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**THE MANAGEMENT OF STRUCTURAL CHANGES
IN THE ECONOMY OF A REGION: PRINCIPLES, CRITERIA
AND INDICATORS SYSTEM OF EFFICIENCY EVALUATION
(by the example of industry of the Kostroma region)**

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**УПРАВЛЕНИЕ СТРУКТУРНЫМИ ИЗМЕНЕНИЯМИ
В ЭКОНОМИКЕ РЕГИОНА: ПРИНЦИПЫ, КРИТЕРИИ
И СИСТЕМА ПОКАЗАТЕЛЕЙ ОЦЕНКИ ЭФФЕКТИВНОСТИ
(на примере промышленности Костромской области)**

The relevance of the study is determined by the necessity of transition of the Russian economy to a new model and a new quality of economic growth, which is possible through introducing structural reforms in the economy, and is a component of economic development. The purpose of the study is in developing methodological and procedural foundations for estimating the quality and efficiency of structural changes in the economy. The objectives of the study are to give a brief evaluation of the industry in the Kostroma region as a control object of structural changes; to formulate the principles of structural changes management in the economy (industry); justify the selection criteria of the purpose, methods, and tools to manage structural changes in the economy (industry) and requirements for the subjects of management of structural changes; develop principles, criteria and indicators for assessing the quality of structural changes in the economy (industry); to propose criteria and system of indicators of an efficiency estimation of structural changes management in the economy (industry) for the controlled and controlling systems. The research methodology is based on a systematic approach. The method of study is economic analysis. It is possible to allocate the following features of the conducted research and the results obtained: principles, criteria and systems of indicators were developed on the basis of the principle of consistency as a core of system philosophy; the author offers a system of indicators to assess structural changes in the object, project, process and environmental systems on the basis of the classification of economic systems proposed by Kleiner; the structural changes themselves are considered as process and project systems with the appropriate features and specifications; the industrial complex as control object of structural changes is also considered as a set of systems of different types. The methodology and procedures for assessing the quality and effectiveness of the management of structural changes in the economy should act as a support for achieving the goals of state development programs and for improving the efficiency of state management of the economy of the region. Continuous monitoring of structural changes in the economy of the region and its industry will allow to timely identify structural problems and their aggravation, and to direct the available resources to resolve these problems. The proposed methodology and procedure will provide a systematic management of structural changes in the economy and industry of the region. The scope of application of the obtained results is the structural policy, the management of structural changes in national, regional economy, economic complexes, industry.

MANAGEMENT OF STRUCTURAL CHANGE; REGIONAL INDUSTRY; EFFECTIVENESS EVALUATION OF MANAGEMENT; METHODOLOGY AND PROCEDURE.

Актуальность исследования определяется необходимостью перехода российской экономики на новую модель и новое качество экономического роста, который возможен при условии структурных преобразований в экономике, являющихся составляющей экономического развития. Целью исследования стала разработка методологических и методических основ оценки качества и эффективности структур-

ных изменений в экономике. Задачи исследования: дать краткую оценку промышленности Костромской области как объекта управления структурными изменениями; сформулировать принципы управления структурными изменениями в экономике (промышленности); обосновать критерии выбора цели, методов и инструментов управления структурными изменениями в экономике (промышленности), а также требования к субъектам управления структурными изменениями; разработать принципы, критерии и систему показателей оценки качества структурных изменений в экономике (промышленности); предложить критерии и систему показателей оценки эффективности управления структурными изменениями в экономике (промышленности) для управляемой и управляющей систем. Методология исследования: системный подход. Метод исследования: экономический анализ. Можно выделить следующие особенности проведенного исследования и полученных результатов: принципы, критерии и системы показателей разработаны исходя из принципа системности как ядра системной философии; предложены системы показателей для оценки качества структурных изменений объектных, проектных, процессных и средовых систем на основе классификации экономических систем Г.Б. Клейнера; сами структурные изменения рассматриваются как процессные и проектные системы с соответствующими особенностями и характеристиками; промышленный комплекс как объект управления структурными изменениями анализируется как совокупность систем разного типа. Методология и методика оценки качества и эффективности управления структурными изменениями экономики призваны стать методологическим и методическим обеспечением достижения целей государственных программ развития и повышения эффективности государственного управления экономикой региона. Постоянный мониторинг структурных изменений в экономике области и ее промышленности позволит вовремя сигнализировать о структурных проблемах и их обострении, а также направлять имеющиеся ресурсы на решение этих проблем. Предлагаемая методология и методика обеспечат системность управления структурными изменениями в экономике и промышленности области. Область применения полученных результатов: структурная политика, управление структурными изменениями в национальной, региональной экономике, хозяйственных комплексах, промышленности.

УПРАВЛЕНИЕ СТРУКТУРНЫМИ ИЗМЕНЕНИЯМИ; РЕГИОНАЛЬНАЯ ПРОМЫШЛЕННОСТЬ; ОЦЕНКА ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ; МЕТОДОЛОГИЯ И МЕТОДИКА.

