair wise comparisons of dimension $n \times n$ is created, where $n$ – is the number of criteria at a given level. On the basis of the data in Table 2, matrices of pair comparisons for each criterion are compiled (Table 3).

Table 3

**Matrix of pair comparisons for different criteria**

[calculated on the basis of data tab. 2-3]

| | | | | | |
|---|---|---|---|---|---|
| delivery time | | Railroad | Automobile | Pipeline | Air |
| | Railroad | 1 | 1/3 | 5 | 1/5 |
| | Automobile | 3 | 1 | 7 | 1/3 |
| | Pipeline | 1/5 | 1/7 | 1 | 1/9 |
| | Air | 5 | 3 | 9 | 1 |
| delivery frequency | | Railroad | Automobile | Pipeline | Air |
| | Railroad | 1 | 1/5 | 5 | 1/3 |
| | Automobile | 5 | 1 | 1/3 | 3 |
| | Pipeline | 7 | 3 | 1 | 5 |
| | Air | 3 | 1/3 | 1/5 | 1 |
| reliability of compliance with the delivery schedule | | Railroad | Automobile | Pipeline | Air |
| | Railroad | 1 | 1/3 | 1/5 | 5 |
| | Automobile | 3 | 1 | 1/3 | 7 |
| | Pipeline | 5 | 3 | 1 | 9 |
| | Air | 1/5 | 1/7 | 1/9 | 1 |
| ability to deliver goods to any point in the territory | | Railroad | Automobile | Pipeline | Air |
| | Railroad | 1 | 3 | 7 | 5 |
| | Automobile | 1/3 | 1 | 5 | 3 |
| | Pipeline | 1/7 | 1/5 | 1 | 1/3 |
| | Air | 1/5 | 1/3 | 3 | 1 |
| transportation cost | | Railroad | Automobile | Pipeline | Air |
| | Railroad | 1 | 3 | 1/3 | 5 |
| | Automobile | 1/3 | 1 | 1/5 | 3 |
| | Pipeline | 3 | 5 | 1 | 7 |
| | Air | 1/5 | 1/3 | 1/7 | 1 |

The method of reaching the minimum amount is used to select a mode of transport:

$$\sum_{i=1}^{n}(\alpha_i \times \beta_i) \to \min, \quad (5)$$

Where $n$ – number of factors that influence on the choice of the type of transport ($n$=6);

$\alpha_i$ – rating value $i$–th factor on a five-point scale (best score is 1);

$\beta_i$ – specific weight of $i$–th factor.

The values for each type of transport are calculated using formula 5:

$$\sum_{i=1}^{n}(\alpha_i \times \beta_i)_{railr} = 3 \times 0{,}2 + 4 \times 0{,}09 + 3 \times 0{,}1 + 2 \times 0{,}11 + 3 \times 0{,}5 = 2{,}98$$

$$\sum_{i=1}^{n}(\alpha_i \times \beta_i)_{auto} = 2 \times 0{,}2 + 2 \times 0{,}09 + 2 \times 0{,}1 + 1 \times 0{,}11 + 4 \times 0{,}5 = 3{,}08$$

$$\sum_{i=1}^{n}(\alpha_i \times \beta_i)_{pipel} = 5 \times 0{,}2 + 1 \times 0{,}09 + 1 \times 0{,}1 + 5 \times 0{,}11 + 2 \times 0{,}5 = 2{,}74$$

$$\sum_{i=1}^{n}(\alpha_i \times \beta_i)_{air} = 1 \times 0{,}2 + 3 \times 0{,}09 + 5 \times 0{,}1 + 3 \times 0{,}11 + 5 \times 0{,}5 = 3{,}80$$

Determined that the best mode of transport for the transport of goods to rail ($\sum_{i=1}^{5}(\alpha_i \times \beta_i)_{\min} = 2{,}98$), if the enterprise the railway line was raised. Average value – 3,06. To obtain the index of transport logistics competitiveness of products, the average value is considered to be optimal. The indicator of logistic competitiveness of products from transport logistics equal 1,027. ($I_{transp} = \frac{3{,}06}{2{,}98} = 1{,}027$) The obtained results can be used for any tasks, it is enough only to change coefficients of significance of this or that criterion depending on our initial conditions.

