ECONOMY AND MANAGEMENT

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INDUSTRIAL POTENTIAL: ASSESSMENT, MODELING AND ADMINISTRATION UNDER THE CONDITION OF SUSTAINABLE DEVELOPMENT

Purpose. The world community recognizes the concept of sustainable economic development as the dominant ideology of society in the 21st century. The aim of the research is to improve the theoretical and methodological as well as methodologically applied principles of economic assessment of the industrial potential development and to work out, on this basis, the conceptual principles of state administration, directed towards its balanced development that will foster the implementation of the sustainable development concept.

Methodology. To reach the aim, we used the systems analysis — to develop the system of indexes and evaluation indicators; integral evaluation — to determine integral levels of indexes; multivariable correlation-regressive analysis — to determine cause-and-effect relations between the factors of the macro environment and levels of development of the industrial potential.

Findings. It is suggested to consider the industrial potential as a multicomponent category through input and output indicators, their outline being the basis for determination of integral levels of reproductive and achieved potentials development. Conceptual bases of the state administration of the balanced development of the industrial potential are formulated, the main idea of which is fulfillment of sustainable industrial development principles due to the achievement of certain levels of the development of the reproductive and achieved potential components. The creation of a favorable macro environment is defined as the main direction of state administration of industrial potential development. It is proposed to use the following indicators to identify the relationship between macro-environmental indicators and result indicators of industrial potential development: development of scientific potential, development of educational potential, development of consumer potential, macroeconomic stability, business environment development, investment activity, labor market development, infrastructure development, demographic situation, ecological stability, level of law and order, and innovation activity. Econometric models of macro environment formation for the balanced development of the industrial potential are worked out. Factors of significant influence on the development level of the reproductive and achieved potentials are identified. The result of implementation of the suggested concept is to achieve a high level of the industrial potential development both at the input stage (the stage of formation) and at the output (stage of implementation) since disbalance gives evidence of an arising problem, unsustainable use of the potential available can result in structure crises.

Originality. The system of indicators of complex economic assessment of industrial potential is substantiated on the conditions of multicomponentity. The proposed methodological approach allows distinguishing two types of industrial potential (reproductive and achieved ones), the balanced interaction of which is the basis of its development, which should be taken into account when developing the conceptual foundations of state management of sustainable development. A set of models for the formation of a favorable macroenvironment as a result of multicollinear influence of factors with regard to the result indicators of industrial potential development has been developed.

Practical value. These results can be used by practitioners, scientists, government officials in developing a strategy for sustainable industrial development, forming a set of tools for the mechanism of state administration of industrial potential in order to suspend and eliminate negative trends inherent in the current stage of economic development.

Keywords: *industrial potential, indicators of evaluation, development, state administration, balanced development*

Introduction. Keeping of high rates of industry development and level of profitability of industrial enterprises is impossible without an effective use of the industrial potential of the national economy as a primary link of economic mechanism that accumulates in itself all resources; due to their effective use it is possible to conduct basic economic processes, form balanced industrial and economic relations between the subjects of management, and create a national revenue.

The models of economic development are changing under the condition of globalization, which directly influences the industrial development [1]. Under the conditions of the strate-

gic course towards European integration chosen by Ukraine, structural reconstruction and modernization of industry, development of the innovative-investment model of the national economy must become the key tools of the economic policy of the country. With the constant progress of globalization, innovations in science and technology have become an important means of national strategy implementation and achievement of goals of sustainable development [2]. The results of the economy growth are introduction of the ecologically directed management and increase in social standards of population living. We would like to note that the necessity of taking into account the social and ecological factors is imbedded in the mechanism of implementation of the sustainable development concept as a fundamentally new model of economic development [3, 4]. In this regard, the transfer of industrial potential to a new qualitative basis of development actualizes the processes of its evaluation and modeling, as their results can determine the strategy of sustainable industrial development taking into account existing opportunities and conduct effective governance aimed at achieving sustainable development goals.

Literature review. A significant contribution to the study on the essence of industrial potential as an economic category, its scientific attribution, typology and conceptual principles of formation was made by such well-known scientists as L. Abalkin, I. Ansoff, V. Arkhipov, A. Anchishkin, T. Burns, K. Vobly, V. Weinz, V. Leontiev, D. Lvov, E. Mansfield, I. Razumov, L. Siles, R. Solow, D. Stolker, M. Chumachenko, J. Schumpeter and others. Some aspects of the problem of assessing industrial potential, its individual components are reflected in the works by such scientists as O. Balatsky, P. Belenky, E. Boyko, V. Boronos, S. Ishchuk, S. Knyaz, Y. Kudrina, O. Maslak, O. Melnyk, I. Ternova, O. Fedonin, R. Feshchur, L. Shkvarchuk and others. Note that to establish causal links between the components of industrial potential, as well as finding external factors influencing industrial development, researchers often use econometric modeling tools. The works by E. Alayev, O. Amosha, V. Geyts, Z. Gerasymchuk, S. Davymuka, M. Dolishny, G. Zakharchyn, V. Kravtsiv, I. Lukinov, A. Mazur, I. Mykhasyuk, N. Mikula, V. Pavlov, N. Podolchak, V. Symonenko, L. Fedulova and a number of other scientists are devoted to the search for effective approaches to state administration of industrial development.

