

EVALUATION OF THE LEVEL OF THE COMPETITIVENESS AND LABOR POTENTIAL OF INDUSTRIAL ENTERPRISES BY MEANS OF THE INTEGRAL INDICATOR

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Abstract. *The purpose* of the article is to improve the methodology for the evaluation of the level of the competitiveness and labor potential of economic units by means of the integral indicator that allows industrial enterprises to determine the efficiency of available resources, the company's position in the market, as well as to increase their competitive advantages. *The object of the research* is theoretical-methodical and practical approaches to the formation of labor potential in the process of increasing the competitiveness of industrial enterprises. *Methodology.* Complex integral indicators of competitiveness and labor potential were determined by means of the mechanism developed by the author of the article on the foundation of the Fishburne method. This method assumes that with respect to the level of the significance of structural components, only the intervals of their possible values are known. The author proposes a structure that consists of six components: the indicators of the activity of the enterprise, the indicators of business activity, liquidity, financial stability, profitability and property status. The next stage involves normalizing the indicators of the competitiveness and labor potential of the industrial enterprise and assigning weights to each structural component. The weights served as the basis for the calculation of the complex integral (generalized) indicator of competitiveness that evaluates the level of attractiveness of the enterprise on the market. The author also calculated the integral indicator of the labor potential of the investigated enterprise. This complex indicator characterizes the current generalized state of the staff and its ability to reproduce. The *results* of the calculation of the integral indicators of the enterprise made it possible to determine the relationship of labor potential with the optimal level of competitiveness. The *practical significance of the obtained results* consists in the elaboration of the author's methodology for determining the integral indicator, which can be used to predict the level of competitiveness and develop an appropriate program for the further development of industrial enterprises in the short term. *Value/originality.* Improvement of the mechanism for assessing the level of competitiveness and labor potential of economic units by means of the integral indicator will allow industrial enterprises to strengthen their competitive position in the global market.

Key words: integral indicator, competitiveness, labor potential, normalizing the indicators, Fishben's method, Harrington's desirability scale.

JEL Classification: J23, C53, E27

1. Introduction

When assessing the level of the competitiveness of an enterprise, we should consider the set of the indicators that characterize various aspects of its financial activities rather than individual indicators. An integral indicator allows taking into account all aspects of the phenomenon under study. It makes possible an in-depth analysis that takes into account main strengths and weaknesses. The integral indicator of competitiveness is one of the generalizing indicators that characterize

the potential of the enterprise and the efficiency of use of available resources. On its basis, the position of an individual enterprise on the market can be determined. So, the primary task of any enterprise is the complex assessment of its competitiveness.

2. The methodology of the calculation of integral indicators

Integrated indicators of competitiveness and labor potential serve as the basis for making