Introduction. The need for structural changes in the economy, including the development of domestic industrial production and import substitution, is recognized not only by the scientific community [2, 12–14, 23], but at the federal level of management of the economy. This is evidenced by the changes in the institutional environment: the Federal law no. 488-FZ ‘On industrial policy’, which came into effect in 2015, as well as the ‘Plan to promote import substitution in industry’, approved by Order of the Government of the Russian Federation on September, 30 2014 no. 1936-p, under which the federal executive authorities formed sectoral action plans for import substitution approved by numerous orders of the Ministry of industry and trade of the Russian Federation of March, 31, 2015 no. 650, no. 653, no. 658, etc. The developed and adopted legislative framework regulates structural changes in the domestic industry, however, implementing the plans for structural change and, in particular, import substitution faces a lot of obstacles, which are dysfunctions of management: dysfunctions of goal-setting, planning [24], organization, coordination [27], control, etc.

Evaluation of the efficiency of managing the structural change in the economy is a subsystem of control. Completeness and quality of maintaining the functions of control depends on the completeness and quality of implementation of other management functions.

The proposed methods are part of the procedure for assessing the structural balance of the economy, whose necessity and practical significance are determined by the objectives of government economic policy and a number of regulations that reflect these goals. In particular, one of the five state programs of the Russian Federation is ‘Balanced regional development’ [28]. In addition, the strategic goal of the state program of the Russian Federation ‘Development of industry and increasing its competitiveness’, approved by decree of the Government of the Russian Federation dated April, 15, 2014 no. 328 ‘is the creation in Russia of a competitive, stable and structurally balanced industry...’. In the passport of the state program of the Kostroma region ‘Economic development of the Kostroma region for the period up to 2025’ the following is established as the goal of the program: ‘Creation of conditions for



sustainable and balanced economic development of the Kostroma region'. One of the objectives and subprogrammes is 'the formation of a competitive, sustainable, structurally balanced industry in the Kostroma region'.

Thus, the methodology for estimating the structural balance of the economy should become a basis for achieving the goals of the state development programs and improving the efficiency of state management of the economy of the region. Continuous monitoring of structural changes in the economy of the area will allow to timely identify the structural problems and their aggravation, and to direct the available resources to resolve these problems. From the point of view of the author, a systematic approach, aimed at maintaining the balance of labor resources, investments, and innovations necessary for the development of the region and its industry. is needed to deal with the structural problems of the regional economy. The proposed methodology and procedure will provide a systematic approach to managing the structural changes in the economy of the region.

The article describes the characteristics of the process of managing the structural changes in the economy and industry. The paper examines the regional aspects of this process. The author develops methodological and procedural foundations for assessing the quality and efficiency of the management of structural changes in the economy (industry).

Theory and methodology of research. The research methodology is a systematic approach. A significant contribution to the development of the systematic approach was introduced by L. von Bertalanffy, A. Bogdanov, A. Rapoport, N. Wiener, I.V. Blauberg, D.M. Gvishiani, V.N. Kostyuk, V.N. Sadovsky, E.G. Yudin, L.V. Kantorovich [7], R.L. Ackoff, W.R. Ashby, L. Zadeh, M. Mesarovic, K.A. Bagrinovskii, G.G. Malinetskii, V.A. Volkonsky, G.B. Kleiner, V.N. Livshits, D.S. Lvov, A.L. Lurie, N.Ya. Petrakov, I.V. Prangishvili [18] Y.A. Schreider [25], Yu.I. Chernyak and others.

The structural analysis of the economy within the framework of the general theory of systems was studied by A.I. Anchishkin [1], L.V. Kantorovich [7], Yu. V. Yaremenko [26], A.N. Efimov [17], L.J. Berry [17], D.S. Lvov

[13–15], V.N. Livshits [12], G.B. Kleiner [8–10, 16], R.S. Greenberg [5], O.S. Sukharev [22], [23] S.D. Bodrunov [2] and others.

The main object of analysis of the systemic economy is the the relationship between the structure and functions of the systems [10]. From the point of view of system approach, due to internal diversity and external multifunctional nature of every economic system, its operation can be viewed from different perspectives and be described by different characteristics [16].

In accordance with the classification of economic systems by Kleyner, which distinguishes between object, design, process and environmental systems [9], structural changes in the economy (industry), from the point of view of the author, can be seen in the following aspects (planes): (a) structural changes within the complexes object, project, process, and environmental economic systems; (b) structural changes of the relationships and interconnections between systems of different types (for example, between object and process systems, etc.); (c) structural changes, recruitment and completeness of implementation of functions of economic systems. At the same time, structural changes can be regarded as economic systems of different types: a) structural changes as a process; b) structural changes (within an internally managed controlled or controlling system, between the controlled and controlling systems) as a project of a management system. Structural changes as projects require assessment of effectiveness.

