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A METHODOLOGY FOR CALCULATING THE ESTIMATED FIGURES OF SOCIO-ECONOMIC DEVELOPMENT OF TERRITORIES TAKING INTO ACCOUNT RISKS

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The paper describes a unique methodology for forecasting the socio-economic development of territories, which, unlike the ones currently applied, allows taking into account the forecasting risks. The problem of estimating and calculating the risks at the stage of forecasting has acquired particular importance due to increasing uncertainty of the environment in which the modern economic systems have to develop and interact.
Keywords: Forecasting of the socio-economic development, forecasting risks, evaluation of forecasting risks, calculation of forecasting risks.

Introduction
1.1. Introducing the Problem

Today the system of state management of the development of territories aims at the prevention, already at the stage of planning, of various negative phenomena. This necessity is due to the instability of modern environment: in this context, as never before, those management technologies are currently important that create a high level of flexibility and adaptability.

1.2. Importance of the Problem

Prediction of the socio-economic development of territories is charged with a responsible function: to set the target and normative guidelines for the next period by describing the possible outcomes and future impact of various factors. Currently, in the forecasting of the socio-economic development of individual territories, an effective instrument is lacking which would enable to develop an effective regional development policy. This is because a number of problems remain unresolved: numerous inconsistencies are indicated in the organization of some forecasting procedures, the principles of systems approach in the analysis of a territory are not fulfilled, the used instruments of calculation or estimation of the projected values often do not correspond to the type of the developed forecasts, there is practically no verification of the accuracy (reliability) of predictions and, most importantly, the developed forecasts do not provide a possibility to anticipate crises and thus to make management decisions to get out of the situation at hand.

The reality shows that in these circumstances it is necessary to take into account all possible risks: both the risks of socio-economic development (SED) of territories and the risks of the forecasting process. Whereas the risk factors of SED of a territory are qualitatively determined and described in the SED program, the risks of forecasting are mainly considered only from the mathematical point of view. In addition, at the stage of forecasting of socio-economic development of a region or territory, the risks can often occur that are associated with the high degree of uncertainty of the development of a territory by the socio-economic system itself, which are not currently taken into account in the preparation of the programs of socio-economic development of a region. This deficiency creates a threat to effective planning in modern conditions, when, as noted earlier, the management of regional systems comes to the level of strategic management, whereas the formal extrapolation is replaced by the elements of strategic planning. Thus, the importance of the studied problem is that the qualitative consideration of the prediction risks as possible causes of unreliability of forecasts contributes to the solution of numerous problems of modern regional economy.

1.3. Relevant Scholarship

The forecasting methodology is founded on the genetic and teleological (target) bases of creating plans (Kondratyev, 1988). Moreover, it is assumed that the genetic approach is considered more acceptable which is based on taking into account objective conditions, on the analysis of the experience of foreign countries concerning the development of predictions for the future (Minko, 2012). During this period of economy, the foundation of application of statistical methods for the forecasting processes is a model of density distribution of the studied random variable which depends on several parameters. To estimate the parameters, the maximum likelihood method is used (Minko, 2012).

The modern concept of socio-economic forecasting at the meso-level is based on the research by A.N. Kovalevsky, who thought that the future development plan should be built by means of goal-oriented construction of the transformation (Minko, 2012). The method of statistical forecasting used in this study allows revealing the trends and patterns by both evaluating the basic forms of prediction (extrapolation on the basis of time series) and using more sophisticated tools based on regression equations (Granberg, 1990). The research and forecasting of socio-economic processes have a pronounced interdisciplinary character and require special methodological tools. Therefore, special attention in the study is paid to the systems approach in forecasting (Tsygichko, 2009). It should be noted that the prediction in the conditions of the instability of economic environment creates a whole new attitude of the participants of forecasting to the economic information (Adams, 1986). The methods of forecasting the development of an economic complex, its parts and territorial components are based on the evaluation in the conditions of incomplete information. The principle of minimum of reorganization becomes a key principle in these conditions (Albegov, 2001). However, despite some important research on the problem of forecasting the socio-economic development of regions, not all the aspects of this problem have been sufficiently developed. This is evidenced by the lack of methodologies of assessment of the forecasts for re-

gional development; insufficient attention is paid to the management of risks of forecasting SED of a region (Marquard, 1994).

1.4. State Hypotheses and Their Correspondence to Research Design

The aim of the study is to develop recommendations for improving the processes of socio-economic forecasting at the level of territories.