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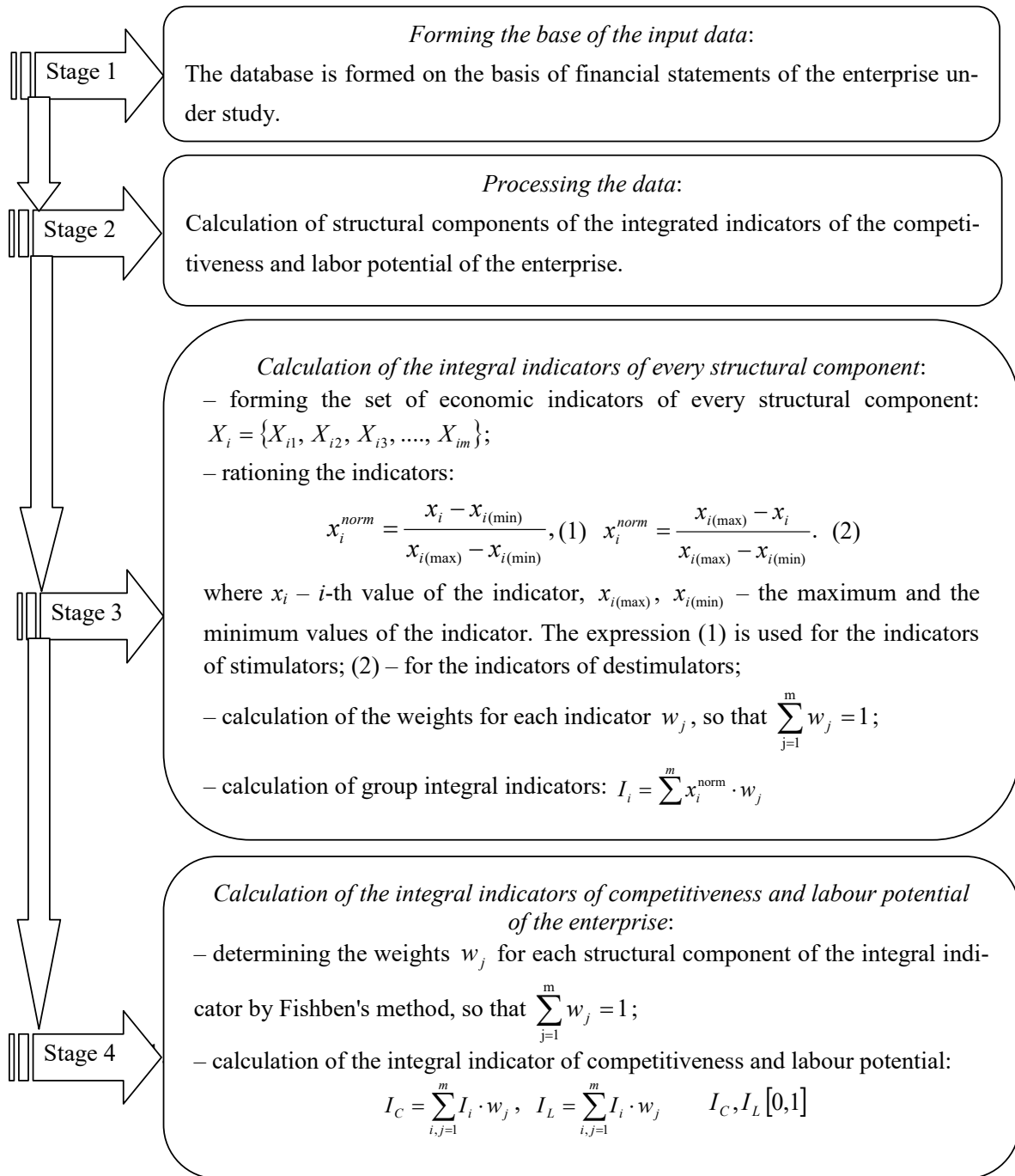


Figure 1. Stages of determining the integrated indicator

justified management decisions and improving the methods of staff management. In this article, we propose to calculate integrated indicators in four stages (Figure 1).

The proposed mechanism for assessing the integrated indicator of competitiveness and labor potential is implemented on the example of the industrial enterprise LLC "Zaporizhzhia Titanium and Magnesium Plant" (Zaporizhzhia, Ukraine). The financial and labor indicators used in the

calculation of the generalized integral indicator are formed on the basis of the annual financial statements (balance sheet, profit and loss account, statement of cash flows and statement of equity).

The competitiveness is characterized by a number of indicators that determine the efficiency of the use of the resources available to the enterprise. The author proposes the structure that consists of six components: indicators of the activity of the enterprise, indicators of business

activity, liquidity, financial stability, profitability and property status. Indicators of the activity of the enterprise reflect net income, profit / loss, costs per hryvnia sales. The efficiency of the use of the enterprise's assets is characterized by indicators of business activity. Liquidity indicators show the reliability of the enterprise and the efficiency of its financial activities in the short term. Indicators of financial stability characterize the level of financial risks. The efficiency of the enterprise is evidenced by profitability indicators. Indicators of property status characterize the efficiency of the production assets of the enterprise.