Unsolved aspects of the problem. At the same time, the above mentioned researchers' scientific achievements concerning the development of conceptual principles of the economic growth do not solve the range of problems of the balanced development as a compound economic category taking into account the peculiarities of its certain components development, their structural changes, establishing connections between the processes of reproduction and use, determination of factor influence that requires the development of an appropriate methodical tools, due to its application it would be possible to get its compound analytical view.

Growth of deformation processes in the industrial development of Ukraine negatively affects the economic security of the country and indicates the absence of effective mechanism of the state administration of the industrial potential development aimed to overcome threatening tendencies, both in branch and spatial aspects. This stipulated the necessity to work out the applied tools of comprehensive economic evaluation of the condition and level of the industrial potential development in order to establish effective cooperation between its constituents as a result of the use of the appropriate tools of state administration, defined the relevance of the chosen theme, and predetermined the aim and tasks of the research.

The purpose of the article is to improve theoretical, methodological and applied principles as to conducting the comprehensive economic evaluation of the industrial potential and formation of conceptual administration basis of its development under the conditions of implementation of the Concept of sustainable development in the country.

To achieve the aim, the following tasks were set:
- to develop methodological principles of a comprehensive economic assessment of the industrial potential as a multicomponent category, the system of indicators and evaluation indexes;
- to ground conceptual principles of the state administration of the balanced development of the industrial potential;
- to work out a set of models of establishing a favorable macro environment for transition of industrial potential to the principles of a sustainable development.

Methods. To achieve the set goal of the research, we used: systems analysis — to develop the system of indexes and indicators of evaluation of industrial potential and factors of macro environment; integral evaluation — to carry out compound evaluation of the industrial potential and determine integral indexes of a macro environment; multivariable correlation-regressive analysis — to model a favorable macro environment for a sustainable development of the industrial potential.

Results. The development of the industrial potential anticipates a transition from one condition to another; at the same time previous achievements must be preserved and conditions for future changes must be created. Intensification of the industry growth is impossible without activation of the components of its industrial potential, formation of its balanced structure taking into account the basic provisions of the sustainable development concept. Defining the level of the identified progress trends of separate constituents of the potential allows mobilizing efforts, defining reserve stock, setting more precisely the planned indexes of the industry development, types of activity, enterprises, and others. It is structuring that allows shifting from a general theoretic area to more applied research.

Due to the thorough study of scientific works, it is found out that approaches to evaluate innovative, social, and ecological components of the industrial potential are widely examined in modern literature. So, Bogers M. and West J. developed an approach to evaluate the industrial potential based on determination of efficiency of open innovations [5]. Kao Y.-S.; Nawata K.; Huang C.-Y. proposed the scheme of evaluation of system functions on the basis of the technological innovative system and conducted a relevant modeling to establish factor connections from the position of functional approach for providing steadiness in the processing industry [6]. The use of socio-environmental management in small industries will promote the realization of basic principles of corporate social responsibility in the country [7]. Methodological approach aimed at evaluation of social responsibility model for sustainable company growth is disclosed in work [8]. The evaluation of social component of the industrial potential is carried out by the selection of indicators, that specify the attractiveness of labor, scale of labor resources involvement, and efficiency of their use [9]. To identify cause and effect relations between the components of the industrial potential, as well as to distinguish external influence factors on the industrial, means of econometric modeling are widely used. In the work [10] it is proved by the construction of nonlinear ARDL model that the economy growth stimulates the economy to increase energy efficiency and to transfer industrial sector on energy-saving technologies. Lee, H. S.; Choi, Y. found out by examining industrial enterprises of South Korea that innovative effect leads to the ecological productivity growth of the industry [11], that points out to interrelation between innovative and ecological components of the industrial potential.

It is suggested to evaluate efficiency of the innovative development from the position of ecologically directed management in works [12, 13]. Bezhentseva T. V., Aleksandrova N. N., Matyus E. G. developed the system of indexes of the evaluation of industrial enterprises activity taking into account the environment factors [14].

Based on the generalization of the above scientific works, as well as taking into account modern strategic directions of economic development of the state, we propose to identify socio-labor, production and economic, financial and investment, innovation and ecological components of industrial potential. However, a component structure of the industrial potential cannot be of a permanent value, as existing elements can be complemented by new ones. Such dynamics is predefined by the change in the economic development types, appearance of new unconventional factors of production, instability of the environment, market condition, etc. As a result, there are structural changes that come forward as factors of the industrial potential development.

