# Evolution of economic development aims. Assessment of the smart growth

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**Abstract.** The paper investigated the global trends of changing aims for evaluating economic development. Approaches to assessing the level of innovation are systematized. Classifications of innovations are given. The approach to the assessment of smart growth using the theory of technological way is proposed. The results of testing the author's approach to the assessment of innovative development on the example of one of the branches of the Russian economy are presented in the article. The correlation between the specificity of the system elements and their rate of evolution is determined. The industry's innovative development forecast based on the Foresight estimates is performed.

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**Keywords:** economic growth and development, a strategy for smart, sustainable and inclusive growth, classification of innovations, technological way, the rate of evolution of the system and its components

## Introduction

The turning point in the evolution of views on economic development is the 1992 UN conference in Rio de Janeiro. In the published document of the conference «Agenda 21» reflected the principles of sustainable development, concretized in the list of indicators [1]. Over the past five years a number of documents, reflecting the evolution of the aims and values of economic development were accepted. The most significant of these are The Growth Report: Strategies for Sustained Growth and Inclusive Development [2], Europe 2020: A strategy for smart, sustainable and inclusive growth [3] и World Investment Report 2012: Towards a New Generation of Investment Policies [4]. Evolution of aims determines the change of model of economic development and the degree of progress evaluation system.

The basis of the traditional economy is the concept of unlimited economic growth. A. Smith linked economic growth with level of labor productivity and national welfare, D. Riccardo – with increase in consumption, K. Marx – with surplus value. In the early twentieth century, J. Schumpeter introduced the concept of quality changes linking economic development with the introduction of innovations that contributed to the evolution of views on economic development (Table 1).

**Table 1. Evolution of concepts of economic growth and development**

| Concept of development | Characteristic | Start of building concept |
|---|---|---|
| Economic growth | Assessment based on welfare, labor productivity | The second half of the eighteenth century |
| Economic growth and development | Evaluation of quantitative (GDP growth ) and qualitative changes (innovation ) | J. Schumpeter in the early twentieth century |
| Sustainable development | Comprehensive assessment of development based on economic, social, environmental, and legal aspects. | United Nations Conference, 1992; Work program Indicators of sustainable development, 1995 |
| Sustained growth and inclusive development | Assessment of the development from the standpoint of social justice and equality of opportunities (poverty reduction, growth of employment, access to education, health care) | The Growth Report. Strategies for Sustained Growth and Inclusive Development, 2008. |
| Smart, sustainable and inclusive growth | Comprehensive assessment of the economy based on knowledge and innovation; efficient use of resources and competitiveness; promoting employment, social and territorial cohesion. | Europe 2020. A strategy for smart, sustainable and inclusive growth, 2010. |
| Inclusive growth and sustainable development | Assessing the contribution of foreign direct investment from the perspective of created added value, employment, incomes, and territories. | UNCTAD, World Investment Report 2012: Towards a New Generation of Investment Policies. |

Economic growth in contrast to economic development is associated with quantitative changes. Many researchers use the concepts of economic growth and development as interchangeable. Among the indicators that reflect the level of economic development the indicator of GDP per capita is currently the most widely used. For valid comparisons across countries indicator is calculated based on purchasing power parity.

In the second half of the twentieth century the assessment of degree of progress became based not only on economic but also social criteria. Economic values were considered as one of components of human development. It is noted in the article [5] that «Evolution of methods for assessing countries and regions is directed towards the «socialization» of indicators». World Bank experts from the 90s began to use so-called «crystals of development» allowing comparing the four most important socio-economic characteristics visually: 1) life expectancy; 2) Primary education enrollment of children, 3) access to safe drinking water; 4) GNP per capita. The reports of the United Nations Development Programme (UNDP) estimate the level of development achieved in various countries with a special Human Development Index (HDI).

Intensive economic growth, especially in the second half of the twentieth century, led not only to increasing economic inequality, but also increasing the burden on the environment. Increasing the number of accidents by the end of the twentieth century, climate change and the depletion of non-renewable resources contributed to the greening of scientific knowledge and system of values. Triune concept of sustainable development which includes economic, social and environmental dimension began to take shape in the 70 - 80s of the twentieth century, received the official status at the UN Conference in 1992. The Sustainable Development Strategy was proclaimed in the Russian Federation by Presidential Decree in 1994. In 1995 the UN Commission adopted the Work Program on indicators of sustainable development, reflecting the four aspects of development: social, economic, environmental and institutional.

Modern values and principles of development were enshrined in the UN Millennium Declaration in 2000 [6]. Equality of opportunities to use the benefits from development, solidarity in equitable distribution of costs, and respect for nature were declared among the social values. Equity and social justice were recognized as the most important principles.