3. Normalizing the indicators

According to the proposed structure of the integral indicator of the competitiveness of an industrial enterprise, we formed an array of statistical data for each individual structural group. To bring the data to dimensionless values, normalizing is required. It was made with the use of the formulas shown in Figure 1 (Bakhrushin, 2011; Medvedev, 2013). After normalizing the initial data, the weights of indicators in each group were determined. In the analysis of the structural components of the integral indicator of competitiveness, it was found that with this strategy of the development of the studied enterprises, all indicators that characterize individual structural components are equipotent, that is, have the same impact on the group integral indicator. Therefore, the weight of each individual economic indicator is calculated as follows: $w_j = 1/m$, where m is the number of the indicators that relate to j -th structural component. If the development strategy changes, the weights should be revised. The results of normalizing the data and calculating group integral indicators are adduced in Table 1.

The first structural component of the integrated indicator of competitiveness are indicators of the activity of the enterprise, which characterize the level of income and the cost of production. When analyzing the dynamics of this integrated indicator, we should take into account that in 2015, there was its steep decrease (by 74.6%). This decrease was due to the decrease in the net income from sales by 40%; in 2015 and 2016, the company operated at a loss, which caused the current dynamics of the group indicator. Generally, from 2014 to 2020, the indicator decreased by 20%, primarily due to

the decrease in the net profit of the company from 34 273 thousands UAH to 2 605 thousands UAH, and to the increase in the cost of goods by 2.3 times.

The group integral indicator of business activity shows how effectively the company uses its assets. During the analyzed period, this indicator decreased by 27.4% – from 0.465 in 2014 to 0.337 in 2020. This was due to the decrease of the transformation ratio by 13%, of the ratio of the turnover of inventories by 40.7%, and of the ratio of the turnover of receivables by 39.1%. So, the current trend shows the decrease in the number of cash flows invested in inventories and revenues. However, the group contains an indicator with a positive trend – the return on assets, which increased from 2014 to 2020 by 11.1%. which in turn indicates an increase in revenue per unit of production assets. This indicates an increase in revenue per a unit of productive assets.

Before 2019, the integral group indicator of liquidity did not exceed 0.2 until 2019; then there was a rapid growth due to the increase in the ratio of current, rapid, and absolute liquidity. So we can conclude that the enterprise under study is capable, if it were needed, to eliminate the existing short-term debt instantly. Generally, the value of the group integral indicator of liquidity has increased 4.8 times in seven years.

The integral indicator of financial stability was decreasing until 2018, with the average decrease 12.3% annually. In 2019, there was a sharp increase in the indicator by 2.5 times. It was due to the growth of the ratio of the enterprise's own funding of its current assets, the ratio of its working capital to inventories, and the ratio of financial stability. However, it should be noted that LLC "Zaporizhzhia Titanium and Magnesium Plant" depends on long-term liabilities, as evidenced by the relatively high value of the financial leverage ratio, and exceeds the allowable value by 3 times (in 2019 – $0.76 > 0.25$). So, the company has significant financial risks.

The dynamics of the integrated indicator of property status is fluctuating. The maximum increase of 2.3 times was recorded in 2019; it was caused by the increase in the asset mobility ratio by 2.41 times. So LLC "Zaporizhzhia Titanium and Magnesium Plant" has the potential to convert its assets into liquid assets. The depreciation rate of fixed assets decreases, which indicates a decrease in the depreciation of fixed assets. The share of fixed assets in all assets also has a decreasing trend;

Table 1

The normalized indicators that constitute the integral indicator of competitiveness of LLC "Zaporizhzhia Titanium and Magnesium Plant"