The methodological approach, suggested to conduct compound economic evaluation of the state and level of the industrial potential development, is based on the selection of input and output indicators in the context of its constituents. On the whole, input indicators characterize the scale of resources allocation and their capacity for renewal. Output indicators are formed taking into account the effectiveness and efficiency indexes of the resource usage. On the basis of distinguishing of input and output indicators, we suggest to differentiate the level of the reproductive potential development (available possibility) and the level of the achieved potential development (used possibility), the balanced cooperation of which is the basis of the industrial potential development that should be taken into consideration while developing conceptual bases of the state administration.

Taking into account the level of information availability on the basis of the output data, got from the InfoBase of General Administration of Statistics of Ukraine, the system of indexes of compound economic evaluation of the industrial potential is developed by input and output indicators by their certain types in the context of the basic structural elements (Table 1).

Note that in determining the performance and efficiency indicators for the socio-labor and production-economic component, it is advisable to use indicators that reflect the ratio between the volume of output in industry to, respectively, the average annual number of employees and average annual value of fixed assets (labor efficiency and return on assets) and indicators that reflect the ratio between the volume of products sold in industry to, respectively, the average annual number of employees and the average annual cost of fixed assets (labor efficiency ratio and coefficient of the fixed assets efficiency).

To standardize the indicated indexes in order to get respective integral indexes on each of the distinguished indicators, we suggest using the following equations

$$X_{iy}^I = \frac{Xij}{Xm+1j};$$ (1)

$$X_{iy}^I = \frac{Xm+1j}{Xij},$$ (2)

where X_{m+1j} is the j-index of the standard year.

Therewith, formula (1) must be applied for indexes-stimulators and formula (2) — for indicators-destimulators.

Deviation from the standard must be found by the formula (3).

$$Y_{iy} = 1 - X_{ij}^1.$$ (3)

In our opinion, taking into account the basic principles of the theory of factors of production and strategic priorities of modern economic development of the state, each selected component of industrial potential has the same significance.

To calculate integral levels of the reproductive and achieved potentials growth, we suggest formula (4)

$$I_{rp(ap)} = \sqrt[5]{I_{slc} \cdot I_{pec} \cdot I_{fic} \cdot I_{inc} \cdot I_{ec}},$$ (4)

where $I_{rp(acp)}$ is the integral level of the industrial potential development (reproductive or achieved); I_{slc} is the integral level of social and labor component development; I_{pec} is the integral level of production and economic component development; I_{fic} is the integral level of financial and investment component development; I_{inc} is the integral level of innovative component development; I_{ec} is the integral level of ecological component development.

Combining of indicators within a certain component of the industrial potential is conducted by the same formula.

Each of the integral indexes of the level of the industrial potential development has a complex hierarchical structure, as in the initial stage (first level) the specific variety of indicators is formed. The second level requires their generalization at the level of separate components of the industrial potential. The third level is the obtaining of the generalized results through gradual curtailing of indexes of the first and second levels.

The process of management of the balanced development of the industrial potential is an open system, on the input of which we have resources grouped by their functional application, and on the output — the results obtained from their use. Integrated combination of the resource-functional and efficient approaches for industrial potential study gives an opportunity to balance its growth in branch and spatial aspects, to correlate its inner-structure contents taking into account economic viability of resources usage.

In the context of state administration, the balanced development of the industrial potential must be regarded as an integral combination of reproductive ability of its interconnected components that provide the processes of formation and capacity building of the potential, their changes cause growth and economic effect, obtained from the use, which proves the expediency of involving certain type of resources in the process of industrial production.

The primary objective of the concept implementation is to achieve a high level of the industrial potential development both on the input (stage of formation) and on the output (stage of the implementation), as the availability of misbalances proves the problems emerging, irrational use of the available potential can cause structural crises. The achievement of the set goal requires creation of a favorable macro environment for the balanced development of the industrial potential.

From the available array of statistical data for further research, indicators characterizing the state of the macroenvironment in the country were selected, and it was proposed to group them in terms of such indicators (Table 2).

To standardize the mentioned indexes in order to receive relevant integral indexes on each of the distinguished indicators, we suggest using formulae (1−3) and formula (5) accordingly.

$$I_j = \sqrt[n]{\prod_{i=1}^n I_j},$$ (5)

where n is the number of economic indexes used to assess the relevant indicators; I_j is the integral indicator index.

Distinguishing of dynamic rows in the context of defined indicators allows assessing the tendency of changes in the key social, economic, and ecological processes of the country, that is necessary for making effective administrative decisions in the sphere of state administration of the industrial potential development (Table 3).