It is known that the general criterion of efficiency is the economic performance of the managed subsystem as a whole, that is, how the enterprise (or organization) achieves its mission at minimum costs. The concept of 'efficiency' was originally associated with Pareto, whose idea of efficiency became the basis for further research in this area. Because 'efficiency' is one of the central concepts of economic science, the theory of efficiency developed by many scientists: M. Allais, N. Kaldor, J. Hicks, T. Scitovski, A. Bergson, R. Zerbe etc. The Cobb–Douglas production function was used as a model for measuring the economic efficiency for a long time. Leibenstein complemented the theory of efficiency with the concept of X-efficiency. The definition of efficiency was also given by the representatives of institutional analysis (North). P.L. Vilensky [3], A.L. Weinstein, A.G. Gryaznova,

L.V. Kantorovich, G.B. Kleiner, R.M. Kachalov, V.V. Kossov, V.N. Livshits [3, 11], D.S. Lvov, and S.A. Smolyak [3], A.G. Shahnazarov all made contributions to the development of evaluation of efficiency of investment projects. Sukharev shows the necessity of developing approaches to measuring adaptive efficiency, one of which may be an approach for measuring the degree of dysfunctionality of the system [21]. Because 'every economic system can be evaluated from the point of view of its functions, that is, systematically performed actions in relation to the super-system whose part it makes up' [16], the concept of ineffectiveness is associated in the scientific literature with the concepts of dysfunction and the dysfunctional system [16, 20]. In our opinion, complete execution of system functions in relation to the meta-system can be considered as an important criterion for evaluating the performance of the system.

The process of managing structural changes in the economy and industry

In order to make the desired structural changes in the economy (to increase output and share in GDP of the manufacturing industry, including high-tech; the amount and proportion of export of machinery, equipment, including high-tech), a set of measures is necessary covering structural, industrial, investment, financial, innovation, regional policy, etc., adequate institutional and methodological support of the processes of structural change and investment, innovation and personnel able to implement these structural changes. In order to create the conditions necessary for the formation of the desired structure of the economy, it is necessary to answer a number of questions:

A) characterizing the management process:

- 1) What is the structure of the Russian (regional) economy and the Russian (regional) industry, as its subsystem? (object of management)
- 2) What structure of the Russian (regional) economy and the Russian (regional) industry as its subsystem should be formed? (goal of management)
- 3) What are the methods and tools to achieve this goal? (methods and management tools)
- 4) What organizational structure will manage these changes? (subjects of management) What

requirements should be placed on the subjects of management of structural change?

B) characterizing the process of managing structural changes in the economy (industry):

- 1) What are the principles of managing the structural changes?
- 2) What are the criteria for selecting the target of managing?
- 3) What are the criteria for selecting the methods and management tools?

C) describing the methodology and procedure for evaluating the quality of the structural changes in the economy (industry):

- 1) What are the principles of evaluating the quality of the structural changes?
- 2) What are the criteria for evaluating the quality of the structural changes?
- 3) What is the system of indicators for measuring the quality of the structural changes?

D) describing the methodology and procedure for evaluating the efficiency of managing the structural changes in the economy (industry):

- 1) What are the principles for estimating the efficiency of managing the structural changes?
- 2) What are the criteria for evaluating the effectiveness of managing the structural changes?
- 3) What is the system of indicators for estimating the efficiency of managing the structural changes?

The author answers these questions and develops methodological and procedural foundations for estimating the efficiency of managing the structural changes in the economy (industry).

Industry in the Kostroma region as an object of managing the structural changes

Let us consider the object of managing the structural changes on the example of the industry in the Kostroma region and describe a number of basic processes: the process of changes in the industrial structure, the investment process, foreign trade operations, establishing the role of the economic system in the international division of labor.

In 2014, the largest share in the structure of shipped products of the extractive and manufacturing industries and engaged those engaged in the production and distribution of electricity, gas and water in the Kostroma region was held by jewelry manufacturing and furniture manufacturing (22.8 %), production, transmission

and distribution of electric power (21.3 %), manufacture of wood and of products of wood (16.2 %), which can be called the industries of specialization. The shares of other industries are significantly lower: metallurgical production and production of finished metal products (7.7 %), manufacture of vehicles and equipment (6.4 %), manufacture of food products, beverages and tobacco (6.4 %), production, transmission and distribution of steam and hot water (thermal power) (3.5 %), production of electrical, electronic and optical equipment (2.9 %) and manufacture of other non-metallic mineral products (2.6 %), manufacture of machinery and equipment (2.5 %), chemical manufacturing (2.0 %), and so on [19].

The dynamics of volumes of manufacturing in the Kostroma region (there was a 2.3 % decline in 2014) matches the overall Russian tendencies, with the fastest reduction rates observed for production of vehicles and

equipment (32.1 %) and manufacture of machinery and equipment (26.4 %) (Tab. 1).

Note: the data from 2010 to 2012 is given taking into account the retrospective restatement of industrial production indices in connection with the transition to the new base in 2010.