The work is dedicated to solving a number of conceptual problems: to consider the experience of application of means and methods of forecasting in the modern system of management of Russian regions and foreign countries; to generate proposals for improving the existing organizational and economic mechanism of predicting SED by means of inserting the risks of forecasting into the management processes; to develop and test a methodology of assessing the risks of forecasting and create a step-by-step algorithm of management of the risks of forecasting SED of a territory; on the basis of the research results, to forecast the main indicators of SED of a territory taking into account the forecasting risks.

Material studied, area descriptions, methods and techniques

The methodological foundation of socio-economic forecasting as an essential component of the decision-making process is constituted by the systems approach and systems analysis (Capps, 1995), formal methods of forecasting, in particular, expert evaluation, as well as the methods of extrapolation and deflation by which the estimated figures of socio-economic development of a region are currently calculated (Fiske *et al.*, 1991). The whole process of prediction is realized in four stages: pre-forecasting orientation, organizational stage, reporting stage, analysis and improvement (Butakova, 2010). In the first stage, there are determined the goals and objectives of the prognostic research and the requirements for the content and form of the prediction results, as well as the object of study and the program. The object of research is the system of regional management, in particular, the mechanism of forecasting the socio-economic development. On the basis of systematic and processed information about the patterns and trends of the object development, the dynamic series of indicators are constructed (Marquard, 1994). By the method of extrapolation, the values of the estimated figures are calculated. The scientific novelty of the present study lies in inserting, at this stage, of risks into the management processes: starting with their identification and, finally, their evaluation and calculation. To assess the risks of forecasting, it is necessary to calculate the deviation of each estimated indicator from the actual one in the previous period. The absolute error of forecasting is defined as the difference between the actual and forecasted value of the indicator. In the next step, using the method of expert evaluation, there are identified the risks and the degree of influence of each of them on the indicators of socio-economic development of a territory. For this purpose, there is developed a matrix of determination of potential riskiness which provides ranking of risks with respect to the value of the corresponding error of the past period. After the implementation of this step, it is necessary to adjust the calculated indicators of socio-economic development of a territory by eliminating the obtained risks. In order that the forecast can be used in the practice of management decision-making, the resulting forecast should meet the requirements of accuracy and assurance (Bassie, 1958). Evaluation of validity of the forecast makes it possible to

identify the development characteristics of the object under study and ensure the accuracy of the description of the processes (Greenspan, 1991).

Accuracy and completeness of the information support is a necessary prerequisite for the successful implementation of the forecasting processes (Albegov, 2001). The data sources of the conducted research are the official statistical agencies, the reports of regional ministries.

Results and discussion
Result 1

In order to determine the quality of prediction, the prognostic indicators of SED of Buryatia for the planning period of 2011-2015 are analyzed in comparison with the actual figures at the end of the period of 2011-2014. This makes it possible to estimate the deviations, which define the quality of the forecast. In the analysis of the accuracy of forecasts, the following formulas to calculate the absolute and relative errors are used:

1) the absolute error of the forecast $\Delta_k = \left| y_k - \hat{y}_k \right|$, where $\hat{y}_k$ is the anticipated value of the indicator, y_k is the actual value (Dubrova, 2010).

2) the relative error of the forecast $\Delta_k = \dfrac{y_k - \hat{y}_k}{y_k}$, where $\hat{y}_k$ is the anticipated value of the indicator, y_k is the actual value (Dubrova, 2010).

In general, the analysis of the main indicators of SED shows that the socio-economic forecasting of a territory by the methodology being used today cannot serve as a reliable and accurate benchmark for the development of planning standards. For example, in the analysis of socio-economic development of the Republic of Buryatia in the years 2011-2014, a number of deviations of the forecast values from the actual ones are revealed, which do not meet the general quality standards for a forecast (Table 1).

Table 1 – Absolute and relative errors of the forecast of socio-economic development of the territories on the example of the Republic of Buryatia (according to the end results of the period 2011-2014)

Indicator		2011		2012		2013		2014	
		Δ_{abs}	Δ_{rel}	Δ_{abs}	Δ_{rel}	Δ_{abs}	Δ_{rel}	Δ_{abs}	Δ_{rel}
Gross regional product, bln roubles	Var. 1	2.5	1.6	9.9	6	28.6	15	15.3	8
	Var. 2	0.9	0.5	3.8	2.3	13.2	7.2	4.5	2.2
Annual average population size, thousand people	Var. 1	6	0.6	8.2	0.8	7.4	0.76	6.3	0.65
Growth of the production output, % relative to the first year level	Var. 1	Δ_{abs} =14.9, Δ_{rel} =15.2							
	Var. 2	Δ_{abs} =25.1, Δ_{rel} =25.6							

