Forecasting development risks of regional economy

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Abstract — **The role of planning of target indicators and forecasting of risks of economic stability significantly increases in the conditions of economic independence of regional development. At the present stage, a strategic approach to the formation of the region's economic potential is required. The purpose of the research is to substantiate the directions of modernization of the management system of mesoeconomics. The paper considers the mechanism of the preemptive-regulatory impact on the economy in identifying the risk factors of failure to meet the development targets. The process of economic and mathematical forecasting of key indicators of the region is presented on the example of the Rostov region. The authors substantiate an iterative algorithm of analyzing the risks of development of the region's reproductive base. The directions of regulation of the leading sectors of the economy in conditions of structurally-dynamic instability are the result of the research.**

Keywords—forecasting of risks, development of the region, macroeconomics, economic potential, reproductive base

I. INTRODUCTION

The role of regional government has significantly increased in the existing economic realities. First of all, this is due to the strengthening of the structurally-dynamic instability of Russian regions [1], [2], [3]. The instability of the socioeconomic course of single regions can be so significant that it can provoke increased interest on the part of the authorities [2]. Therefore, we can talk about tightening the criteria for the development of organizational schemes, simple and fair algorithms and mechanisms to increase the level of stability of economic development of economic complexes in the territories [3].

The uncertainty of a further vector of development of the certain area can be considered as the ground for the appearance of such complexities. This will inevitably lead to difficulties in the search for mechanisms of socio-economic research and regulation of its constituent elements [4].

The need for proactive management of the regional economy, above all, is justified by the cyclical algorithm of its development. The foundation for determining the direction of the gradual progressive development of the region is the competent analysis of the overall dynamics of structural and voluminous criteria for the work of the regional economy sectors. Such an assessment helps to identify the interrelations of development and the emergence of the possibility of selecting targeted instruments of influence [5].

Regulation of the economy based on the mechanisms of the reproduction approach determines the oscillatory movements of economic development.

At the same time effective public administration on the basis of scenario approaches allows to change the nature of recessions of a business cycle and can act as the instrument of the advancing regulation. Crises in this process carry out a role of factors of high-quality structural catalysts of updating of main capital [6].

II. MATERIALS AND METHODS (MODEL)

The difficulties connected with the search and comparative analysis of different scenarios for the development of the region, and, in addition, the identification of prospective sources of their financing, are relevant to date [7]. A key reason preventing the full development of the potential of the Russian regions may be a lack of implemented socio-economic reforms, especially in terms of the investment and structural policies of the entity [8].

Therefore, there is a need to develop methods and tools for managing investment activities in the region, as this will help to implement a consistent strategy for managing the regional economy. Changes and additions to the list of previously practiced methods of management can be the consequence of sudden changes in the external environment [9].

If the usual methods reactive character, since management with their application is possible only after the fixed deviation of planned targets, the outstripping control is very effective and consists in the fact that the object and the subject of management are determined based on external factors and could predict the changes. The methods of proactive management correspond to today's conditions of economic development in the domestic regions.

National projects, federal and regional programs of socio-economic development, which are formed both by the federal authorities and by the subjects themselves are traditionally considered to be another form of governance.

Known methods for overcoming the financial and economic crisis assume the transformation of forms and tools of government planning both in the Russian Federation and abroad, where there is a great deal of experience in the methodology and practice of developing directive plans. Various methods, for example, those used for the development of industries, it is possible to apply practically without changes today [10].

There is a format of planned regulation, the authorities influence economic development by coordinating and providing the necessary information than by taking decisions and issuing instructions, in many states [11].

The states take the methods of strategic planning and economic regulation as a basis, and, also, if necessary, place market relations in conditions of absolute competition, the economy into a dynamic balance regime, the level of consumption of less protected groups of population into an acceptable level of the subsistence level.

Today, the practice of resuscitation of strategic planning is widespread in the Russian Federation, especially at the regional level. The obsolete planning mechanism at the meso level and the insufficient borrowing of the mesoeconomic regulation instruments tested in various states have become one of the prerequisites for the low rate of the domestic economy's exit from the crisis [11].