Macro environment is characterized by considerable changeability and causes changes in the scale of the industrial potential by input and output indicators. Herewith, components of the industrial potential are dependent variables from the influence factors, which are grouped according to the nature of changes caused by them. Under these conditions, the industrial potential development is the result of a general influence from integration of institutional-and-legal, economic, sociocultural, geopolitical, scientific-and-technological, natural and ecological environments. The model of favorable macro environment creation to achieve the balanced development of the industrial potential is shown in Figure.

Multicriteria system of evaluation indexes of the level of the industrial potential development [15]

Groups of indicators	Types of indicators	Indexes
1. Social and labor component		
Input indicators	Scale (S_s)	1.1. An average number of regular employees, thousands of persons 1.2. A number of hired employees, thousands of persons 1.3. Level of employment, % to the general amount
	Social attractiveness (S_{sa})	1.4. Average monthly nominal salary of regular employees, $. 1.5. Average monthly nominal salary of an employee in the equivalent of full-time employment, $
Output indicators	Effectiveness and efficiency (S_{ef})	1.6. Labor efficiency. 1.7. Labor efficiency ratio
2. Production and economic component		
Input indicators	Scale (P_s)	2.1. Cost of the fixed assets, $ millions 2.2. Cost of putting new fixed assets into operation, $ millions
	Ability to renewal (P_r)	2.3. Coefficient of fixed assets updating 2.4. Coefficient of intensity of fixed assets updating 2.5. Coefficient of the fixed assets amortization
Output indicators	Effectiveness and efficiency (P_{ef})	2.6. Return on assets. 2.7. Coefficient of the fixed assets efficiency
3. Financial and investment component		
Input indicators	Scale (F_s)	3.1. An amount of capital investments in actual prices, $ millions 3.2. Share of the enterprises that got a profit , %
	Liquidity (F_l)	3.3. General liquidity ratio 3.4. Instant liquidity ratio 3.5. Absolute liquidity
	Financial independence (F_{fi})	3.6. Equity ratio 3.7. Leverage ratio 3.8. Coefficient of purposefulness of long-term investments
Output indicators	Effectiveness and efficiency (F_{ef})	3.19. Return on equity ratio 3.11. Profitability ratio of the whole activity of the enterprises 3.12. Profit-to-investment ratio
4. Innovative component		
Input indicators	Scale (I_s)	4.1. A share of enterprises that implemented innovative activity, in % to the total number of industrial enterprises 4.2. A share of enterprises that sold innovative products, in % to the total number of industrial enterprises 4.3. A share of enterprises that sold products new for the market, in % to the total number of industrial enterprises 4.4. A share of enterprises that sold innovative products abroad, in % to the total number of industrial enterprises
	Innovative activity (I_{ina})	4.5. A share of industrial enterprises that implemented innovative kinds of products, in % to the total number of enterprises that implemented innovations 4.6. A share of industrial enterprises that implemented industrial products new for the market, in % to the total number of enterprises that implemented innovations 4.8. A share of industrial enterprises that implemented innovative activities, in % to the total number of enterprises that implemented innovations
Output indicators	Effectiveness and efficiency (I_{ef})	4.9. A share of sold innovative products, % to the total amount of sold industrial products 4.10. Investment efficiency ratio
5. Ecological component		
Input indicators	Scale (E_s)	5.1. Expenses on environmental protection measures for air protection, $ millions 5.2. Expenses on environmental protection measures for water protection, $ millions 5.3. Expenses on environmental protection measures for waste utilization, $ millions
	Ecological condition (E_{ec})	5.4. Spillover of the sewage into the surface water bodies, millions of m^3 5.5. Volume of emission of pollutants in the air, thousands of tons 5.6. Volume of waste production, thousands of tons
Output indicators	Effectiveness and efficiency (E_{ef})	5.7. Volume reduction in waste production, thousands of tons 5.8. Reduction in spillover of sewage into the surface water bodies after taking water protection measures, thousands of tons 5.9. Reduction in emission of pollutants in the air after taking air protection measures, thousands of tons 5.10. Coefficient of efficiency of environmental protection measures for air protection 5.11. Coefficient of efficiency of environmental protection measures for water protection

A matrix algorithm is used to determine the force of factors' influence (6)

$$A = (X'X)^{-1}X'y, \qquad (6)$$

where A is a force of influence of a separate factor represented as a vector-column; X is a matrix of factors; X' is the matrix transported in accordance to X; $(X'X)$ is an inverse matrix to

The system of indexes of macro environment evaluation in the country [15]

