Man In India, 97 (15) : 343-352 

# SYSTEMATIZATION OF PROGRESSIVE INDICATORS OF INDUSTRIAL ENTERPRISES' SUSTAINABLE DEVELOPMENT

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The relevance of the study is conditioned by the modern trends of economic development which suggest that the sustainability of production is possible to provide, while maintaining and enhancing the natural and ecological environment, by looking qualitatively new, revolutionary opportunities, associated with the use of resource-saving and energy-saving technologies, as well as alternative, reproducible sources of industrial activity, the creation of favorable ecological, economic and social conditions for the accumulation and realization of human capital. The purpose of the paper is to systematize progressive indicators of the sustainability of the development of industrial enterprises aimed at increasing the competitiveness of products, the use of innovative energy and resource-saving technologies, minimizing waste generation. The leading method to the study of this problem is the index method, which allows us to consider this problem as a purposeful and organized process to increase the sustainability of the development of industrial enterprises. The paper gives an assessment of the current state of energy consumption of industrial enterprises; a set of progressive indicators of the sustainability of industrial enterprises is suggested. The practical value is that the results of the research make it possible to regulate the sustainable development of industrial enterprises in a better and more targeted way by applying innovative forms of energy and resource saving and can be used in the framework of sector programs, they are of interest to state statistics bodies, as well as ministries and agencies which are responsible for strategic analysis and planning.

***Keywords:*** Sustainable development, ecology, economy, resource saving, production.

## INTRODUCTION

Modern economy is characterized by huge expenditure of energy, capital and labor to maintain the competitive advantages of industry at the proper level, i.e. increasing the pace and scale of production by increasing the use of limited natural resources. The need for introducing a resource-saving type of economic development is described in a large number of studies, publications in scientific and periodicals (Mensch, 1985; Lazonick, 2006; Shinkevich, 2012; Malysheva, 2016; Lubnina, Melnik & Smolyagina, 2016). It is necessary consistently to develop methods and tools for managing the resource-saving of industrial enterprises, achieving adequate economic estimates of the real consumption of

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various kinds of resources (first of all, material), and also increasing the potential of resource-saving industries. Moreover, the need to accelerate the innovative development of society, based on the creation and widespread application of waste-free and low-waste, resource-saving technologies, the creation of ecological safe production, the search for alternative sources of thermal and electric energy, etc., is declared as the main goals and objectives in the industrial, scientific and technical, energy, socio-economic and other policies of the Russian government (Shinkevich et al., 2015a; Shinkevich et al., 2015b; Reznikov et al., 2015; Malysheva et al., 2016; Kudryavtseva et al., 2015 ; Zaraychenko et al., 2016; Ermolaeva, 2016).

## METHODOLOGICAL FRAMEWORK

### Theoretical background of the study

The theoretical basis of the paper was the theory of management, the theory of innovations, the neo-institutional theory, the evolutionary theory of innovation changes, the theory of cyclic nature of innovation development, the theory of transaction costs, the theory of the effectiveness of economic phenomena and processes, the theory of sustainable development.

The objectives of the study are: systematization of progressive indicators of the sustainability of industrial enterprises' development, aimed at increasing the competitiveness of products produced, the use of innovative energy and resource-saving technologies, minimizing waste generation.

### Methods of investigation

In obtaining scientific results, general scientific and private methods of cognition were used: formalization method, dialectical method, analogy, analysis and synthesis, methods of system, structural-functional, economic-mathematical simulation, multidimensional statistical analysis, comparisons, index methods, matrix methods, and methods of forecasting.

### Stages of the study

The study was conducted in three stages:

- at the first stage - the analysis of energy and resource consumption by industrial enterprises is conducted;
- at the second stage, the choice of a sustainable development strategy for the economy as a promising direction of energy and resource saving for industrial enterprises is scientifically justified;
- at the third stage - a set of progressive indicators of the sustainability of the development of industrial enterprises was proposed.

## RESULTS

### Current state of energy efficiency of the Republic of Tatarstan

Over the years, one of the priority areas for developing and improving the competitiveness of the economy of the Republic of Tatarstan is the implementation of the state policy in the field of energy saving and energy efficiency. The main document on the implementation of the energy efficiency policy is the state program of energy saving of the Republic of Tatarstan for 2014-2020.