- For solution issue, which concerns warehouse logistics in the context of its impact on the competitiveness of products, method of determination the center of gravity is used. This method is used to determine the location of one distribution center outside the manufacturer's production. On the map of potential warehouse locations places a coordinate network system that allows estimating the cost of delivery from the manufacturer to the warehouse and choosing an option that is defined as the center of mass. The coordinates of the center of gravity of freight flows ($X_{whareh}$, $Y_{whareh}$), that is, the point at which the distribution division may be located, is determined by the formula:

$$X_{whareh} = \frac{\sum_{i=1}^{n} V_i \times X_i}{\sum_{i=1}^{n} V_i}; \; Y_{whareh} = \frac{\sum_{i=1}^{n} V_i \times Y_i}{\sum_{i=1}^{n} V_i}, \quad (6)$$

Where n – quantity of enterprises-consumers;

$V_i$ – Volume of sales of the enterprise-producer to the *i*-th consumer enterprise;

$X_i$, $Y_i$ – Coordinates i-th enterprise-consumer.

Coordinates are found the center weights cargo flows that is, the point around which is recommended, based on freight traffic organize the work of the distribution warehouse outside the enterprise-manufacturer, using the data tab. 4:

Table 4

**Sales volume and coordinates of *i*-th consumer enterprise**

[Calculated by the author]

| Enterprise-consumer | Volume of sales of the enterprise-producer of the product to the *i*-th enterprise-consumer, tone | Coordinate X, km | Coordinate Y, km |
|---|---|---|---|
| $П_1$ | 400 | 45 | 19 |
| $П_2$ | 420 | 30 | 50 |
| $П_3$ | 510 | 150 | 120 |
| Average value | | 75 | 63 |
| Optimal location of the warehouse | | 80,5 | 67,5 |

$$X_{whareh} = \frac{400 \times 45 + 420 \times 30 + 510 \times 150}{400 + 420 + 510} = \frac{(18 + 12{,}6 + 76{,}5) \times 10^3}{1330} = \frac{107100}{1330} = 80{,}52 \text{ (km)}$$

$$Y_{whareh} = \frac{400 \times 19 + 420 \times 50 + 510 \times 120}{400 + 420 + 510} = \frac{(7{,}6 + 21 + 61{,}2) \times 10^3}{1330} = \frac{89800}{1330} = 67{,}52 \text{ (km)}$$

Thereby, the best place to locate the warehouse outside the manufacturer is the coordinate point: $X_{whareh} = 80{,}52$ km; $Y_{whareh} = 67{,}52$ km. When deciding on the location of the warehouse, there may be other options, one of which may be the option of location of the warehouse based on arithmetic mean value distance from the manufacturer. The coordinates of the composition obtained as a result of the calculation are as follows: $X_{склад} = 75$ km; $X_{whareh} = 63$ km. (table 4) [8, c.106].