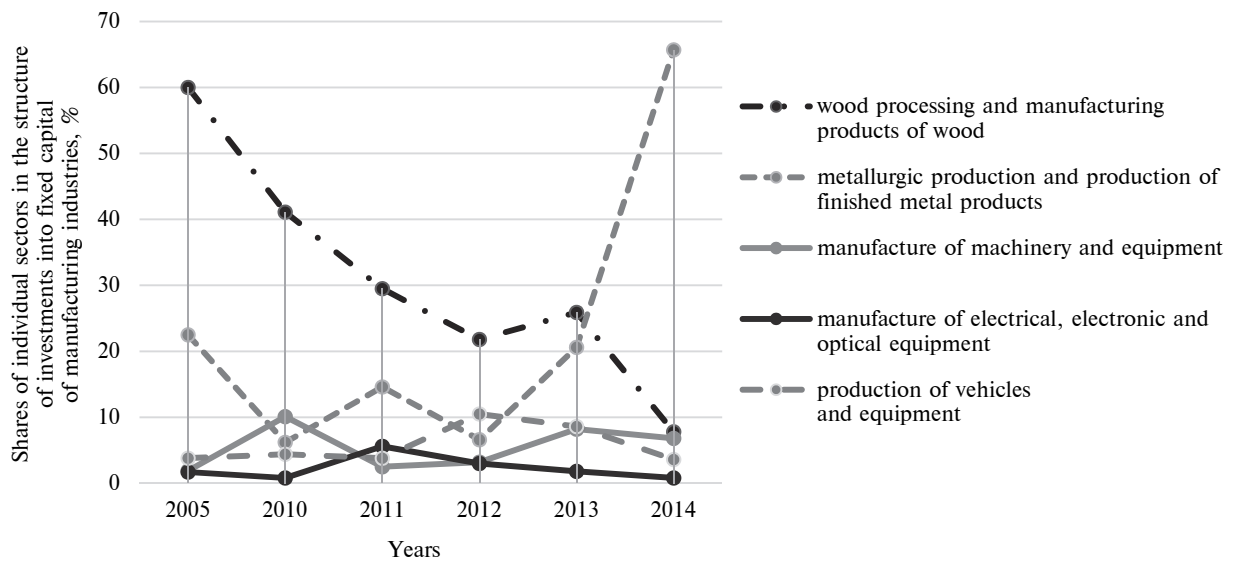
Source: Industrial production in the Kostroma region, Statistical collection. Regional office of the Federal service of state statistics for the Kostroma region (Kostromastat), Kostroma, 2015, 294 p.

The following industries were in the lead in the structure of investment in manufacturing: manufacture of wood and of products of wood and metallurgical production and finished metal products (Figure). The share of production of machinery and equipment, production of electric, electronic and optical equipment, transport vehicles and equipment in the period under review was lower on average.

Table 1

Indices of manufacturing production in the Kostroma region, as a percentage (or by times, where so indicated) with respect to the previous year

Manufacturing	1995	2000	2005	2010	2011	2012	2013	2014
Manufacturing, including:	83.2	116.4	112.0	120.5	109.4	104.2	106.1	97.7
manufacture of food products, beverages and tobacco	75.4	107.4	110.8	100.7	92.0	113.3	92.0	96.2
textile and clothing manufacture	70.7	107.1	99.4	106.0	88.0	94.2	101.7	90.8
manufacture of leather, products from leather and footwear	84.8	100.1	110.1	100.9	75.0	111.0	127.1	106.9
wood processing and manufacturing products of wood	106.9	108.4	127.8	115.9	108.8	103.6	103.5	102.9
pulp and paper production; publishing and printing	89.2	99.3	89.6	100.5	135.0	125.9	108.5	95.2
chemical production	72.5	120.5	97.7	73.0	117.7	74.0	123.0	99.3
manufacture of rubber and plastic products	131.4	by 2.3	149.1	116.5	117.4	101.4	118.9	119.5
manufacture of other non-metallic mineral products	75.0	92.2	103.4	125.7	114.4	102.0	111.1	114.8
metallurgic production and production of finished metal products	83.4	by 2.5	99.8	115.5	103.9	84.8	101.7	96.2
manufacture of machinery and equipment	79.0	110.3	114.5	by 1.8	90.0	119.0	107.6	73.6
manufacture of electrical, electronic and optical equipment	94.2	136.1	145.6	125.8	124.2	105.0	115.2	118.4
production of vehicles and equipment	114.2	99.2	108.3	135.6	130.7	107.9	105.9	67.9
miscellaneous manufacturing	83.1	110.3	107.9	133.2	114.5	106.3	110.8	106.4



Dynamics of the share of individual sectors in the structure of investments into fixed capital of manufacturing in the Kostroma region, %

Source: compiled by the author based on the data from Industrial production in the Kostroma region, Statistical collection, Regional office of the Federal service of state statistics for the Kostroma region (Kostromastat), Kostroma, 2015, 294 p.