The global financial crisis that began in 2008 has exacerbated social problems - loss of jobs and declining living standards. In the same year, the Commission of Growth and Development published the Report on Growth: Strategies of sustainable growth and inclusive development. According to M. Spence [2] steady growth is not an end in itself, but it can ensure the reduction of poverty, employment, education, health and opportunity for creativity. Strategy of inclusive growth and sustainable development reflected in the new investment policy UNCTAD 2012. New FDI (foreign direct investment) Contribution Index to economic development became evaluated «in terms of value added, employment and wage generation, tax revenues, export generation and capital formation» [4].

In accordance with the evolutionary approach economic development is a moving target. Evolution of aims of development occurs in accordance with changes in the external and internal environment. Taking into account the effects of the global financial crisis and exacerbated problems with employment, especially among young people, economic slowdown and increasing external debt in 2010, the third draft of the EU's Lisbon strategy Europe 2020 was adopted: A strategy for smart, sustainable and inclusive growth. «Smart growth» is understood as development based on knowledge and innovation, «sustainable growth» - as increase of competitiveness with efficient use of resources; «inclusive growth» - as promotion of employment , social and territorial cohesion. Smart growth enables sustainable growth and inclusive growth by reducing the load on the environment and improving living standards.

The urgency of developing systems for measuring the level and the rate of growth is determined by the need for effective management of development. Among the declared goals of development the greatest difficulty to measure progress is «smart growth». Widespread commercial evaluation approach based on the criteria of innovation NPV (Net Present Value), PP (Pay-Back Period), PI (Profitability Index), ROI (Return on Investment), and IRR (Internal Rate of Return). Management of innovative development based on economic feasibility criteria narrows the range of options for innovation. As practice shows, primarily small innovations are introduced requiring a minimum cost.

A different approach to evaluation of innovation is known - energy information. A. Makarov [7] uses the concept of materialized knowledge in the art and technology to explain patterns of energy development. The growth rate of the materialized knowledge is considered in this approach by improving the quality of energy sources and information measure of system diversity. The

notion of an information component was introduced by I. Shannon [8]. Innovative development of energy sources is estimated by A. Makarov through its value. The logarithm of the product of the energy density and power process handling is used in [9] for a quantitative measure of the value of energy. The dynamics of innovative development by sources of used energy is shown in Figure 1.

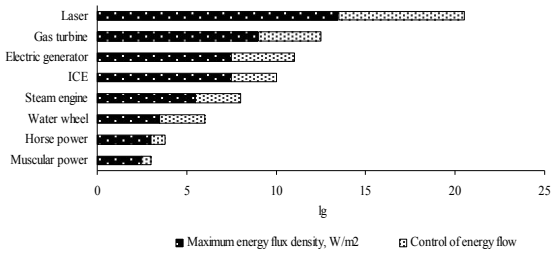


**Figure 1. Evolution of energy sources on the characteristics of the value of energy (constructed by the authors according to A. Makarov [7])**

Energy-information approach allows quantifying smart growth only for energy processes. The most versatile method to assess the level of innovative development of the economy and its individual subsystems is required.

Most of researchers engaged in innovative development share innovation on several levels. Table 2 shows two-level classifications. Innovation division at revolutionary (radical) and evolutionary (routine) indicates that smart growth occurs nonlinearly. Evolutionary approach to development is associated with quality abrupt changes. Of particular interest from the standpoint of evolutionary theory of economic development is the theory of technological structures (ways) of Glazyev, according to which the basic (core) innovations are implemented in the form of technical generation change [10]. The economy in this theory is seen as a system of interrelated industries. Each new structure is the formation of new industries based on revolutionary innovations that constitute a key factor. Technological wave length corresponds to the length of Kondratieff long waves. Glazyev allocated 6 technological structures.

**Table 2. Classification of innovations**

| Authors | Types of innovations and inventions | |
|---|---|---|
| J. Schumpeter, 1934;<br>R. Stoubaugh,1988;<br>R. Henderson and K. Clark, 1990;<br>R. Moriarty and T. Kosnik, 1990;<br>C. Freeman, 1994;<br>M. Lee and D. Na, 1994;<br>K. Atuahene-Gima, 1995;<br>R. Balachandra and J. Friar, 1997;<br>E. Kessler and A. Chakrabarti, 1999 | Incremental | Radical |
| J. Grossman, 1970 | Instrumental | Ultimate |
| W. Priest and C. Hill, 1980 | Incremental | Discrete |
| W. Abernathy and K. Clark, 1985 | Regular | Revolutionary |
| R. Rothwell and P. Gardiner,1988 | Reinnovations | Innovations |
| J. Tidd, 1988;<br>M. Rice et al, 1998; | Incremental | Breakthrough |
| P. Meyers and F. Tucker, 1989 | Routine | Radical |
| J. Utterback, 1996 | Evolutionary | Revolutionary |
| C. Christensen, 1997 | Sustaining | Disruptive |
| J. Schmidt and R. Calantone, 1998;<br>M. Song and M. Montoya-Weiss, 1998 | Incremental | Really new |
| V. Medynsky, 2002;<br>S. Ildemenov, 2003 | Ordinary | Radical |
| M. Coccia, 2005 | Elementary (micro-incremental) | Cluster (new technological system) |
| S. Glazyev, 2010 | Secondary | Basic (core) |

