

Economic Mechanism of Industrial Enterprise Resources Management Efficiency Assessment

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Abstract

The gist of this article boils down to a model for assessing the economic potential of chemical enterprises. The article is very urgent nowadays because we propose a model for assessing the economic potential of enterprises in this sector. Chemical enterprises occupy a significant place in the economy as they have a significant impact on the performance of related industries. The article comments on the formation of economic mechanisms for assessing the effectiveness of resource management of industrial enterprises. To develop a mechanism for optimizing economic resources seven enterprises located in the territory of the Ural Federal District were selected. The selection was carried out according to the type of economic activity. The authors propose a model for assessing the economic potential of chemical enterprises, develop a methodical approach and a scale of resource potential that will allow us estimating various options for the use of resources, identify reserves for competitive development of enterprises. A methodical approach and a scale of resource potential being developed, it is possible to evaluate various options for the use of resources and to identify reserves for the competitive development of enterprises. The activity of any enterprise is aimed at maximizing financial results. To achieve this goal it is necessary to distribute resources available to the economic entity considering the influence of the macro environment. A comprehensive analysis of the rationality of resource management can be carried out using the integrated assessment model.

Keywords: Methodical approach; Resources; Enterprise; Management efficiency; Chemical industry.



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1. Introduction

It is known that chemical enterprises occupy a significant place in the economy, as they have a significant impact on the performance of related industries. At present, the mechanism for managing the resources of chemical enterprises remains weak, and with the aim of optimizing it we propose a model for assessing the economic potential of enterprises in this sector. The application of the developed methodology and the scale of resource potential will allow us to evaluate various options for using resources and to identify reserves for the competitive development of enterprises. The term «rationality» in the broadest sense means rationality, meaningfulness, the opposite of irrationality. To say more: the characteristic of knowledge in terms of its compliance with certain principles of thinking (Aswath, 2002; Choi and Mueller, 1992; Damodaran, 2007; Fouquet and Pearson, 2006; Scholtens and Van, 2003)

The organization of rational use of production resources is considered to be systematically implemented system of measures, the task of which is scientifically based, the most optimal quantitative and qualitative combination of production resources in a single production process to ensure the achievement and implementation of the objectives of the enterprise.

It is believed that the problems of assessing the optimization and efficiency of resource management are interrelated (Bakanov and Sheremet, 1997; Tronin, 2015).

This is determined by the fact that in the process of optimization there is a transition from less effective options to more efficient ones. The most significant goal of analyzing the economic resources of an organization is to assess their availability, dynamics, quality and productivity.

The purpose of this paper is the formation of economic mechanisms for assessing the effectiveness of resource management of industrial enterprises in the Urals Federal District.