The foreign investments into the economy of the Kostroma region in the period under review were predominantly into manufacturing: 85.2 % in 2011 and 68.6 % in 2012, 99.97 % in 2013 [6]. of the leading industries benefiting from foreign investments in manufacturing in 2000, 2005, 2011, 2012, 2013 were the manufacturing of wood and of products of wood (73.8 %, 97.6, 91.0, 93.4, 77.8 %, respectively). The main volume of foreign investments in 2010 (85.4 %) was in the manufacturing of machinery and equipment, while it amounted to 17.9 % in 2013 [6].

The structure of foreign investments in the manufacturing enterprises of the Kostroma region corresponds to the commodity structure of its exports. The export commodity structure of the Kostroma region from 2010 to 2014 was dominated by wood pulp, paper and products: 67.7 %, 72.6, 80.9, 77.7, 85.3 % of the merchandise exports, respectively, and their share has been growing [4]. The shares of machinery, equipment and vehicles (10.8 %, 10.9, 7.0, 8.6, 5.5 %) decreased (Tab. 2).

Table 2

Commodity structure of export of the Kostroma region, in % to the total

Export goods	2010	2011	2012	2013	2014
Total exports, including:	100	100	100	100	100
food products and agricultural raw materials (except textile)	0.6	0.5	0.5	0.2	0.1
chemical products, rubber and rubber products	1.5	1.2	1.3	1.1	1.5
wood and pulp and paper products	67.7	72.6	80.9	77.7	85.3
textiles and textile products	2.8	2.2	0.6	0.3	0.2
ferrous metals and products made of them	9.7	8.8	7.3	7.2	5.0
machinery, equipment and vehicles	10.8	10.9	7.0	8.6	5.5
other	2.9	2.1	0.8	2.2	2.4

Source: Foreign economic activity of organizations of the Kostroma region: Statistical collection, Regional office of the Federal service of state statistics for the Kostroma region (Kostromastat), Kostroma, 2015. 55 p.



The share of other commodity groups also decreased. In general, we can talk about the deterioration in the sectoral structure of industry and commodity structure of industrial exports in the Kostroma region. The manufacturing industry related to the exploitation of natural resources is developing, and the foreign investments into this industry are involved in this exploitation, which generally reflects the nationwide problems of the structure of exports and foreign investments.

One of the most acute structural problems in the economy of the region and its industry is the low population density and the second largest area of territory in the Central Federal district with underdeveloped transport infrastructure and insufficient investments. The situation is exacerbated by the constantly decreasing population of the region. The proximity of the Kostroma region to such industrial centers as Moscow and Moscow oblast, and Yaroslavl contributes to the outflow of the most mobile labor from the region. The decisive factors for young people are higher wages, more attractive career opportunities and education. Many applicants with high exam scores prefer to leave to study in Moscow, Yaroslavl, or Saint Petersburg, because there more opportunities to get a budget place at a university and then get a job. Thus, the region annually loses a significant share of the most promising young people who could play a positive role in its development.

A complex of measures concerning the processes of education, investment, innovation, production is necessary in order to stop the outflow of workforce from the region. It would be justified to increase the number of budget places in educational institutions of the region, providing its organizations with qualified human resources, including industrial enterprises, with the prospect of future employment in the region. This requires improving the quality of strategic planning, the coordination of the processes of investment planning and the creation and development of enterprises, innovation, training of qualified human resources. Only state investments can play a leading role in the investment process and the creation of new jobs in the current economic crisis. The scientific, expert, project and educational activities of the Kostroma State University as the regional educational center can help improve the

structure of the innovation process and the process of education with the appropriate government support and in active cooperation with the federal and municipal authorities, the business community and the public domain.

Solving structural problems requires the development and continuous improvement of methodological and procedural bases for estimating the efficiency of managing the structural changes in the economy (including regional) and industry in particular.

Principles of managing the structural changes in the economy (industry)

Principles of managing the structural changes in the economy (economic systems) with respect to the system approach should, from the point of view of the author, on the one hand, conform to the general principles of management (scientificity; systematicity and integrity; purposefulness; proportionality; presence of feedback; efficiency; effectiveness, etc.), principles of implementing the specific managerial functions (planning, organization, control, coordination, etc.), and, on the other hand, to the principle of consistency as the core of system philosophy.

Livshits gives the following main provisions of the principle: the integrity of the systems; the interrelation of the system as a whole and its parts; the superiority of the whole over the parts; the hierarchical structure of the system; the interaction of any object in the system with many others; a comprehensive external environment and its impact on the studied system; the dynamism of the systems, their structure, characteristics of elements; the ambiguity of the potential future state and behavior, including the often chaotic external environment of the studied systems; stability and/or effective adaptation, including the homeostatic behavior of complex systems in relation to the unknown; orientation toward the high efficiency of the systems performing their functions, taking into account all the major effects, i.e., internal, external and interactions [12].