The way out of this situation presupposes a significant strengthening of the impact on the economy from the part of the authorities. But in this case, it is necessary to adapt the foreign and domestic practice (both positive and negative) in the context of the correlation of the plan and the market in certain territories [12].

Given the existing range of perspectives on how to achieve, the region's tasks of achieving national competitiveness, sustainable economic growth of mesoeconomics, improving the living standards of people, the leading role in this, of course, is played by strategic planning.

III. RESULTS AND DISCUSSION

One can not underestimate strategic planning in the rapidly changing context of the transition of modern states to a post-industrial economy. Due to this, innovation-technological development of the territory's economy becomes possible. Despite progressive hardening and growth of basic macroeconomic factors in recent decades, this does not balance the consequences of the past crisis in the economic development of subjects [8].

The reason for this is the technological backlog, which needs a significant increase in the volume of capital investments, which is currently not done and most likely will not be achieved by the usual methods.

Also, the increasing volumes of production can be called qualitatively unsatisfactory. They reveal the problems typical for the domestic economy in general - the distortion of the raw export-oriented industries to the detriment of the more technologically advanced industries.

Due to the entrenched order of redistribution of commodity assets, such trend captures the technological backwardness of Russia and the dependence of the economy on external factors, deprives our country of the opportunity to be fully involved in the fierce international competition.

The analysis resulted in the identification of basic strategic risks for the stable socio-economic development of the territories [13]:

- rotation of generations and technological order. Younger generation will exist in the post-industrial world. Different technologies, artificial intelligence, gene industry, bioengineering, strengthening of the world division of labor, uselessness of borders will significantly change the structure and definition of productive forces;

- the industrial type of economy or exclusively its agricultural orientation from competitive superiority can be transformed into a problem in the new century;

- "demographic issue", for which typically the increase in the average age of the population, as well as the disproportionality of the structure and quality of labor resources to the requirements of the country's economy;

- lack of various mineral and raw materials and fuel-energy assets;

- ecological problems. During the development of the industrial sector, people have accumulated billions of tons of waste.

Considering all the above factors, one can confidently say that it is impossible to deal with the risks and adequately respond to the challenges that Russia is facing today, in large part because of the imperfection of the market system with under-formalized structural elements, which is Russian system today.

The optimal way out for solving the announced tasks is to strengthen the system-forming role of the state. There are already real prerequisites that are expressed in political and

economic stability, for the formation of development programs for an extended period.

Based on the economic theory of production tools, the scale and dynamics of social reproduction, the stability of economic growth, the prospects for the most complete satisfaction of the needs of citizens are provided by the availability, condition and quality of the use of productive forces. Accordingly, when deciding on the choice of a management style for the development of the territory, the advantage was behind the analysis and forecasting of threats in the development of the reproduction base of the subject in the context of today's instability [11].

The research of the level of territorial risks and their structure helped to identify those developmental markers which affect the structural and dynamic instability of the socio-economic conjuncture in the period under study. Having deduced such factors, it is possible to build a forecast of their development to understand the level of the future threat, and to reduce the regional risk with the help of influence on them.

During the research, standard characteristics of the level of regional risk were calculated: mathematical expectation; dispersion; standard deviation; the coefficient of variation.

To illustrate the calculations, the social and economic potential of the Rostov region is considered (Table 1).

TABLE I.   INITIAL DATA FOR CALCULATION

Years	Indicators		
	$X(t)$	$F(t)$	$L(t)$
2004	221167441	2287952	661721
2005	263051545	3221535	652260
2006	340012499	4155118	628894
2007	450434740	5088700	635649
2008	576125729	6022283	617947
2009	555917065	6955866	584960
2010	659667404	8077948	567794
2011	765967230	8664441	542049
2012	843560316	9846046	535898
2013	917689136	10347938	519118
2014	1007758755	11731858	502338
2015	1171784071	12672198	485558

The calculations were based on the model of the production function with an autonomous rate of technological progress: $X(t) = A_0 e^{\gamma t} F^\alpha(t) L^\beta(t)$, where $X(t)$ is the gross regional product; $L(t)$ - the average annual number of employees; $F(t)$ - fixed assets in the economy; γ is the autonomous rate of technological progress; A_0, α are the parameters of the function.