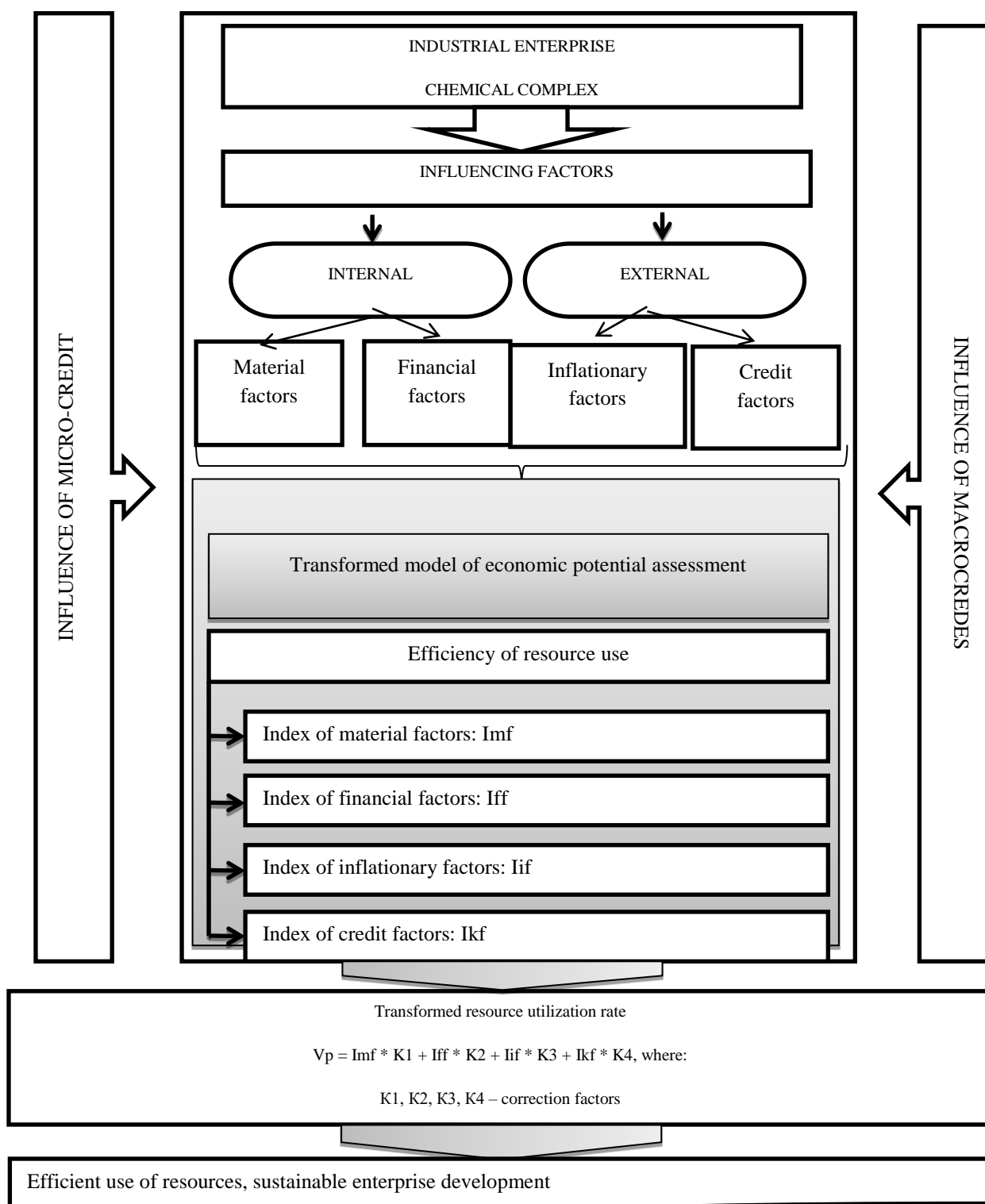
To achieve the objectives the following tasks are set:

- 1) to propose a model for assessing the economic potential of chemical enterprises;
- 2) to develop a methodical approach and a scale of resource potential that will allow us estimating various options for the use of resources;
- 3) to identify reserves for competitive development of enterprises.

2. Evaluating the Efficiency of Resource Use

The key goal of analyzing the economic resources of an organization is to assess their availability, dynamics, quality and productivity (Aktas *et al.*, 2015; Livshits, 1984; Mizik and Jacobson, 2009; Pereiro, 2006). To develop a mechanism for optimizing economic resources, seven enterprises located in the territory of the Ural Federal District were selected. The selection was carried out according to the type of economic activity (chemical production). At the present stage of the development of chemical production, the mechanism for managing the resources of these enterprises remains imperfect (Brusov *et al.*, 2015; Olson and Wu, 2010). With the aim of improving it, the author proposes a transformed model for assessing the economic potential of enterprises in the chemical complex (Fig 1). The proposed model takes into account the mutual influence of external and internal factors on the distribution of economic resources. Based on the level of the transformed indicator, the directions of the behavior of the economic entity corresponding to the present state of the economy and the capabilities of the chemical enterprise are developed at the current moment and for a certain perspective. Based on the impact on the activities of the enterprise both internal and external factors, a sample of the main ones was made. From the point of view of internal factors (the influence of the microenvironment), material and financial are identified. The influence of the macro environment, according to the author, can be expressed through inflation and credit factors.

Figure-1. Model of integrated assessment of the efficiency of resource management of chemical enterprises



The model for assessing the effectiveness of enterprise resource management takes into account the mutual influence of external and internal factors on the distribution of economic resources.

Based on the level of the transformed indicator, the directions of behavior of the economic entity at the current time and for a certain perspective are investigated. Based on the impact on the activities of the enterprise both internal and external factors, a sample of the main ones was made. In terms of internal factors, material and financial factors are identified. Macro-impact is represented by inflationary and credit factors (Modigliani and Miller, 1958).