Proceeding from the fundamental provisions of the principle of consistency and the general principles of management the author identifies the following principles of managing the structural changes in the economy (industry): 1) *the scientific principle*, implying that the

economy (industry) should be considered as an economic system; 2) *the principle of the complexity of the structure*, according to which the economic system has an inherently holistic nature, the whole and its parts are interconnected, the whole is superior over the parts, the system structure is hierarchical, any object in the system interacts with many others; 3) *the principle of taking into account the external environment* as a set of interacting economic systems of different types, properties, and functional; 4) *the principle of dynamism* of systems and their structure (given the ambiguity possible in the future state and behavior of the system); 5) *the principle of the systems fully accomplishing their functions* (each system has a set of functions in relation to the super-system); 6) *the principle of purposefulness* (the management of structural change should focus on achieving certain goals); 7) *the principle of adequate and timely response of the control system* to changes in the managed system; 8) *principle of effectiveness* (management aimed at achieving concrete results); 9) *the principle of efficiency* (the choice of those methods and management tools where planned results are achieved at the least cost).

The purpose of managing the structural changes in the economy (industry): criteria for selecting the management purpose

Based on the principle of consistency, the author formulates a definition for the purpose of managing the structural changes in the economy and the criteria for selecting this purpose. The purposes of managing the structural changes in the economy (industry) may include be the desired state of the economic system which corresponds to a certain structure, certain directions and pace of change, a certain set of sufficiently accomplished functions, some relations between subsystems and elements of the system, a certain character of response to the environment, a certain degree of stability, performance, efficiency of economic system.

The criteria for selecting the purpose of managing the structural changes in the economy should be: 1) the adequacy of the purposes to the essence (the objective) of the economic system; 2) compliance of the purpose with the current and desired level of development of the economic system; 3) compliance with the

condition of the external environment in which the economic system is functioning; 4) compliance with the time period in which the structural changes are supposed to be implemented; 5) the attainability of the goal (adequacy of financial, administrative, labor and other resources to achieve this goal); 6) compliance with the requirements of sufficient functionality (sufficient degree of achieving the functions of the economic system and its subsystems; 7) compliance with the requirements of stability, performance and efficiency of functioning of economic systems subject to structural changes.

Methods and tools for managing the structural changes in the economy (industry): criteria for choosing the methods and management tools

Based on the principles of purposefulness, efficiency and effectiveness of managing the structural changes in the economy, from the point of view of the author, it is possible to allocate the following criteria of choosing the methods and management tools: 1) the suitability of the selected methods and tools for the management objectives, the current and desired state (structure) of the economic system, the current and projected state of the environment that is external to the economic system; 2) the availability of adequate and quality institutional and methodological support for using appropriate techniques and management tools; 3) the efficiency of the appropriate methods and management tools; 4) the sufficiency of resources (financial, administrative, labor, etc.) for using the appropriate methods and management tools.

The subjects of managing the structural changes in the economy (industry)

Because structural changes occur in economic systems of different types (objects, projects, processes, environments), the approach to managing them must be integrated. The group of entities governing the structural changes should include entities that implement different economic policies: structural, financial (including monetary, monetary, fiscal, investment, industrial, etc. The operation of a group of control subjects implies the presence of a coordinating body. Thus, the first requirement

to the subjects of managing the structural change is a comprehensive approach.

The next requirement is a requirement to the level and quality of education of specialists and managers in state administration bodies responsible for planning, organizing, accounting, analyzing and controlling the structural changes in the corresponding economic system.

Principles, criteria and system of indicators to measure the quality of structural changes in the economy (industry)

Because structural changes can be analyzed and evaluated as a process and as a project, each of these subjects of structural changes will to different principles of assessment. In our opinion, the principles of evaluating investment projects are applicable to assessing structural changes as a project [3]. Some of these principles are applicable to assessing the process of structural changes. In particular, the methodological principles for assessing structural changes include: consistency, comprehensiveness, adequacy; methodological principles: comparison of situations with and without changes; uniqueness; measurability; the uncontrollability of the past; dynamic; incomplete information; operational principles: relationship between the parameters; multistage assessment; modeling; information consistency; methodological coherence; simplification; interconnection with government policy. Principles for assessing the structural changes of a project, in addition to the above, must include: public acceptability; payment for resources; nonnegative and maximum effect; profitability; presence of different project participants and coordination of their interests; organizational and economic mechanism of implementing the project, etc.

Let us formulate the criteria for evaluating the quality of structural changes in the economy. Structural changes occur in the managed and management systems in different types of economic systems, individual subsystems, between subsystems; may reflect evolutionary processes and processes of management; changes in the analyzed system and in the environment; characterize the integrity of the systems and the quality of the relationships between parts and the whole, the hierarchy of the system structure, the quality of interaction of any object in the system

with many others; stability of the economic system, its capacity for adaptation and survival, the effectiveness of its functioning.