Indicators		Years						
№	Notation key	2014	2015	2016	2017	2018	2019	2020
Indicators of the activity of the enterprise								
1	Net profit	0,190	0,020	0,123	0,435	0,572	0,631	1,000
2	The cost of goods sold	1,000	0,931	0,913	0,675	0,525	0,402	0,000
3	Gross profit (loss)	0,999	0,001	0,439	0,924	0,991	0,822	1,000
4	Net profit (loss)	0,735	0,070	0,295	1,000	0,449	0,649	0,638
5	Expenditures on hryvnia sales	1,000	0,067	0,571	0,843	0,843	0,771	0,786
I _{AE}		0,785	0,200	0,354	0,733	0,676	0,655	0,685
Indicators of business activity								
1	Transformation coefficient	0,412	0,000	0,941	0,868	1,000	0,265	0,250
2	Return on assets	0,560	0,429	0,000	0,055	0,802	0,275	1,000
3	Capital intensity	0,176	1,000	0,265	0,206	0,029	0,147	0,000
4	Inventory turnover ratio	1,000	0,491	0,814	0,772	0,569	0,000	0,108
5	Receivables turnover ratio	0,639	0,205	0,815	0,497	1,000	0,168	0,000
6	Depreciation rate of fixed assets	0,000	0,889	1,000	1,000	0,889	0,444	0,667
I _{BA}		0,465	0,502	0,639	0,566	0,715	0,216	0,337
Indicators of liquidity								
1	Current ratio	0,450	0,039	0,000	0,116	0,062	1,000	0,946
2	Rapid liquidity ratio	0,125	0,091	0,068	0,148	0,000	1,000	1,000
3	Absolute liquidity ratio	0,060	0,000	0,000	0,040	0,440	1,000	0,920
4	The ratio of short-term receivables and payables	0,160	0,120	0,060	0,380	0,000	0,960	1,000
I _L		0,199	0,062	0,032	0,171	0,126	0,990	0,966
Indicators of financial stability								
1	Ratio of current assets with own funds	0,664	0,102	0,000	0,328	0,182	1,000	0,985
2	Maneuverability of own working capital	0,000	0,875	0,875	0,866	0,904	1,000	1,000
3	The ratio of own working capital stocks	0,604	0,114	0,000	0,297	0,271	1,000	0,996
4	Coefficient of financial autonomy	0,967	0,350	0,000	0,300	0,100	1,000	0,983
5	Coefficient of financial dependence	0,254	0,210	1,000	0,198	0,000	0,255	0,254
6	Financial leverage ratio	0,746	0,790	0,000	0,802	1,000	0,745	0,746
7	Equity maneuverability ratio	0,230	0,180	1,000	0,184	0,000	0,246	0,245
8	Coefficient of financial stability	1,000	0,278	0,093	0,185	0,000	0,963	0,944
I _{FS}		0,558	0,362	0,371	0,298	0,307	0,776	0,769
Indicators of property status								
1	Share of fixed assets in all assets	1,000	0,880	0,880	0,640	0,520	0,040	0,000
2	Depreciation rate of fixed assets	0,077	0,058	0,231	0,000	0,115	1,000	0,885
3	Asset mobility ratio	0,000	0,029	0,139	0,229	0,229	1,000	0,918
I _{PS}		0,359	0,322	0,417	0,290	0,288	0,680	0,601
Indicators of profitability								
1	Return on equity	0,332	0,301	0,380	1,000	0,059	0,300	0,298
2	Profitability of production assets	0,691	0,020	0,857	1,000	0,524	0,677	0,670
3	Profitability of sales by gross profit (gross margin)	1,000	0,014	0,576	0,846	0,843	0,766	0,783
4	Profitability of sales on operating profit (operating margin)	0,866	0,240	0,459	1,000	0,724	0,610	0,682
5	Profitability of sales at net profit (net margin)	0,893	0,345	0,510	1,000	0,734	0,819	0,814
6	Operating cost-effectiveness	0,837	0,478	0,368	1,000	0,645	0,414	0,549
I _P		0,770	0,233	0,525	0,974	0,588	0,598	0,633

on average, it decreased by 12.5% annually. This indicates that the funds invested in fixed assets are declining every year.