The gross domestic product of the Republic of Tatarstan in 2016 in current prices amounted to more than 1.9 trillion. Rubles, which in comparable prices gave an increase of 29.7% to the base year of 2007. At the same time, the energy intensity of GDP has decreased by 24% since 2007, in particular, the decrease of this indicator in 2016 by 2015 was 0.76%. The task of developing the sustainability of the economy is to reduce the energy intensity of the republic's economy by another 16% by 2020.

The Republic of Tatarstan is among the leading regions in the energy efficiency rating of the constituent entities of the Russian Federation formed by the Ministry of Energy of Russia for 2016 and occupies the second place in its group in the category of estimated budgetary security, behind only the group leader of the Khanty-Mansiysk Autonomous District only by 0,1 point.

Among the main criteria taken into account when compiling the energy efficiency rating of subjects:

- reduction of GDP energy intensity;
- ensuring high energy efficiency of budgetary sector buildings;
- share of energy-efficient light sources in outdoor and indoor lighting;
- equipping with individual heat points;
- share of heat supply from CHP;
- inclusion of energy efficiency indicators in government programs,
- energy efficiency ensuring in construction and overhaul;
- Popularization of energy saving lifestyle.

The main contribution to the formation of the gross regional product of the republic is made by industry. This sector of the economy, including energy, accounts for more than 90% of the volume of consumption of primary fuel and energy resources (natural gas, fuel oil, diesel fuel, gasoline, coal, electricity purchase). At the end of 2016, the indicator of energy intensity in industry was reduced by 1.9% by 2015 (by 27.2% compared to 2007). In the context of the main industries, the reduction in the energy intensity indicator of output in 2016 is observed in all sectors, except for the fuel industry. Separately, it should be noted a significant reduction in energy intensity of agricultural production by 9.3% by 2015 (the

indicator value in 2015 - 9.53 tons / ton of rubles in 2007 prices). One of the most energy-intensive industries is chemical and petrochemical production. Among the enterprises of the industry, the most effective work to reduce the energy intensity of production was carried out at the factories "KVART", "Ammoniy", "Kazanorgsynthes" and " Nizhnekamskneftekhim". The positive experience of Nizhnekamskneftekhim on the introduction of an efficient energy management system based on the energy management standard (GOST R ISO 50001-2012) was noted. The system allows daily monitoring of consumption of all types of energy resources, managing the process of energy consumption and optimizing the consumption of all types of resources to optimal values for the technology of production.

Despite quite good results, in comparison with the developed countries of the world and Europe, it should be recognized that we still have a high specific energy intensity of the economy and there is a significant unrealized potential for energy saving. In this regard, there is still a lot of work to improve the energy efficiency and competitiveness of the economy of Tatarstan.

**Sustainable development as a promising direction of energy and resource saving of industrial enterprises**

The most important criterion for assessing the state of production, determining its competitiveness and potential, is sustainability. It is the main goal of industrial production, which can be achieved with the use of new efficient technologies, reducing adverse environmental impact, saving natural resources, high social responsibility, contributing to the success of enterprises and helping to build more efficient production that can function reliably and maintain sustainability in an unstable competitive environment.

Sustainability of production is the ability continuously to fulfill all of its obligations in the event of sudden fluctuations in market conditions, business conditions, and predictable force majeure circumstances for future years.

For the first time, the term "sustainable development" was expressed in the Report presented to the United Nations in 1987 by the International Commission on Environment and Development (under the leadership of G.Kh. Brundtland). The Commission proposed the following definition of "sustainable development" - a development that meets the needs of the present, but does not compromise the ability of future generations to meet their own needs. The concept of sustainable development was officially recognized at the United Nations Conference on Environment and Development (Rio de Janeiro, 1992), which brought together representatives of more than seventy states. At the Conference, reports were published proving that the world as an integral system has growth limits, natural resources are almost exhausted (oil, gas, ores, etc.), and the growth of the industry has come to its boundaries, beyond of which humanity is waiting

for a global catastrophe, therefore a new concept of sustainable development is needed.