3. Algorithm for Calculating the Transformed Efficiency Index

Current trends in the theory and practice of resource management are related to the problem of finding a single indicator of efficiency. It is necessary to select from only a wide variety of economic indicators only those that will comprehensively and most fully characterize the level of rationality in the use of the resource components of the organization. In this case, it is necessary to take into account the influence of external factors. With reference to the Russian enterprises of the chemical complex, the model can be developed according to the following algorithm:

1) selection of the most informative from the array of economic indicators;

2) determination of the correlation relationship between the selected indicators based on the statistical approach. With high correlation coefficients, one can speak of a high correlation between the indicators, and, consequently, the duplication of information. To apply the model for estimating the economic potential of enterprises of the chemical complex, we take into account indicators with a correlation coefficient of less than 0.5;

3) compiling a model for assessing the level of efficiency of resource use from indicators that have a weak correlation dependence.

In Table 1 the author proposes a system of indicators that allow estimating the level of use of resources of chemical complex enterprises, which are least correlated with each other. With the help of the transformed indicator (Ur), a comprehensive assessment of the work of the enterprise is given, and indices of material, financial, inflationary and credit factors are combined.

Table-1. Indicators characterizing the efficiency of the use of enterprise resources

The name of indicators	Indicator symbol	Conventional designation of specific gravity
1. Index of material factors	Imf	-
material return	X_1	U_1
material consumption	X_2	U_2
coefficient of turnover of material resources	X_3	U_3
2. Index of financial factors	Iff	-
coefficient of return on equity	X_4	U_4
absolute liquidity ratio	X_5	U_5
short-term debt ratio	X_6	U_6
total capital turnover ratio	X_7	U_7
3. Index of inflation factors	Iif	-
consumer price index	X_8	U_8
4. Index of credit factors	Icf	-
average interest rate	X_9	U_9
5. Correction coefficients	K1, K2, K3, K4	-
Transformed resource utilization rate	Ur	-

The combination is made through the transformation of the index values by the factors that establish the significance level of each indicator f0 (K1, K2, K3, K4) or the specific weight of each indicator $K1 + K2 + K3 + K4 = 1.00$. The index of material factors (Imf) unites three indicators. Let us establish the specific weight of each coefficient f1 ($X1, X2, X3$). The index of the use of material resources is determined by the formula:

$$Imf = X1 \times Y1 + X2 \times Y2 + X3 \times Y3, \tag{1}$$

where $Y1, Y2, Y3$ is the specific weight of each indicator ($Y1 + Y2 + Y3 = 1,00$). The index of financial factors (Iff) includes four coefficients that comprehensively assess the financial position of the enterprise f2 ($X4, X5, X6, X7$).

The index of the use of financial resources is determined by the formula:

$$Iff = X4 \times Y4 + X5 \times Y5 + X6 \times Y6 + X7 \times Y7, \tag{2}$$

where $Y4, Y5, Y6, Y7$ is the specific weight of each indicator ($Y4 + Y5 + Y6 + Y7 = 1,00$).

The index of inflationary factors (Iif) is represented by the consumer price index f3 ($X8$). The index of inflation factors is determined by:

$$I \text{ and } \varphi = X8 \times Y8, \tag{3}$$

where Vs is the specific weight of the indicator. The index of credit factors (Icf) includes the average level of credit rates f4 ($X9$). The index of credit factors is determined by the formula:

$$Icf = X9 \times Y9, \tag{4}$$

where Vg is the specific weight of the exponent.

Further, all the indicators are combined into the analytical system (S). In this case, all indicators of the system (S) have different ranges of variation and significance relative to each other. Priorities of indicators can be established taking into account specificity of branch. The optimization process begins with the calculation of the composite transformed indicator (S₀) for all selected chemical enterprises (i). According to the calculated data, the priority of each indicator is determined, with the sum of the correction coefficients being unity. The transformed indicator is recommended to have equal to unity ($V_p = 1$). Then, the obtained values of each indicator are transformed into indicators for each business entity separately, and the initial system (S) is recalculated according to the index formulas into the optimal analytical system (S'), including individually for each organization (S'(i)). Calculations must be made according to the indicators included in the index of material, financial, inflationary and credit factors.