Thus, we can identify different *criteria* of analysis and assessment of structural changes: *temporal, spatial, conceptual, the criterion of communication and interaction*, as well as *evaluation criteria: sustainability, adaptation and efficiency*. Structural changes occur over time (with different frequency (intensity) and depth of the changes) in different points (areas) of economic space, for different reasons: in the course of evolution or under the influence of the control subject (that is, have a different nature). The structural changes taking place in the past and present, in different systems and subsystems influence each other, giving rise to regular structural changes. Structural changes (quantity, length in time and space) can serve as parameters of the analyzed economic system and elements for evaluating its stability, adaptability and survival, the efficiency of its functioning. It is important to assess the directions of structural change: whether the totality of the changes represents scientific and technological progress, socio-economic development, or, conversely, regress and degradation. It is also important to assess the impact of structural changes on accomplishing the functions of the economic system and its subsystems: whether it leads to an increase or decrease of dysfunctionality. The intensity of structural changes and whether it leads to dysfunctions of management (planning, organization, coordination, control) is of great importance. Additionally, it is important to assess the impact of structural changes on the stability of the economic system, its adaptability and efficiency of its functioning.

The author proposes a *system of indicators to measure the quality of structural changes in the economy (industry)*. The structural changes in industry as a set of *object* systems can be evaluated with the following set of indicators: evolution of the share of output of manufacturing industries, high-tech industries, import substitution industries, export-oriented industries in the production structure of the industrial complex, %; the structural dynamics of economic entities in the industrial complex (including in comparison with other complexes, and other regions); structural dynamics of employees of the economic complex, its

individual sectors (including in comparison with other complexes, and other regions); changes in the structure of average annual number of employees by types of economic activity (including changes in the share of manufacturing, mining); relationship dynamics of the average nominal wage in the industrial sector (individual sectors) to the average monthly nominal wage in the region, the average monthly nominal wage in other industrial complexes (industries), other regions, etc.; dynamics of commodity composition of exports of the industrial complex, dynamics of the specific weight of exports of separate kinds of production in their industrial production; dynamics of the share of imported raw materials, materials, components, machines, equipment consumption of the industrial complex; dynamics of indicators of profitability for individual businesses, some of the most important system types of products, individual sectors (in comparison with other business entities, products, sectors); indices of manufacturing production, in percent with respect to the previous year; dynamics of indexes of production of individual industries, the most important products (with a significant share in the production structure of the complex or strategically important for the supersystem), etc.

The structural changes in industry as a set of *project* systems can be evaluated with the following set of indicators: dynamics of sectoral structure of investment projects in the industry; dynamics of investments (domestic, foreign; direct, portfolio, other); structural dynamics of foreign investments by type; dynamics of the sectoral structure of funding of state programs in the industry, dynamics of indicators of efficiency of investment projects and state programs in the industry (compared with other regions), etc.

The quality of the structural changes in industry as a set of *process* systems (investment process, innovative process, process of privatization, etc.) can be assessed through a set of the following indicators: index of physical volume of investments into fixed capital in the industrial complex, % with respect to the previous year, in comparison with other industrial complexes (including in other regions); dynamics of the share of industry in the structure of investments in fixed capital in the region; structural dynamics of fixed capital investments in the industry; dynamics of structure of foreign

investments in the region's economy by type of economic activity, including industry; dynamics of the structure of foreign investments in manufacturing; structural dynamics of innovation in industry (selected industries), in comparison with innovation in the industry of other regions; dynamics of the share of innovative production in the total output of the industrial complex (separate branches), in comparison with other regions; dynamics of the specific weight of industry organizations involved in innovations in the total volume of industrial organizations; structural dynamics of the privatization process (change in the structure of the average annual number of employees in industry by type of ownership), etc.

Quality assessment of the structural changes of *the environmental systems* that affect the state and dynamics of the industrial complex involves: a qualitative analysis of changes in legislation; analysis of changes in the external environment: economic conditions (economic growth), the terms of credit (interest rates), inflation, etc.

Principles, criteria and system of indicators for assessing the efficiency of managing the structural changes in the economy (industry)

Principles of estimating the efficiency of managing the structural change in the economy (industry) comply with the general principles for assessing the efficiency of investment projects [3]. The author offers criteria and a system of indicators for estimating the efficiency of managing the structural changes. It should be noted that the criteria of the performance of the controlled and controlling subsystems have their own specifics, and therefore, their effectiveness should be reflected by different sets of indicators. The controlled system here indicates a system whose governance has undergone structural changes (Tab. 3). It is known that common approaches to the performance criteria of the control subsystem are: the effectiveness of management decisions, achievement of objectives, efficiency, the quality of the results. The degree of achievement of management objectives can be expressed using the ratio of actual and planned values of target indicators. Objectives, methodology, methods and management tools can completely or partially match the purpose or be unfit for it at all. Control functions may also be implemented



Table 3

Methods for assessing the effectiveness of implementing structural changes: criteria and indicators (controlled subsystem)