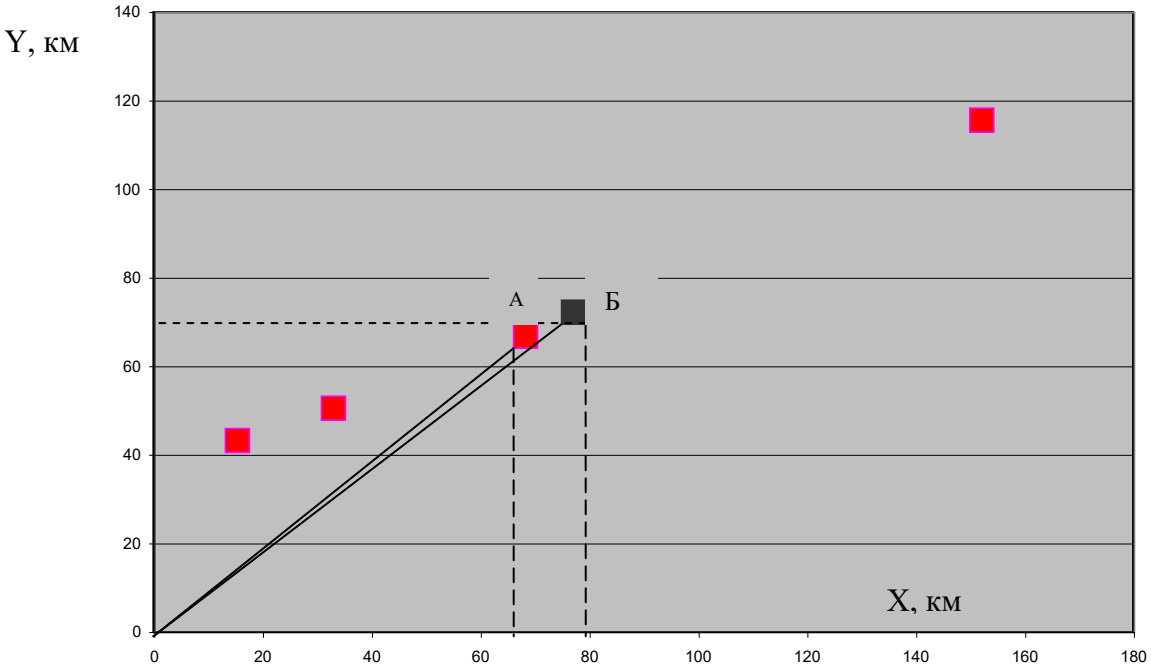


**Figure 1. Location of the optimal space**

To determine the single indicator of logistic competitiveness of products from warehouse logistics build on the graph two triangles with straight angles. For these triangles, the hypotenuse with coordinates of the cathetus constructed earlier is calculated (Fig. 1). The first triangle is built from the beginning coordinate (from the location of the enterprise-manufacturer) to the location of the warehouse, found by the method of the arithmetic mean. The second is built to the location of the warehouse, calculated by the method of weighted average for the volume of sales of the manufacturer. The distances from the warehouse location to the manufacturer (as the hypotenuse of the triangle) are calculated using Pythagoras' theorem.

Consequently, the distance to the structure can be calculated as:

$$0A^2 = 0X^2 + 0Y^2 \quad , \tag{7}$$

$$0Б^2 = 0X^2 + 0Y^2 \quad , \tag{8}$$

Where $0A$ – the hypotenuse of a triangle, found by the method of arithmetic mean;

$0Б$ – Hypotenuse of a triangle, found by the method of weighted arithmetic.

$0A = \sqrt{75^2 + 63^2} = 97{,}9$ (km); $0Б = \sqrt{80{,}5^2 + 67{,}5^2} = 105{,}1$ (km).

Based on the above, single rate of warehouse logistics as a factor of competitiveness of products ($I_{whareh}$) is equal to the ratio of distances optimal and average values of the location of the warehouse relative to the manufacturer:

$$I_{whareh} = \frac{0Б}{0A} = \frac{105{,}1}{97{,}9} = 1{,}07 . \quad (9)$$

Consequently, the index of warehouse logistics competitiveness of products the enterprise is 1.07. This value of the index – 1.07 shows, what the products of the enterprise are is competitive on this factor.

The next step in determining the logistical competitiveness of products is the rationale for its factor - distribution logistics, that is, the choice of channels for the sale of goods. It is necessary to determine the costs of renting and servicing the composition of the finished product of the enterprise (Table 5).

Table 5

**Output data for the justification of the product sales channels of the enterprise**

[Built by the author]

| Indicators | Value |
|---|---|
| Area of the warehouse, $m^2$ | 200 |
| Rent cost 1 $m^2$, UAH. | 100 |
| Costs of rental of warehouse, thousand UAH | 20 |
| The cost of equipment lease, (40% p.3) thousand UAH | 8 |
| Retention and maintenance of the warehouse, (30% p.3) thousand UAH | 6 |
| Total costs, thousand UAH | 34 |
| Sales volume (tractors KhTZ-17021, produced by PJSC «KhTZ»), thousands of pieces | 1920 |
| Unit price, thousand UAH | 199,44 |
| Price per unit of products at a discount of 5%, thousand UAH. | 189,468 |
| Price per unit of products at a discount of 10%, thousand UAH | 179,496 |
| Sales volume (price without discount), thousand UAH | 382925 |
| Sales volume (discount price 5%), thousand UAH | 363779 |
| The discount amount is 5%, thousand UAH | 9,972 |
| Sales volume (discount price 10%), thousand UAH | 344632 |
| The discount amount is 10%, thousand UAH | 19,944 |
| Sales volume (price without discount), taking into account the costs of the warehouse, thousand UAH | 382891 |
| Sales volume (discount price 5%), taking into account the costs for the warehouse, thousand UAH | 363745 |
| The profit of the intermediary (5% discount), thousand UAH | 19146,2 |
| Sales volume (discount price 10%), with expenses for the warehouse, thousand UAH | 38292,5 |
| The profit of the intermediary (discount 10%), thousand UAH | 344598 |

The volume of sales directly by the enterprise-producer (wheeled tractor of general purpose XT3-17021 produced by PJSC «KhTZ»), taking into account retention and maintenance costs of the finished product, will amount to 382891 thousand UAH. To realize the products of the enterprise indirect sales channel (with the help of intermediaries), it is necessary to provide discounts on the price. When

providing a discount of 5% (9,972 thousand UAH), the intermediary's income, taking into account the costs of the warehouse, will amount to 19146.2 thousand UAH. And at a discount of 10% (19,944 thousand UAH), the intermediary's income, taking into account the costs of the warehouse, will amount to 344598 thousand UAH. In the current situation, it is advantageous for the enterprise-manufacture to use a direct channel of product sales, that is, to independently sell products and retention a warehouse. The intermediary could agree to sell the products of the company while holding the warehouse at the same time. Decision-making in this area also depends on the volume of sales and the need to sell products in different directions (the content of one warehouse will not satisfy consumers, and if it is necessary to have several warehouses and the manufacturer can use an indirect channel of sales).