The results of the UN Conference cannot be overestimated. In many countries, laws on environmental protection have been enacted, the withdrawal of industries from major cities began, the harmful industries (coal mines, sections, quarries, etc.) began to be closed. In the Russian Federation, the Concept of transition to sustainable development was adopted by the Decree of the President of the Russian Federation of April 1, 1996, No. 440. Although this concept was supported by the President of the Russian Federation, however, its further development in the form of developing a state strategy for sustainable development of Russia has not been determined to this day. Consequently, the concept of sustainable development has not yet become the determining basis of the economic policy of the Russian state, the measures taken by the government in this area are clearly insufficient, often contradictory, and most of its provisions are not implemented in practice and in this connection, research on this topic is relevant in the current market economy.

The theory of sustainable development is based on the priority of economic, environmental and social factors that form a dialectical unity. They are interrelated, interdependent, have an impact on each other.

Economic sustainability is achieved while maintaining the aggregate capital with the help of which the income is generated. It implies the optimal use of non-reproducible natural resources, the use of innovative energy and resource-saving technologies, minimization, processing and elimination of waste. The economic component is the basis of production reliability. The concept of sustainable development changed the understanding of the concept “production efficiency”. Obviously, long-term economic planning is more effective if natural patterns are taken into account when implementing it.

Environmental sustainability of production is to preserve the integrity of natural systems. Particular attention is paid to maintaining the ability to self-repair ecosystems. Under the influence of industrial enterprises on the environment, natural resources are degraded, pollution of the environment and loss of biodiversity take place, which reduces the ability of ecosystems to self-restoring. To refuse from the traditional stereotypes of the behavior of managers are not allowed, on the one hand, by mercantile interests, on the other - a lack of understanding of the environmental threat. The further development of industrial production is necessary, taking into account an adequate assessment of its impact on the natural environment.

Social sustainability is aimed at a person, to preserve the stability of public goods. To do this, it is necessary to preserve the quality of the environment, cultural capital, and to create a more effective decision-making system that takes into account historical experience, traditions and diversity of cultures.

At the beginning of the 21st century, the creation and operation of highly effective resource-saving technologies, which ensure the production of high-quality,

environmentally safe products with optimal material consumption and energy intensity, further improvement of existing technologies and the rapid development of innovative resource-saving technologies, is the most important factor in the implementation of the transition to sustainable development.

Resource saving in industry or production is a purposeful combination of a variety of research, educational, design, business, production, economic, managerial and trade activities performed on the basis of the most complete use of intellectual and information resources of society to ensure optimal unit costs of all types of natural, material and labor resources, which are necessary for production of products (goods or services) at the required time of the required type, of required quantity and quality in compliance with the provisions of national and international law, as well as environmental protection from pollution.

Proceeding from the proposed approach, it can be concluded that sustainable development of production can be ensured by preserving and strengthening the natural and ecological environment, by searching for qualitatively new revolutionary possibilities connected with the use of resource-saving and energy-saving technologies, as well as alternative, reproducible sources of production activity, environmental and economic and social conditions for the accumulation and realization of human capital.

**Systematization of progressive indicators of sustainable development of industrial enterprises**

For the economy of industry, in order to guide its activities towards greater sustainability, it is necessary to have tools for assessing the technological and entrepreneurial operations to which they relate. One can consider the indicators that can be used to measure the stability characteristics of an enterprise as a whole or a certain subdivision of an industrial and economic organization.

The processing industry has made significant progress in the last decade of the twentieth century, especially in improving the characteristics and performance indicators of production and the characteristics of the state of the environment. However, moving towards a goal related to sustainable development demands from enterprises also to check and improve other aspects, which usually were not given much attention.

In general, the impact of industry on the environment can be generalized as a concept that embraces three components of sustainable development: responsibility for the state of the environment, economic reproduction (creation of wealth) and social development.

Many organizations are now studying and closely following these three parallel directions for sustainable development, using indicators of sustainable development to assess and manage their products, technological processes and social development

of employees and to protect their position in rapidly changing environment legislation and shareholder associations.

Progressive indicators are presented in the form of three groups: indicators of the state of the environment, or natural-resource indicators, economic indicators and social indicators, which reflect the three main components of sustainable development.

Not all progressive indicators described in this paper will be applicable for every enterprise, operating unit, process operation or business process. For some enterprises, other indicators may be more appropriate, and those enterprises which are responsible for sustainable development should be prepared to select and describe their own special indicators. Nevertheless, in order to provide a balanced overview of indicators of sustainability of development, there should exist basic or key indicators in each of the three areas related to human technological or entrepreneurial activities: ecological, economic and social.