4. A Methodical Approach to Assessing the Use of Resources

Using the transformed indicator (Ur), a unified assessment of the enterprise's performance is given, and indices of material, financial, inflationary and credit factors are combined. The grouping of these indicators allows the formation of an algorithm for assessing the use of resources of industrial enterprises in the chemical industry (Kaplan and Norton, 1992; Modigliani and Miller, 1958; Niven, 2002). The validity of actions is reduced to the following processes:

1) Initial information (an array of data) is formed, which is divided into internal and external factors. As information the annual accounting statements of enterprises, data of official statistical observation, reporting information of the Ministries, etc. can be possible.

2) Specific weights of the indices forming a set of indices are formed. When the aggregate of selected enterprises or their initial economic data change the share of indicators will change. They could not be kept constant, because in the current economic conditions, it is necessary to set a goal not to the ideal state of the enterprise, but also to the result of the recommended values of a number of coefficients (resources are not always allocated efficiently) and to an increase in the rating of the economic entity in comparison with similar enterprises in the industry.

3) The specific weights of the indices included in the transformed indicator of the efficiency of resource use are found. The economic indicators that make up the index group are predetermined taking into account the purpose of the analysis, and it is desirable to avoid duplication of information.

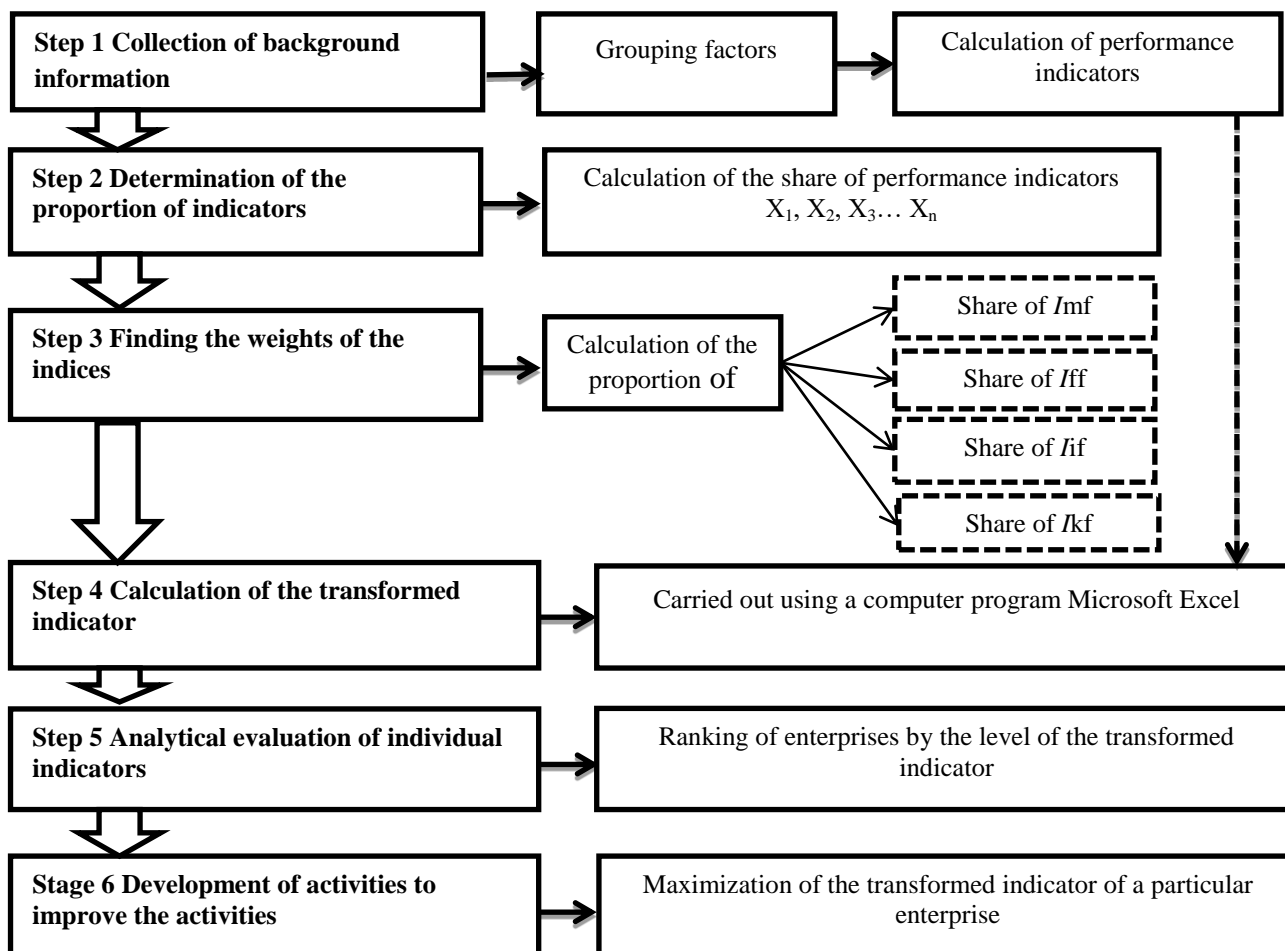
4) The transformed indicator of the efficiency of resource use is calculated. It is necessary to determine the transformed indicator in the context of the analyzed enterprises. It is advisable to calculate using the Microsoft Excel computer program.