Groups of indicators	Indexes
Development of a scientific potential (x_1)	A share of researchers among the economically active working age population %; proportion of doctors of economic sciences among the economically active working age population %; proportion of candidates of economic sciences among the economically active working age population %; proportion of the applied researches in the total amount of the completed scientific and scientific-technical studies %; proportion of the amount of the completed scientific and scientific-technical studies in GDP %; the number of organizations that fulfil scientific studies and developments, units per 100 000 people
Development of an educational potential (x_2)	A share of students of higher educational establishments of I−IV levels of accreditation to the number of population %; a number of specialists of higher educational establishments of III−IV levels of accreditation, persons per 100 000 people; the number of postgraduate students, persons per 100 000 people; the number of postdoctoral students, persons per 100 000 people; the number of higher educational establishments of I−IV levels of accreditation, units per 100 000 persons
Development of a consumer potential (x_3)	An average monthly nominal salary, US $; incomes of the population per person, US $; share of the population with an average per person equivalent income per month (monetary), below a minimum subsistence income %; share of the population with an average per person equivalent income per month (general), below a minimum subsistence income %; the rate of increase of a nominal salary, % to the previous year; the rate of increase of the actual salary, % to the previous year; rates of increase in income of the population, % to the previous year; consumer price index (from December to December of the previous year), %
Macroeconomic stability (x_4)	An average official exchange rate of the national monetary unit to $ US, hryvnias (for $100 US); GDP per person, US $; the rate of increase in GDP per person, % to the previous year; the rate of increase in tax receipts, % to the previous year; the rate of increase in loan volume provided by the banks, % to the previous year
Development of a business environment (x_5)	Proportion of enterprises that received profit, in % to the total amount; profitability of the operating activity of enterprises %; the rate of increase in the number of entities of the United State Register of Enterprises and Organizations of Ukraine (USREOU) %; the number of small enterprises per 10 thousand of real population, units; the number of the hired workers at small enterprises, % to the number of the hired workers of enterprises of entrepreneurial activity; volume of the products (works, services) sold by small enterprises, % to the total volume of the sold products (works, services); index of volumes of retail commodity turnover of enterprises (in comparable prices), % to the previous year; rates of increase in export volume of goods and services, %
Investment activity (x_6)	Capital investments per person in actual prices, US $; the rate of increase in capital investment volumes, % to the previous year; an increase in direct foreign investments to Ukraine, millions of US dollars
Development of labor market (x_7)	Level of employment of working age population, % to the population of the relevant age group; labor turn-over ratio on hiring, % to the average number of regular workers; the rate of increase in the number of the employed, % to the previous year; the rate of reduction in the number of the unemployed, % to the previous year
Development of infrastructure (x_8)	Putting into operation the total area of accommodation, m^2 per 1000 persons; planned capacity of ambulatory-policlinic establishments per 10 000 people, persons; the number of establishments of general education, units per 100 000 persons; the number of stock exchanges, units per 1000 persons; the number of markets selling consumer goods at the end of a year, units per 1000 persons; transportation of cargo by all types of transport, milliards of tons; rates of increase in volumes of cargo transportation by all types of transport, % to the previous year
Demographic situation (x_9)	Natural population growth, thousands of persons; migratory increase in a population, thousands of persons; average life expectancy, years; the number of the live-born, persons per 10 000 people; the number of the dead, persons per 10 000 people; the number of the registered cases of diseases occurred for the first times, cases per 10000 persons; the number of the registered marriages, cases per 10 000 persons; the rate of increase in the permanent population number, %
Ecological stability (x_{10})	Spillover of sewage waters, millions of m^3; emission of sulphur dioxine per person, kg/person; oxides of nitrogen emission per person, kg/person; waste production, 1000 tons/year
Innovative activity (x_{11})	A share of enterprises engaged in innovations %; a share of enterprises that implemented innovations %; processual innovativeness, units per 1 innovatively active enterprise
Level of law enforcement (x_{12})	The number of the detected crimes, cases per 1000 persons; the number of people brought to administrative responsibility, persons per 1000 people; the number of the civil cases considered in courts, cases per 1000 persons; the number of the registered crimes of the blackmail, cases per 100 000 persons

Dynamics of the factors of macro environment creation [16]