The integral indicator of profitability is volatile; so in 2015, there was a sharp decrease in its value (by 69.7%), the next two years there was its growth by 125.3% and 85.6%, and in 2018, there was again the decrease by 39.6%. In general, during the period of the study, the integral rate of return decreased by 17.8%. The analysis of the causes of this dynamics shows that the sharp fluctuations were due to the decrease in the net profit per the unit of value of productive assets. The profitability of sales and the profitability of expenses have similar dynamics. So we can conclude that the efficiency of the enterprise is satisfactory.

After calculating the group integral indicators, we have to determine the weights of each structural component, using the Fishburne method (Fishburne, 1978). This method assumes that with respect to the significance level of the structural components, only in the intervals of their possible values are known, i. e. $a_i \leq w_i \leq b_i, i = \overline{1, m}$. With respect to the developmental strategy of the enterprises un-der study, a group of experts identified the possible intervals of their significance:

$$w_1 \in [0,179; 0,504]; w_2 \in [0,098; 0,436]; w_3 \in [0,198; 0,405];$$

$$w_4 \in [0,188; 0,654]; w_5 \in [0,089; 0,404]; w_6 \in [0,199; 0,605].$$

Having established the limits of possible intervals for each structural component, we can calculate the significance of the i -th group by the formula:

$$w_i = a_i + \frac{1 - \sum_{i=1}^m a_i}{\sum_{i=1}^m (b_i - a_i)} \cdot (b_i - a_i), \quad i = \overline{1, m}$$

where $a_i < b_i, i = \overline{1, m}, \sum_{i=1}^m a_i \leq 1, \sum_{i=1}^m b_i \geq 1, m$ is the number of the indicators.

This formula can also be used to calculate the weights of the structural components. The following condition is fulfilled:

$$\sum_{i=1}^m w_i = 0,187 + 0,106 + 0,203 + 0,199 + 0,097 + 0,209 = 1.$$

On the basis of the weights of structural components of the integral indicator of competitiveness, the complex integrated indicator can be calculated. It reflects the level of attractiveness of the enterprise on the market according to the financial pa-rameters of its activities.

4. Analysis of the integral indicator on the Harrington desirability scale

To interpret the obtained results of the level of the integral indicator of competitiveness, we use the Harrington desirability scale, as adduced in Table 2 (Harrington, 1965).

Table 2

The Harrington desirability scale

Indicator range	The evaluation of the level of the integral indicator
[0; 0,2]	"very bad"
[0,2; 0,37]	"bad"
[0,37; 0,63]	"satisfactory"
[0,63; 0,8]	"good"
[0,8; 1]	"very good"

In our analysis of the dynamics of the integral indicator of competitiveness, we should note that there is a trend of growth in the last two years. Thus, its value increased by 57.6% from 2018 to 2019, and by 2% from 2019 to 2020. On average, the level of the integral indicator grew by 12.5% annually. During the study period, the integral competitiveness index of LLC "Zaporizhia Titanium and Magnesium Plant" ranges from 0.255 in 2015 to 0.692 in 2020. So, according to the Harrington Desirability Scale, the overall competitiveness indicator for the last two years is at a good level.

One of the most important resources of any enterprise is labor resources. That is why there is a need to determine a generalized indicator that would characterize the efficiency of labor potential. It is the integral indicator of labor potential that characterizes the current generalized state of staff and determines its ability to reproduce. Labor potential is part of the economic potential and affects the performance of the enterprise and its competitiveness.

Next, let us calculate the integral indicator of the labor potential of the enter-prises under study. This comprehensive indicator characterizes the current generalized state of staff and determines its ability to reproduce. According to the available statistics of the labor report, the author grouped seventeen indicators of labor potential into four groups.