At the first stage, graphs of the functions $X(t)$, $F(t)$, $L(t)$ in one coordinate system are constructed (Fig. 1). Analysis of

these graphs made it possible to conclude that on a large retrospective segment, the determining factor is the cost of production assets. Given that the gross regional product was in a state of some structural and dynamic instability, $L(t)$ is systematically decreasing, and $F(t)$ is increasing, we can assume that γ is a negative number and at the same time not less than (-1).
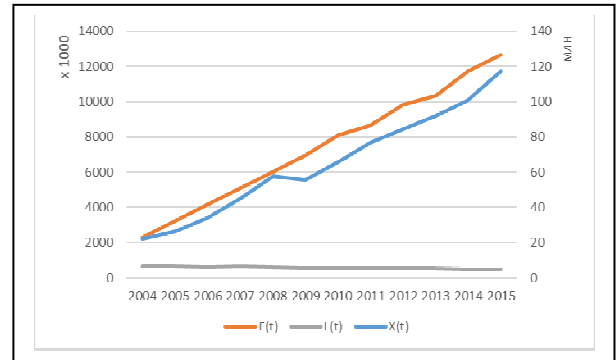

Fig. 1.   Visualization of functions $X(t)$, $F(t)$, $L(t)$.

In the next step, the parameters of the production function $X(t) = A_0 e^{\gamma t} F^\alpha(t) L^\beta(t)$ are defined by least-squares method what logarithming of both parts of production function is made for:

$$\ln x(t) = \ln A_0 + \gamma t + \alpha \ln F(t) + (1 - \alpha) \ln L(t) =$$

$$= a\,\alpha + \gamma t + \ln L(t) + \alpha \ln F(t) / L(t).$$

$$E = \sum_1^n \left(\ln x - a - \gamma t - \ln L - \alpha \ln \frac{F}{L} \right)^2 \to \min$$

Solution of a system of the normal equations of the form

$$\begin{cases} na + \gamma \sum_1^n t + \sum_1^n \ln L + \alpha \sum_1^n \ln \frac{F}{L} = \sum_1^n \ln x \\ a \sum_1^n t + \gamma \sum_1^n t^2 + \sum_1^n t \ln L + \alpha \sum_1^n t \ln \frac{F}{L} = \sum_1^n t \ln x \\ a \sum_1^n \ln \frac{F}{L} + \gamma \sum_1^n t \ln \frac{F}{L} + \sum_1^n \ln L \ln \frac{F}{L} + \alpha \sum_1^n \ln^2 \frac{F}{L} = \sum_1^n \ln x \ln \frac{F}{L} \end{cases}$$

by Kramer's method using the applied MATHCAD tools gives the following function:

$$X = 321{,}82\; e^{0,174t}\; K^{-0,0002}\; L^{1,0002}$$

To analyze the quality of the regression dependence, the determination coefficient $R^2 = 0{,}98$ has been applied. To determine the statistical significance of the coefficient of determination, the F-criterion was used. The calculated value of the F-criterion is 343,7.

Next, we predicted the gross regional product values for the next 3 years (Table 2). Values of cost of basic production assets (2016-2018) have been also defined.

Thus, taking into account risk factor the received expected values of a gross regional product for lack of official statistics in general correspond to expert estimates.

TABLE II.　　　INITIAL DATA FOR CALCULATION

Years	Indicators		
	X(t)	F(t)	L(t)
2016	1 447 645 105	13 490 944	468 778
2017	1 661 075 787	14 424 527	451 997
2018	1 903 347 396	15 358 110	435 217

An analysis of the risk level of the territory indicates a significant structural and dynamic volatility in the socioeconomic environment. A significant number of different factors that influence the threats in the subject have a significant degree of variability. The dynamics of the gross regional product per capita is least stable in the period under study.