| Years	Integral indexes of macro environment development											
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}
2008	0.132	0,023	0.135	0.010	0.030	0.010	0.055	0.018	0.047	0.531	0.336	0.285
2009	0.252	0,012	0.076	0.075	0.102	0.001	0.035	0.021	0.100	0.463	0.325	0.060
2010	0.278	0,065	0.284	0.426	0.195	0.525	0.151	0.158	0.082	0.355	0.289	0.340
2011	0.305	0,071	0.190	0.050	0.112	0.427	0.093	0.025	0.084	0.452	0.246	0.385
2012	0.324	0,066	0.184	0.237	0.103	0.341	0.079	0.066	0.054	0.492	0.155	0.415
2013	0.334	0,067	0.120	0.226	0.139	0.334	0.078	0.068	0.003	0.494	0.173	0.042
2014	0.363	0,017	0.016	0.066	0.139	0.482	0.040	0.030	0.049	0.475	0.221	0.401
2015	0.427	0,173	0.241	0.377	0.199	0.862	0.168	0.164	0.023	0.287	0.269	0.249
2016	0.417	0,152	0.079	0.467	0.078	0.679	0.145	0.040	0.059	0.041	0.005	0.041
2017	0.313	0,139	0.222	0.404	0.059	0.600	0.034	0.128	0.057	0.024	0.007	0.136
2018	0.064	0,154	0.015	0.384	0.004	0.467	0.032	0.109	0.021	0.023	0.003	0.047
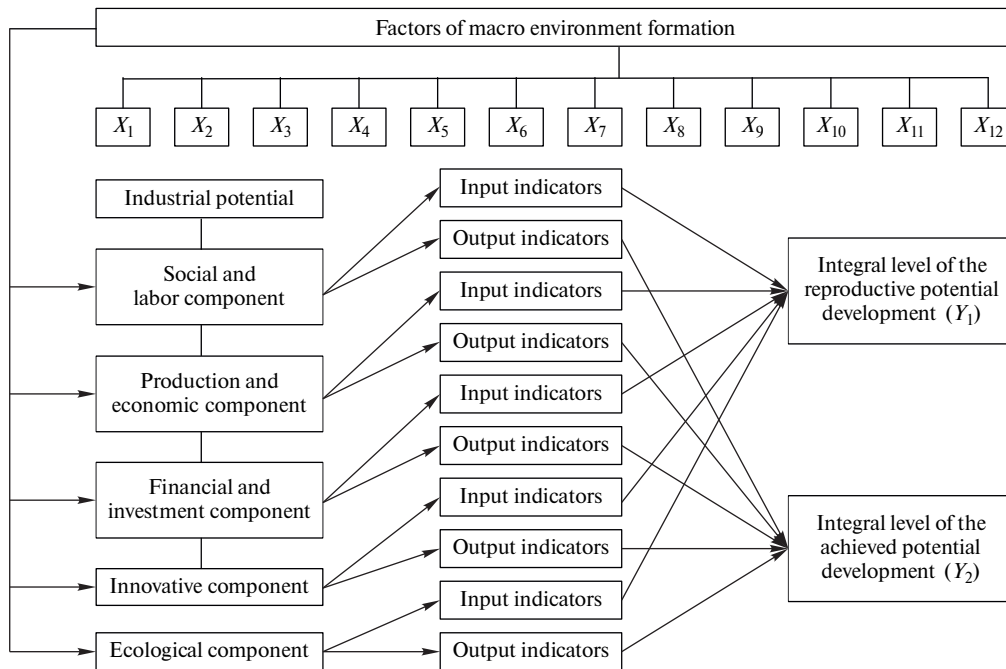
Fig. Structural logical model of macro environment formation for the balanced development of the industrial potential

the multiplication of X' and X matrices; y is a vector-column of indexes that specify the result.

After obtaining the regression equation and determining its parameters, a correlation analysis is performed, which makes it possible to assess the closeness and significance of the relationship between the dependent variable Y and the independent variable X using the coefficient of determination and correlation coefficient. To establish the relationship between the factors influencing the development of industrial potential, multifactor regression models were built using the least squares method.

During the design of econometric models, that allow taking into account a great number of various factors of direct and mediated influence on the industrial potential development, we selected factors that have substantial influence on formation of integral development levels of reproductive and achieved potentials.

It was found out that such factors as development of scientific potential and development of infrastructure influence the level of development of the reproductive potential substantially. This influence is best illustrated with the nonlinear multivariable equation (7)

$$y_1 = 18.69 + 4073.3x_1^5 - 1293.2x_1^3 + 114.003x_1 + \\ + 222\,917.8x_8^5 - 6222.8x_8^3. \qquad (7)$$

The coefficient of determination of this model is $R^2 = 0.974$, which proves the high quality of the designed model. By Fisher's criterion $F_{stat.} = 37.47 > F_{cr.} = 10.97$, that is with probability more than 0.99, the model is qualitative. By Student's criterion, values of all t-statistics are rather high: $t_{stat.}^{b_1} = 4.74$; $t_{stat.}^{b_2} = -5.4$; $t_{stat.}^{b_3} = 5.29$; $t_{stat.}^{b_4} = 4.52$; $t_{stat.}^{b_5} = -5.11$

and exceed the value of the critical point $t_{dv.\ cr.} = 4.03$ by an absolute value, i.e. they show statistical meaningfulness of all parameters of the model. For instance, if the integral index of the development level of scientific potential changes by 0.01, the development level of the reproductive potential will change by 1.14 %.