The first group of indicators characterizes the number of employees of the enterprise and reflects the total number of employees and the number of

employees of industrial production staff, labor productivity per employee, the number of hired and fired employees, the growth rate of labor productivity. The second group characterizes the level of income and includes such factors as the wage fund, the average salary of one full-time employee and the growth rate of the average salary. The third group characterizes the relative indicators of staff turnover, namely: staff turnover ratio, lapse factor, staff variability ratio and staff sustainability ratio. The fourth group characterizes the staff and includes data on the number of workers, managers, specialists and employees, as well as industrial and production personnel and non-industrial group.

To determine the integral indicator of labor potential, we use the proposed methodology (see Figure 1), according to which the first stage involves normalizing the initial data and calculating the group integral indicators. They were calculated under the condition that all structural components in each group are equipotent, i.e. their impacts on

the consolidated indicator are the same. In the first group, the weights equal $w_i = \frac{1}{6} = 0,167$, in the second group – $w_i = \frac{1}{3} = 0,333$, in the third and the fourth groups – $w_i = \frac{1}{4} = 0,250$. The results of normalizing and calculation of the group indicators are shown in Table 3.

According to Table 3, the integral indicator that characterizes the number of employees is growing. Thus, during the study period, its value increased by 72.8%; on average, this figure increased by 9.7% annually. This increase was due to a 4.4 – fold increase in productivity. Also, it should be noted that the number of employees of industrial production staff until 2019 decreased annually by an average of 2%.

The group integral indicator that characterizes the level of income also has a growing trend. In 2020, as compared to 2019, the value of this indicator increased by 2.8%; and compared to 2014, the increase was 4.15 times. This increase

Table 3

Normalized indicators that constitute the integral indicator of labor potential of LLC "Zaporizhzhia Titanium and Magnesium Plant"

Indicators		Years						
N ^o	Notation key	2014	2015	2016	2017	2018	2019	2020
Indicators that characterise the number of staff								
1	Number of employees	0,000	0,136	0,244	0,570	0,935	1,000	0,819
2	Number of employees of industrial and production personnel	1,000	0,879	0,749	0,440	0,070	0,000	0,145
3	Productivity	0,000	0,110	0,281	0,361	0,372	0,648	1,000
4	Accepted	0,462	0,185	0,308	0,708	1,000	0,892	0,000
5	Released	0,040	0,247	0,080	0,240	0,647	0,000	1,000
6	Growth rates of labor productivity	0,721	0,887	1,000	0,304	0,000	0,983	0,877
I _{NS}		0,370	0,407	0,444	0,437	0,504	0,587	0,640
Indicators that characterise the income level								
1	Remuneration fund	0,000	0,064	0,160	0,346	0,483	0,589	0,847
2	Average salary	0,000	0,063	0,148	0,303	0,454	0,712	0,754
3	The growth rate of average wages	0,569	0,000	0,174	0,799	0,424	1,000	0,764
I _I		0,190	0,042	0,161	0,483	0,454	0,767	0,788
Indicators that characterise staff turnover								
1	Staff turnover ratio	0,130	0,029	0,232	0,464	0,565	1,000	0,574
2	Lapse factor	0,619	0,762	0,619	0,190	0,429	0,000	1,000
3	Staff variability ratio	0,083	0,056	0,167	0,583	0,385	0,972	0,324
4	Staff sustainability ratio	0,043	0,171	0,600	0,686	0,654	0,000	0,229
I _{ST}		0,219	0,254	0,404	0,481	0,508	0,493	0,532
Indicators that characterise the staff								
1	Workers	0,887	0,863	0,721	0,390	0,020	0,000	0,208
2	Managers, specialists, employees	0,784	0,927	0,839	0,605	0,250	0,040	0,000
3	Industrial and production staff	0,954	0,879	0,749	0,440	0,070	0,000	0,145
4	Non-industrial group	0,207	0,000	0,379	0,172	0,345	0,448	1,000
I _S		0,708	0,667	0,672	0,402	0,171	0,122	0,338

was due to the growth of the payroll and the average salary of employees by 38.2% and 24.1%, respectively, as compared to 2019. The average wage growth rate is 20%.