Criteria	Indicators
System expansion, sustainable growth, development	The production index of the economic complex (in comparable prices), % with respect to the previous year; the production indices of individual industries, the most important products (with a significant share in the production structure of the complex or strategically important for the meta-system)
Compliance of actual tendencies of system functioning and structural dynamics with requirements of self-preservation, stability, development	Share (and its dynamics) of the output of manufacturing industries, high-tech industries, industries of import substitution in the production structure of the corresponding complex, %; the index of physical volume of investments into fixed capital in the economic interest of the previous year, in comparison with other business systems (including in other regions); the number and dynamics of economic entities in the economic complex, their structure and structural dynamics (including in comparison with other complexes, and other regions); dynamics of the average number of employees of the economic complex, its individual sectors (including in comparison with other complexes, and other regions); the average monthly nominal wage in the economic complex, rub., etc.
Ratio of the performance of the system to the costs of its operation	Profitability for individual businesses in some of the most important types of products for the system, individual sectors (in comparison with other business entities, products, sectors); budget efficiency
Complete execution of system functions with respect to the meta-system	The following should be assessed for businesses (industry clusters): the completeness of accomplishing the functions of providing the population with jobs, income, food consumption; other enterprises with raw materials, materials, components (in cooperation), machinery and equipment, i.e., the indicators of consumption, production chains, import substitution, unemployment, etc.: unemployment rate (region, city, etc.), share of industry (sector) in total employment in the region (city), share of products (complex, industries, enterprises) in the production of such products in the country, in the consumption of its population (country, region, city, town), share of domestic production in consumption, share of domestic raw materials, materials, components, machinery and equipment in purchases of businesses, etc.

Source: compiled by the author.

fully, partially or not at all. In our opinion, the following are the most important for the controlled subsystem: 1) indicators of its viability (ability to continue operating for the foreseeable future): system expansion, sustainable growth and development; the actual tendencies of the system functioning and its structural dynamics meeting the requirements of self-preservation, stability, development; the ratio of the performance of the system to the costs of its operation; complete execution of system functions with respect to the meta-system.

The author suggests a system of criteria and indicators for evaluating the effectiveness of implementing the structural changes for administering the system. The criteria (and indicators) include: the degree of achieving management objectives (the ratio of achieved results to the number planned); consistency of

the goals with the tasks, methodology, methods and management tools (tasks, methods and management tools can either fully (1) meet the set goals, meet them in part: mostly, by half, to a lesser extent (0.75; 0.5; 0.25), or not at all (0)); the ratio of the cost of implementing the structural changes with the degree of achieving the objectives (1st option of assessment: the ratio of the share of the results achieved to the amount of funds spent on implementing the structural changes; 2nd option of assessment (more accurate and reasonable): the ratio of results (volume of production in rubles) obtained through using budgetary funds actually allocated for implementing the structural changes to the amount of budget funds used); the extent to which the management functions are accomplished in relation to the managing meta-system and the managed system (the indicators

measuring the number, depth and frequency (in time and space) [24] of management dysfunctions: planning, organization, coordination, etc., for example, the proportion of disrupted functions in their total amount (from a certain set), the share of dysfunctional subsystems (elements) in the total number of subsystems (elements), etc.).

The results of the study:

1. The article gives a brief analysis of the industry in the Kostroma region as an object of managing structural changes. The study identifies the deterioration trends in the sectoral structure of industry, the commodity structure of industrial exports and other structural problems of the economy of the Kostroma region. The author offers measures aimed at solving certain structural problems in the economy and industry of the region.

2. On the basis of the principle of consistency as a core of system philosophy, and general principles of management, the author formulated the principles of managing the structural changes in the economy (industry). The author justified the selection criteria of the purpose, the methods, and the tools to manage the structural changes in the economy (industry).

3. The author developed the criteria for assessing the quality of structural changes in the economy (industry). The author proposed a system of indicators to assess structural changes in the economy (industry) as a set of object, project and process systems, and to assess

structural changes in environmental systems that affect the state and trends of the industry.

4. The author has developed criteria and a system of indicators for estimating the efficiency of managing the structural changes in the economy (industry) for the controlled and controlling systems.

5. The methodology and procedure for assessing the quality and effectiveness of managing the structural changes in the economy should ensure that the goals of the state development programs are achieved and improve the efficiency of state management of the economy of the region. Continuous monitoring of the structural changes in the economy of the region and its industry will allow to timely indicate the structural problems and their aggravation, and to direct the available resources to resolve these problems. The proposed methodology and procedure will provide a systematic management of the structural changes in the economy and industry of the region. The scope of application of the obtained results is the structural policy, the management of structural changes in national and regional economy, economic complexes, industry.

The author sees the **directions for further research** in developing a more expanded system of indicators for assessing the efficiency of structural changes, in substantiating the criteria for the goals set matching the task, methodology, methods and tools for managing structural changes, the criteria and indicators of completeness of implementing the functions of the economic systems with respect to the meta-systems.

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