Such factors as ecological stability, innovative activity, and law enforcement level substantially influence the development level of the achieved potential. This connection is shown with the linear multivariable equation (8)

$$y_2 = 25.56 - 1.037x_{10} + 5.354x_{11} - 2.537x_{12}. \qquad (8)$$

The coefficient of determination of this model $R^2 = 0.921$ is close to 1, as well as Fisher's meaningful statistics $F_{stat.} = 27.26$, which proves the high quality of the model. Values of t-statistics with variables x_{11} and x_{12}: $t_{stat.}^{X_{11}} = 3.76$; $t_{stat.}^{X_{12}} = -2.95$ show statistic meaningfulness of parameters at these variables with probability not less than 0.95. For instance, if integral index of the level of innovative activity increases by 0.001, the development level of the achieved potential will increase by 0.00535 %. Growth of the environment pollution and crime rate reduces the possibilities to implement industrial potential in a proper way.

The constructed multifactor regression models show that the relationship between the factors exists and is quite stable. The coefficient of multiple determination shows how much the resulting indicator depends on the factor characteristics. Assessment of the development of industrial potential with the help of the constructed econometric models made it possible to determine the forecast values of the levels of development of the reproduction and achieved potentials, respectively (Table 4).

The results obtained are typical for countries with economies in transition. However, it should be remembered that

Table 4

Calculated forecast values of industrial potential development indicators [16]

Indicator (dependent variable Y)	Forecast values, years			
	2020	2021	2022	2023
Integral level of reproductive potential development	24.20	23.84	23.48	23.12
Integral level of achieved potential development	23.63	22.49	21.01	19.13

each country has its own characteristics due to certain stages of economic development, so the implementation of the results should be very careful, as the positive experience of one country may be negative for another due to immaturity of its economy to reform and innovate. In general, the goal of state management should be to achieve strategic guidelines for sustainable industrial development.

Conclusions. The studies conducted allowed accumulating the acquired experience of the preceding scientists and developing conceptual bases of the industrial potential state administration under conditions of sustainable development as a multicomponent economic category, its development is stipulated by the attained level of development of its social and labor, production and economic, financial and investment, innovative and ecological components.

The main results of conducting state administration of the balanced development of the industrial potential must be:

- improvement of branch structure of the national industry and creation of effective component-by-component structure of the industrial potential towards the development of priority types of industrial activity and increase in its competitiveness at the international market;

- prevention of emerging of crisis phenomena in the industrial sector of the economy due to conducting complex evaluation of the development level of both reproductive and achieved potentials of separate types of industrial activity;

- optimization of actions of government bodies that directly influence the creation of favorable macro environment for sustainable industrial growth and minimization of negative influence of factors-destimulators.

Improvement of state administration of the industrial potential development must be directed towards the achievement of greater flexibility and dynamics, possibility of instant reacting to the necessities of the market and working out of relevant measures capable to stimulate the development of the industrial sector of the economy in a selected direction.

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Промисловий потенціал: оцінювання, моделювання та управління в умовах сталого розвитку

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Мета. Світовою спільнотою концепція сталого економічного розвитку визнана як домінантна ідеологія розвитку суспільства у XXI столітті. Метою дослідження є вдосконалення теоретико-методологічних і методико-прикладних засад економічного оцінювання розвитку промислового потенціалу й розроблення на цій основі концептуальних засад державного управління, спрямованих на його збалансований розвиток, що сприятиме реалізації концепції сталого розвитку в державі.

Методика. Для досягнення поставленої мети використані: системний аналіз — для формування системи показників і індикаторів оцінювання; інтегральне оцінювання — для знаходження інтегральних рівнів показників; багатофакторний кореляційно-регресійний аналіз — для встановлення причинно-наслідкових зв'язків між факторами макросередовища й рівнями розвитку промислового потенціалу.

Результати. Запропоновано розглядати промисловий потенціал як полікомпонентну категорію за вхідними й вихідними індикаторами, виділення яких стало основою визначення інтегральних рівнів розвитку відтворювального й реалізованого потенціалів. Сформовані концептуальні основи державного управління збалансованим розвитком промислового потенціалу, основною ідеєю якого є реалізація засад сталого промислового розвитку за рахунок досягнення відповідних рівнів розвитку відтворювального та реалізованого потенціалів його складових.