In addition, the dynamics of the foreign trade turnover per capita volume as well as of the financial provision of the territory and the share of average number of the citizens working at small and medium-sized enterprises, shares of investments into fixed capital is unstable.

These factors are one of the key reasons for the increase in the level of risks in the entity and explain the need for state regulation and reducing regional risk for the growth of socio-economic potential and attracting investors to the territory.

The main trend in the development of the industrial complex is to make an increase in the scale of manufacturing industries, while the most significant dynamics should show engineering and metalworking, the food industry.

The state faces the challenge of modernizing industrial production and introducing innovative technologies in engineering. Based on existing intellectual resources and attracted investments, it is necessary to plan the formation of a base for high-tech engineering that will produce competitive goods and demonstrate labor productivity at the international level [6], [8].

Raw materials industries should also begin to increase the share of output of final finished goods. The key efforts should be directed to the creation of the newest progressive model of economic growth, based on the rapid pace of development of science intensive processes in the planning period. This will help to increase the competitiveness of goods on qualitative criteria and energy intensity, labor costs and environmental requirements. In agriculture, the interrelation between the current specialization of individual regions and the complex development of the agro-industrial complex is vitally important. The task of supporting agriculture sounds in a new way: in addition to budgetary funds, to attract investments from leading industrial enterprises, processing industries, companies engaged in the production of food, meat and dairy products.

The leading party is in the future left behind development of the infrastructure directions of economy, in particular – transport and road economy. In the social sphere, the key to success should be the improvement of the living standards of citizens and the "closing" of their housing needs, modern

medical care, a decent level of education, culture and social interaction [10], [12].

Also distinguish state regulation of mesoeconomy which has to be carried out taking into account the maximum operation of positive sides of a geographical and economic situation of the territory from the main objectives. As it was already told, a marker of efficiency of a strategic course of development is increase in investments. It is remarkable that growth rates of financing have to be twice faster, than the growth rate of industrial production.

Active search of those wishing to invest in the economy of the region is one of the priority areas in the activities of the executive authorities.

Specialized funds are already being created for these needs in the regions to support potential investors whose key task will be to analyze the most promising sectors for the development of the economy or individual projects and the development of financially sound investment policy trends [8].

To carry out activities that are of great importance for the local economy, it is necessary to improve the tools for providing budget loans and interest rate compensation. Also, it is logical to simplify such an order of this form of government support for real business as a guarantee of tax credit and tax benefits to investing companies.

It is logical that the mechanisms of strategic planning, the algorithm for the adoption and implementation of targeted programs are gradually changing and eventually will finally be introduced into the system of management of development of territories. The list of programs to be implemented must correlate with the priorities of long-term and medium-term development, investment policy trends.

The research of the experience of Russian regions in the context of strategic planning makes it possible to draw some conclusions on its most effective development.

IV. CONCLUSION

Today, as a legacy of internal (processes of regionalization, socio-political and economic metamorphosis, a prolonged economic crisis) and external (risks of globalization, actual challenges of Russia in the newest geo-economic and geopolitical space) factors, the regional development is characterized by several "painful points".

They are: interterritorial asymmetry, insufficient aspiration of local authorities to self-development and reproduction of basic strategic resources – natural, human, infrastructural, historical, economic, fragmented economic, cultural and, probably, legal space of the state.

The solution of the problem of a protracted systemic crisis can be a competent system of state management – strategic planning and a medium-term forecast of the growth rates of the economy of the constituent entities of the Russian Federation, using tools that will streamline the use of various resources of the economic system for a stable improvement in the standard of living for various segments of the population.

This goal can be more structured and achievable with the help of characteristics of the development features of the Russian regions as a multi-faceted, integrated into the domestic and world economy territory, where a comfortable and stable external environment for life is created.

Acknowledgment

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