The value of the group integrated indicator that characterizes the turnover of staff for the studied period increased from 0.219 to 0.532. This group of indicators characterizes the change of staff of the enterprise. The analysis of the structural components of this integrated indicator shows the following:

- the staff sustainability ratio averages 81.3%, and the staff turnover rate – 19%, which indicates that the company is permanently renewing its staff;
- the staff turnover ratio averages 8.7%, which in turn indicates the destabilization of the psychological climate in the collective.

The value of the group integrated indicator, which characterizes the staff before 2019, has a decreasing trend; every year this indicator decreased by 26.3% on average. In 2020, as compared to 2014, it decreased by 52.2%. The current trend is explained by the decrease in the number of workers by 9%, industrial and production staff by 11%, and management by 15%.

According to the proposed methodology of determining the generalized integral indicator (Figure 1), at the next stage, we should determine the weights of each structural component. The calculation of the weights is performed according to the Fishburne method. Taking into account the developmental strategies of the studied enterprises and the opinions of a group of experts, the possible intervals of their significance were identified as follows:

$$w_1 \in [0, 203; 0, 436]; w_2 \in [0, 255; 0, 604];$$

$$w_3 \in [0, 195; 0, 405]; w_4 \in [0, 258; 0, 654].$$

The following condition is satisfied:

$$\sum_{i=1}^m w_i = 0,220 + 0,281 + 0,211 + 0,288 = 1.$$

So, we can conclude that the labour potential of LLC "Zaporizhia Titanium and Magnesium Plant" is on the satisfactory level. This indicator characterizes the level of the labor potential of an industrial enterprise. The value of the integral indicator for the studied period increased by 49% and amounted to 0.572. Therefore, we can conclude that the labor potential of

LLC "Zaporizhzhia Titanium and Magnesium Plant" is at the satisfactory level.

The analysis of the structure of the integral indicator of labor potential reveals the following significant changes:

- the share of the personnel sub-index decreased from 52.9% to 17% due to the reduction of the number of personnel of the enterprise;
- the share of the sub-index of the number of employees increased by 3.5% due to the growth of labor productivity per employee;
- the share of the sub-index of the income level increased by almost 25% due to the growth of the wage fund;
- the share of the staff turnover sub-index increased by 7.6%.

5. Findings

The results of the calculations show that the integral indicator of the competitiveness of the analyzed enterprise ranges from 0.446 in 2015 to 0.692 in 2020. The integral indicator of labor potential for the period under study varied from 0.385 in 2015 to 0.582 in 2018. That is, the analyzed company has a satisfactory level of labor potential, which indicates inefficient management work and insufficient use of staff. One of the main problems that hinder the development of the labor potential and competitiveness of the enterprise under study is the difficult economic and political situation in Ukraine due to the hostilities in the east of the country and the consequences of quarantine restrictions.

6. Conclusions

The article presents a methodical approach to assessing the level of the competitiveness and labor potential of metallurgical enterprises by determining the optimal structure of the integral indicator that characterizes the level of the labor potential and competitive position of an individual enterprise on the market.

The author's complex methodology of assessing the level of competitiveness and labor potential of the enterprise on the basis of the integral indicator allows to identify the shortcomings and negative trends in the management of the quantitative and qualitative components of labor potential, to reveal the causes of its inefficient formation and use, to develop the

measures for improving its characteristics, and to assess the level of its competitiveness in general. The use of this technique will direct the attention of enterprises to the most important factors and

modification of their values depending on the specific situation. This will allow to increase the efficiency of their labor potential management and competitive advantages.

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