The authors in [11] applied the theory of technological ways to explore the innovative development of one branch of he Russian economy from 1870 to 2010. The result of the study was

determination of the periods of development of the industry in terms of technological structures and technological wave duration for the objects of innovations.

The problem of formation the evaluation system for level and dynamics of smart growth was posed in this paper. The proposed evaluation system is based on a 6-level scale of technological structures. Each level corresponds to a number of technological way. The study is based on a systemic and evolutionary approach. It is assumed that the evolution of the system occurs nonlinear and depends on the development of its elements. Components of the technological mode of production in the form of materials, equipment and technology for all processes necessary for the functioning of the system are considered as elements of the production system. One of the sectors of the Russian economy served as an object of study.

The level of speed and smart growth was assessed for each element of the system. The evaluation results in Figure 2 show the different rates of development of elements of the system established during the second technological way.

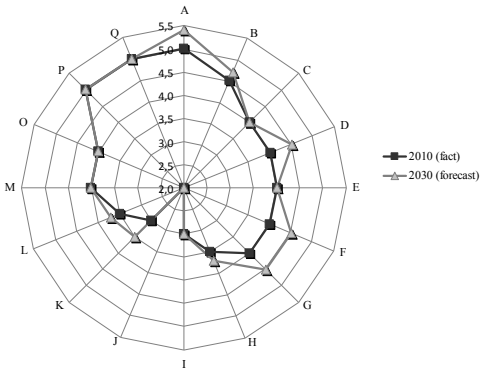


**Figure 2. Comparative evaluation of innovative development of the system elements (forecast was done on the basis of Foresight estimates [12, 13])**

Grouping items according to the speed of innovative development revealed the following:

1. Elements which level of innovative development remains virtually unchanged (I, J elements) refer to the basic technology or the main production process. They have a high level of specificity.

2. Elements with a low rate of change (C, D, E, F, G, H, K, L, M, O elements) refer to the technologies-centenarians associated with the underlying technology. They have an average level of specificity.

3. Elements with a high rate of change (A, B, P, Q elements) are actively evolving elements used in operating and maintenance in a wide range of industries. They are not specific with respect to the other elements of the industry.

The elements of process control systems, diagnostic systems and multifunctional materials were classified as actively evolving elements. The resulting velocity ratio of elements of different groups averaging 1 – 1,2 – 1,3. These results suggest an inverse relationship between the level of specificity of the system element and the rate of evolution. The system structure in terms of the specificity of its elements affects the pace of smart growth.

Revealed laws allow a smart growth forecast by the ratings system, proposed by the authors. In accordance with the structure of the 6th technological way nanoelements will become a key factor in the development, i.e. the development of nanoelectronics, molecular- and nanophotonics, nanobiotechnology, nanosistem technology, nanomaterials and nanostructured coatings .

Speed of innovations of non-specific elements of industries depends largely on the timing of the creation of foreground innovative technologies. The authors made a smart growth forecast for 2030 year for the studied industry based on Foresight estimates of foreground innovative technologies development in the twenty-first century in Europe, USA and Japan in the period 2015-2030 [12, 13]. Forecast results are presented in Fig. 2.

The proposed evaluation system for innovation level can serve as basis for the formation of a monitoring and control smart growth. This rating system is based on the theory of the evolutionary nature of innovation and technological structures that is recognized by scientific community. Universality and systematic nature of the approach enables the assessment of the economy as a whole and its individual members, in retrospect, and in the future. Revealed patterns of the influence of the specificity level of the elements can also be used to form factor model of economic subsystems development.

The results of the research allowed drawing the following conclusions:

1. Economics is an evolving system with moving targets.

2. Compulsory part of modern development is smart growth, which is both ends and means.

3. The proposed approach of estimation the level of smart growth based on the theory of technological ways allows to evaluate its level and speed, as well as to forecast the development of each element and the system as a whole.

4. Testing of the proposed approach revealed different rates of innovative growth of elements of the system suggesting that there is relationship between the structure of the system and the speed of its evolution.

5. Control of smart growth acceleration lies in a plane of the use of non- specific elements of the system with the best prospects for evolution.

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