As with all tasks of etalon testing or etalon assessment, achieved level, the company will get the greatest benefit from this data if they are collected for a large number of operating units, for many years, on a joint basis. This allows us to determine the general trends and the effect of implementing policies in the business of the company's technological activities.

Most progressive indicators of sustainability of development are calculated in the form of the corresponding relative coefficients. Relative indices, or indicators, can be chosen to ensure the measurement of independence of impact from the scale of an operation, or to evaluate costs over profit, and in some cases they can make it possible to compare different transactions among themselves. For example, in some areas, the impact on the environment by the cost of products or services is a good measure of environmental efficiency, or eco-efficiency.

One can consider the system of indicators of sustainable development of manufacturing enterprises.

Economic sustainability

- Industrial production index,%;
- Specific weight of innovative goods, works, services in the total volume of shipped goods of own production,%;
- Labor productivity (ratio of added value to the average number of employees), thousand rubles;
- Degree of depreciation of fixed assets,%;
- Investments per employee, thousand rubles.

Social Reliability:

- The number of employees dropped due to the reduction (in% of the total number of dropouts);

- Average monthly wages, rubles;
- Specific weight of the number of employees working in terms of labor conditions that do not meet the hygienic standards (in percentage of the total number of employees of the corresponding economic activity and sex);
- Actual costs of compensation and personal protective equipment (estimated data,%):
- For payment of additional leave
- For higher salaries
- For payment of preventive nutrition
- For overalls, special footwear and other personal protective equipment.

Environmental Reliability

- General indicators of water use, thousand m3 per 1 worker;
- Polluted wastewater was discharged into surface water bodies, in % of the total amount of fresh water used;
- Emissions of pollutants entering the atmosphere from stationary sources, tons per 1 worker;
- Capture and neutralization of atmospheric pollutants, departing from stationary sources, tons per 1 worker;
- Formation of toxic waste for the reporting year, tons per 1 worker;
- Use and neutralization of toxic waste, tons per 1 worker;
- Current costs of environmental protection, thousand rubles per 1 worker;
- Costs for capital repairs of major production assets for environmental protection, thousand rubles per 1 worker.

Progressive indicators of sustainability of development will help to learn more about the impact of technological operations and business processes of the company on sustainable development. These indicators will also enable the company to establish benchmarks and develop standards for internal benchmark tests of the achieved level of sustainable development and monitoring of annual progress.

## DISCUSSION

The need for sustainable development and the introduction of a resource-saving type of economic development has been the subject of a large number of studies, publications in Russian (Malysheva, 2016, Lazonick, 2006; Mensch, 1979; Perez, 1985; Shinkevich et al., 2016; Galimulina et al., 2016; Kat'kalo, 2003; Shinkevich & Lubnina 2011) and foreign scientific periodicals (Wallerstein, 1979; Krugman & Venabies; 1995; Silverberg & Verspagen; 1995; Leydesdorff, 2005). A significant scientific interest is the methodological development of approaches to assessing

efficiency and managing the institutionalization of sustainable innovation development. Fragmentary studies or statement of tasks by economists are known, which can be adapted to solve this scientific problem. They include the findings and results of scientific research (Williamson, 1985, Kat'kalo, 2003, Shinkevich et al., 2017; Lubnina et al., 2016, etc.).

At the same time, in the presence of an extensive theoretical and methodological array of data and practical solutions, a unified methodology for the innovative development of enterprises is still not developed based on sustainable development and formalized quantitative approaches combining the latest achievements of modern administrative science and taking into account the essential specifics.

## CONCLUSION

The paper gives an assessment of the current state of energy efficiency; prospective directions of increase of energy and resource efficiency of industrial enterprises are revealed.

The choice of sustainable development strategy for the economy as a promising direction of energy and resource saving of industrial enterprises and the ecologization of industries has been scientifically proved.

The complex of progressive indices of sustainable development of industrial enterprises is systematized, which will help to learn more about the impact of technological operations and business processes of the company on sustainable development and will enable the company to establish control objectives, develop standards for internal benchmarking of the achieved level of sustainable development, and monitor annual progress.

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