Як основний орієнтир державного управління розвитком промислового потенціалу визначено створення сприятливого макросередовища. Запропоновано для виявлення залежності між показниками макросередовища й результативними показниками розвитку промислового потенціалу використовувати такі індикатори: розвиток наукового потенціалу, розвиток освітнього потенціалу, розвиток споживчого потенціалу, макроекономічна стабільність, розвиток бізнес-середовища, інвестиційна активність, розвиток ринку праці, розвиток інфраструктури, демографічна ситуація, екологічна стабільність, рівень правопорядку, інноваційна активність. Розроблені економетричні моделі формування макросередовища для збалансованого розвитку промислового потенціалу. Ідентифіковані фактори суттєвого впливу на рівень розвитку відтворювального й рівень розвитку реалізованого промислового потенціалу. Результатом реалізації запропонованої концепції повинно стати досягнення високого рівня розвитку промислового потенціалу як на вході (етапі формування), так і на виході (етапі використання), оскільки наявність дисбалансів свідчить про виникнення проблем, нераціональне використання наявного потенціалу може провокувати виникнення структурних криз.

Наукова новизна. Обґрунтована, на умовах полікомпонентності, система індикаторів комплексного економічного оцінювання промислового потенціалу. Пропонований методологічний підхід дозволяє виділити два види промислового потенціалу (відтворювальний і реалізований), збалансована взаємодія яких є основою його розвитку, що слід ураховувати при розробленні концептуальних засад державного управління сталим розвитком. Розроблено комплекс моделей формування сприятливого макросередовища як результату мультиколінеарного впливу факторів, з огляду на результативні показники розвитку промислового потенціалу.

Практична значимість. Наведені результати можуть бути використані практиками, науковцями, представниками влади при розробленні стратегії сталого промислового розвитку, формуванні набору інструментів механізму державного управління розвитком промислового потенціалу з метою призупинення й ліквідації негативних тенденцій, притаманних сучасному етапу економічного розвитку.

Ключові слова: *промисловий потенціал, індикатори оцінювання, розвиток, державне управління, збалансований розвиток*

Промышленный потенциал: оценка, моделирование и управление в условиях устойчивого развития

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Цель. Мировым сообществом концепция устойчивого экономического развития признана доминантной идеологией развития общества в XXI веке. Целью исследования является совершенствование теоретико-методологических и методико-прикладных основ экономической оценки развития промышленного потенциала и разработка на этой основе концептуальных основ государственного управления, направленных на его сбалансированное развитие, что будет способствовать реализации концепции устойчивого развития в государстве.

Методика. Для достижения поставленной цели использованы: системный анализ — для формирования системы показателей и индикаторов оценки; интегральное оценивание — для нахождения интегральных уровней показателей; многофакторный корреляционно-регрессионный анализ — для установления причинно-следственных связей между факторами макросреды и уровнями развития промышленного потенциала.

Результаты. Предложено рассматривать промышленный потенциал как поликомпонентную категорию по входным и выходным индикаторам, выделение которых стало основой определения интегральных уровней развития воспроизводимого и реализованного потенциалов. Сформированы концептуальные основы государственного управления сбалансированным развитием промышленного потенциала, основной идеей которого является реализация принципов устойчивого промышленного развития за счет достижения соответствующих уровней развития воспроизводимого и реализованного потенциалов его составляющих. Основным ориентиром государственного управления развитием промышленного потенциала определено создание благоприятной макросреды. Предложено для выявления зависимости между показателями макросреды и результативными показателями развития промышленного потенциала использовать такие индикаторы: развитие научного потенциала, развитие образовательного потенциала, развитие потребительского потенциала, макроэкономическая стабильность, развитие бизнес-среды, инвестиционная активность, развитие рынка труда, развитие инфраструктуры, демографическая ситуация, экологическая стабильность, уровень правопорядка, инновационная активность. Разработаны эконометрические модели формирования макросреды для сбалансированного развития промышленного потенциала. Идентифицированы факторы существенного влияния на уровень развития воспроизводимого и уровень развития реализованного промышленного потенциала. Результатом реализации предложенной концепции должно стать достижение высокого уровня развития промышленного потенциала как на входе (этапе формирования), так и на выходе (этапе использования), поскольку наличие дисбалансов свидетельствует о возникновении проблем, нерациональное использование имеющегося потенциала может провоцировать возникновение структурных кризисов.

Научная новизна. Обоснована, на условиях поликомпонентности, система индикаторов комплексного экономического оценивания промышленного потенциала. Предлагаемый методологический подход позволяет выделить два вида промышленного потенциала (воспроизводимый и реализованный), сбалансированное взаимодействие которых является основой его развития, что следует учитывать при разработке концептуальных основ государственного управления устойчивым развитием. Разработан комплекс моделей формирования благоприятной макросреды как результата мультиколинеарного влияния факторов, учитывая результативные показатели развития промышленного потенциала.

Практическая значимость. Приведенные результаты могут быть использованы практиками, учеными, представителями власти при разработке стратегии устойчивого промышленного развития, формировании набора инструментов механизма государственного управления развитием промышленного потенциала с целью приостановления и ликвидации негативных тенденций, присущих современному этапу экономического развития.

Ключевые слова: *промышленный потенциал, индикаторы оценки, развитие, государственное управление, сбалансированное развитие*