5) Analytical evaluation of individual indicators of enterprises is carried out. At the current stage, enterprises are ranked according to the level of the calculated transformed indicators. The effective index of an enterprise should ideally not be less than one. The more the indicator of a particular enterprise exceeds one, the more effectively it uses the totality of available resources. However, it should be critical not only to the final value of the transformed indicator, but also to indicators characterizing the indices of various factors.

6) Measures are being investigated to modernize the activities of an industrial chemical enterprise. It is necessary to set a goal to maximize the transformed coefficient of an individual enterprise, which in the end should positively affect the efficiency of resource use, and, consequently, increase its rank.

7) The algorithm for implementing a methodical approach to assessing the use of resources of chemical enterprises is presented in Fig 2.

Figure-2. Algorithm for implementing a methodical approach to assessing the efficiency of the use of enterprise resources



In accordance with the proposed methodology, the transformed indicators of resource use efficiency were calculated for seven enterprises. The input of information was the accounting reporting of enterprises. The table that you see on the screen summarizes the economic performance indicators of enterprises, selected as a result of the correlation analysis (internal factors), as well as statistical data (external factors).

Table-2. Composition of economic indicators of the results of activity of chemical enterprises according to the financial statements in 2017

Business name	Economic indicators								
	Internal factors							External factors	
	X1	X2	X3	X4	X5	X6	X7	X8	X9
OJSC «Uralchimplast»	1,31	0,76	1,36	0,014	0,15	0,19	1,27	0,066	0,08
OJSC «Ural Chemical Reagents Plant»	1,78	0,56	1,75	0,304	0,95	0,14	1,47	0,066	0,08
OJSC «Ural plant RTI»	1,36	0,74	1,58	0,27	0,02	0,83	1,76	0,066	0,08
JSC «Plastics Factory»	3,14	0,32	3,14	0,047	0,07	0,44	0,37	0,066	0,08
JSC «Kalinovsky Chemical Plant»	1,52	0,66	1,81	0,064	0,01	0,22	1,94	0,066	0,08
OJSC «Linde Uraltekhgas»	2,58	0,39	2,59	0,052	0,01	0,32	1,3	0,066	0,08
OJSC «Uralelectromed»	3,01	0,33	3,73	0,283	0,55	0,13	0,79	0,066	0,08
Total	14,7	3,76	15,96	1,034	1,76	2,27	8,9	0,462	0,56

Further, according to the data presented, the calculation of the shares of each indicator, as well as the correcting coefficients used in the calculation of the transformed indicators (Table 3) was carried out.

Table-3. Calculation of the proportion of economic indicators and indices

Calculation	X1	X2	X3	X4	X5	X6	X7	X8	X9	Total
X1+X2+X3	34,42									34,42
X4+X5+X6+X7				13,964						13,964
X8								0,462		0,462
X9									0,56	0,56
X1+...+X7	34,42			13,964				0,462	0,56	49,406
Share of <i>I</i> mf	0,43	0,11	0,46							1,00
Share of <i>I</i> ff				0,07	0,13	0,16	0,64			1,00
Share of <i>I</i> if								1,00		1,00
Share of <i>I</i> kf									1,00	1,00
Ur	0,697			0,283				0,009	0,011	1,000

Applying the algorithm of actions developed by us, the transformed indicators of the effectiveness of the use of resources of selected enterprises are calculated (Table 4).