Thus, the single indicator of distribution logistics as a factor in the competitiveness of products ( $I_{distr}$ ):

$$I_{distr} = \frac{V_p}{V'_p}, \tag{10}$$

Where $V_p$ – volume of sales at the enterprise's price (without discount), taking into account the cost of the warehouse, UAH (direct sales channel);

$V'_p$ – Volume of sales of the enterprise (discount price) without consideration for warehouse expenses, UAH (indirect sales channel).

The indicator of distributive logistic competitiveness of products should be greater than one, because the best choice of the channel of sales involves a larger amount of sales, taking into account the costs of retention and maintenance of the warehouse ( $I_{distr} = 1{,}053$ ).

Thus, a single indicator of the distribution factor of the competitiveness of products enterprises is equal to 1,053, that is, if using a direct channel of sales, and then the products of the company are competitive on this factor. Having defined the single indicators of the logistic competitiveness of products, the formula 11 [2, c.78] can be used to calculate the complex index of logistic competitiveness of products with the help of its unit indicators, weighted on coefficients of weight its components:

$$I_{\log} = \sum_{i=1}^{n} I_i \times R_i = I_{зак} \times R_1 + I_{трансп} \times R_2 + I_{склад} \times R_3 + I_{розп} \times R_4 \tag{11}$$

Where $I_i$ – single indices of the logistic competitiveness of production (purchasing, transport, storage and distribution);

$R_i$ – Relevant weighting factors (determined expertly).

$$K_{ks} = I_{qual} \times I_p^{-1} \times I_{non-price} \times I_{\log}^{-1} \tag{12}$$

Integrated Competitiveness Index of estimated product ( $K_{кs}$ ) depends on such factors: quality, price, non-price and logistic and is equal to the product of numbers of the group indices of the competitiveness of the product in terms of quality, price, non-price and logistic factor [2, p.113; 9, p. 122], which methodically differs from the integral index of competitiveness of the products. To plan the level of a complex

indicator of product competitiveness, it is possible to use the reserves of changes in the level of competitiveness of products by the factors under consideration (quality, price, non-price and logistic).

Analyzing the influence of the factors of formula (12) on the competitiveness of products, it can be argued that, firstly, the quality and the non-price factor are directly proportional, and the price and logistic factor are inversely proportional; and secondly, each of the above factors of product competitiveness affects it to varying degrees. Competitiveness indicators for quality and prices are given in Table 7. So it is possible to calculate the complex indicator of the competitiveness of the product of the investigated enterprise [5, c. 79].

Table 7

**Data on the complex indicator of the competitiveness of products in three groups of products nomenclature of PJSC «KhTZ»** [calculated by the author]

| Nomenclature product groups | $I_{qual}$ | $I_p$ | $I_{non-price}$ | $I_{\log}$ | $K_{ks}$ |
|---|---|---|---|---|---|
| T-150K | 0,98 | 0,84 | 1,21 | | 1,04 |
| KhTZ-17021 | 0,99 | 1,12 | 1,77 | | 2,04 |
| KhTZ-2511 | 0,96 | 0,99 | 1,15 | | 1,14 |
| Average value | 0,98 | 0,98 | 1,38 | 1,04 | 1,41 |

The analysis of Table 7 showed that the average value of the complex indicator of the competitiveness of products in three product groups of products of PJSC «KhTZ» is 1,41. The average value of the indicator of competitiveness of quality is 0.98, that is, the qualitative indices of the investigated products experts estimated lower than one. The high level $K_{ks}$ is associated with the high importance of the non-price competitiveness, which reflects the influence of the non-price factor on the competitiveness of products in a market economy.

Currently, the non-price factor in the process of assessing the level of competitiveness of products is practically not used, therefore its level, calculated without its consideration, does not objectively reflect the specific situation on the market.

Summing up outlined above conclude that the use of the non-price and logistic approach as factors of increasing the competitiveness of products implies that decisions taken in relation to purchasing, transportation and storage of products should also be considered from their influence on the formation of costs and profits of the enterprise. The proposed approach for calculating non-price and logistic factors for ensuring the competitiveness of products will provide a more accurate assessment of the level of competitiveness of domestic products by accounting for expenses associated with the movement of goods. Work in this direction is promising, especially for products sold on the foreign market [10, c. 68].

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