Table-4. Calculation of the transformed indicators of the efficiency of the use of resources of chemical enterprises

Business name	Estimated figures				
	<i>I</i> mf	<i>I</i> ff	<i>I</i> if	<i>I</i> kf	<i>U</i> r
OJSC «Uralchimplast»	1,2731	0,86027	0,066	0,08	1,13161
OJSC «Ural Chemical Reagents Plant»	1,63282	1,10191	0,066	0,08	1,44905
OJSC «Ural plant RTI»	1,39428	1,27918	0,066	0,08	1,33443
JSC «Plastics Factory»	2,83195	0,31965	0,066	0,08	2,06482
JSC «Kalinovsky Chemical Plant»	1,56052	1,27823	0,066	0,08	1,44998
OJSC «Linde Uraltekhgas»	2,3454	0,88569	0,066	0,08	1,88584
OJSC «Uralelectromed»	3,05109	0,61492	0,066	0,08	2,30095
Total	14,0892	6,33985	0,462	0,56	11,6167
Average level of indicators	2,01274	0,90569	0,066	0,08	1,65953

According to Table 4 it follows that the level of the total transformed indicator of each enterprise exceeds one, therefore, the efficiency of resource use is high. But in the context of the indices of internal and external factors a different picture is observed. All enterprises effectively use material resources, but not always effectively financial. Such a conclusion can be made on the basis of the value of the index of financial resources, if its level is below one. The calculated indices of the inflationary and credit factors index will always be less than one. The individual enterprise isn't able to influence the factors of the external environment, but it would be wrong to ignore these factors, they also affect the state of the enterprise in a certain proportion (Kaplan and Norton, 1992; Sharp, 1964).

In accordance with the received data the ranking of enterprises is carried out according to the level of the transformed indicator of a particular industrial enterprise.

Table-5. Ranking of chemical industry enterprises by the level of the transformed indicator of resource use efficiency

Business name	(<i>U</i> r)	The rank of the enterprise
OJSC «Uralchimplast»	1,13161	7
OJSC «Ural Chemical Reagents Plant»	1,44905	5
OJSC «Ural plant RTI»	1,33443	6
JSC «Plastics Factory»	2,06482	2
JSC «Kalinovsky Chemical Plant»	1,44998	4
OJSC «Linde Uraltekhgas»	1,88584	3
OJSC «Uralelectromed»	2,30095	1

As a result of the conducted studies, a scale of assessment is proposed, the resource potential of enterprises (Table 6) based on the calculation of the average level of the transformed indicator of resource efficiency (*U*r).

Table-6. Indicators of the resource potential scale of the chemical complex enterprises

Resource utilization level	Criteria for reference to the level	Characteristics of the level
Low level	$Ur < 1$	Resources are distributed inefficiently or unevenly (for example, the level of use of material resources is normal, and financial resources are low).
Normal level	$1 < Ur < Ur$	The resources are distributed relatively optimally. The transformed indicator of the enterprise is higher than one, but not higher than the average level for the selected enterprises.
High level	$Ur > Ur$	Resources are used quite effectively. The transformed indicator of the enterprise is above the average value of the analyzed enterprises.

According to the the table we can conclude that:

- a high level of resource use is observed in such enterprises as JSC «Uralelectromed», JSC «Plant of Plastics», JSC «Linde Uraltehgaz»;

- the normal level is inherent in such enterprises as JSC «Kalinovsky Chemical Plant», JSC «Ural Chemical Reagents Plant», JSC «Ural Plant RTI» and JSC «Uralchimplast».

Low level is not present at any considered chemical enterprise.r

5. Conclusion

In solving the problem the article proposes a model for estimating the economic potential of chemical complex enterprises. A methodical approach and a scale of resource potential being developed, it is possible to evaluate various options for the use of resources and to identify reserves for the competitive development of enterprises.

So it can be concluded that the activity of any enterprise is aimed at maximizing financial results. To achieve this goal it is necessary to rationally distribute resources available to the economic entity considering the influence of the macro environment. A comprehensive analysis of the rationality of resource management can be carried out using the integrated assessment model. The application of the proposed transformed indicator and the resource potential scale in practice will allow us to evaluate various options for the use of resources and to identify reserves for the progressive and competitive development of chemical enterprises in future.

6. Conflict of Interest

The authors confirm that this article content has no conflict of interest.

Acknowledgements

This work was supported by the ministry of education and science of the russian federation.

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