Gross output of agri-cultural products, mln roubles	Var. 1	Δ_{abs} =1.9, Δ_{rel} =13.9							
	Var. 2	Δ_{abs} =2.6, Δ_{rel} =19.1							
Amount of construc-tion work, bln roubles	Var. 1	2.6	13	4.9	21.7	5.6	23.7	1.4	8.3
	Var. 2	1.9	9.5	3.7	16.4	3.8	16.1	3.8	22.5
Retail turnover, bln roubles	Var. 1	10.8	10.9	11	9.73	24.2	18.6	6.9	5.5
	Var. 2	7.3	7.4	8.2	7.3	18.6	14.3	8	6.4
Export of goods, bln roubles	Var. 1	130.6	17.9	518.4	54.9	671.6	60.6	443.6	49.6
	Var. 2	119.5	16.4	357.4	37.9	494.1	44.6	248.5	27.8
Import of goods, bln roubles	Var. 1	6.1	2.7	4.02	1.6	16.7	5.8	79.4	58.5
	Var. 2	6.1	2.7	2.09	0.9	13.4	4.7	90	66.3
Per capita income of the population, thou-sand roubles	Var. 1	-	-	2.12	12.4	2.10	10.5	3.3	15.3

Variant 1 corresponds to a conservative scenario of SED
Variant 2 corresponds to an optimistic scenario of SED
Δ_{abs} *is the absolute error of the forecast in the units corresponding to the indi-cator;*
Δ_{rel} *is the relative error of the forecast, %*

The existing problems of modern forecasting of SED of territories which caused significant deviations of some indicators are due to a variety of factors, including the insufficient methodical support of forecasting systems at the regional level, li-mited or inaccurate information, the lack of linkage and harmonization of processes, etc. (Tsyrenov, 2012). One can identify the most important among these problems:

1. Failure to follow the systems approach. The principle of systems approach is violated due to the fact that the regional and territorial forecasts are developed on the basis of the industry forecasts, which, in turn, are developed at the federal level without reference to specific territories. This fact leads to the situation when the strategic goals of development of individual territories are not reflected in the in-dustry strategies.

2. Lack of adaptive management methods in the conditions of occurrence of risk situations.

3. Insufficient development of the optimization mechanisms of the forecasting system (algorithm of the forecast development, engaging the expert community in the development of management decisions, the use of information technologies, etc.).

4. Lack of a unified system for monitoring and assessing the quality of forecasts.

5. There is a need for classification of the objects of prediction (Georgantzas and Acar, 1995), the indicators of SED of a territory, in particular, with respect to the objectives of strategic planning.

6. The lack of a unified effective comprehensive methodology for assessing the regional economic structure and specialization of a territory. This is one of the reasons for the inclusion into the models of socio-economic forecasting of a territory of excessive amounts of calculated indicators, which are prescribed by the provisions of the Federal law but do not represent the specific features of a particular territory.

7. Strong influence of external factors on the development of territories, including significant federal influence. At the same time, there is also an underestimation of the influence of internal factors.

8. Lack of a methodology of assessment of the forecasting risks, their control, which affects the quality of forecasts, the accuracy of the projected indicators.

The ways of solving the above problems are developed and successfully implemented in strategic management. In particular, the central problem of our study, the prediction of SED of a region in view of risks, requires an integrated approach for its solution, first of all, in regard to improving the forecasting model. This is achieved through inserting into the current model of regional socio-economic forecasting of the elements of strategic management to identify and assess the forecasting risks. At the stage of forecasting, it is necessary to manage both the risks of socio-economic development of a territory and the prediction risks. That is, there is needed such restructuring of the system of forecasting, which in the general management concepts should work to create the economy of a territory which is flexible and adaptable to the conditions of the unstable environment.

Result 2

The management of the risks of forecasting SED of a region includes the following main activities: identification of risks, assessment and analysis of risks, the study of the degree of influence of these risks on the planned indicators of SED of a region in order to distinguish the most important ones, the development of measures to prevent and minimize risks (Tsydypova, 2013).

In determining the risks, their identification and analysis are carried out, accompanied by the assessment of the level of threat of their occurrence. The second and third activities of the risk management are closely related with the results of the activity: if the measures to prevent risks were not successful, then it is necessary to talk about crisis management, which consists in eliminating the consequences of the occurring losses. An ideal variant of organization of SED forecasting is such a control loop, in which all risks are taken into account at the stage of pre-forecasting orientation (Fig. 1).

The risk analysis presupposes the assessment of risks, followed by choosing the methods of their minimization, as well as reducing the impact of their occurrence on the forecast figures (Meyer, 2003).
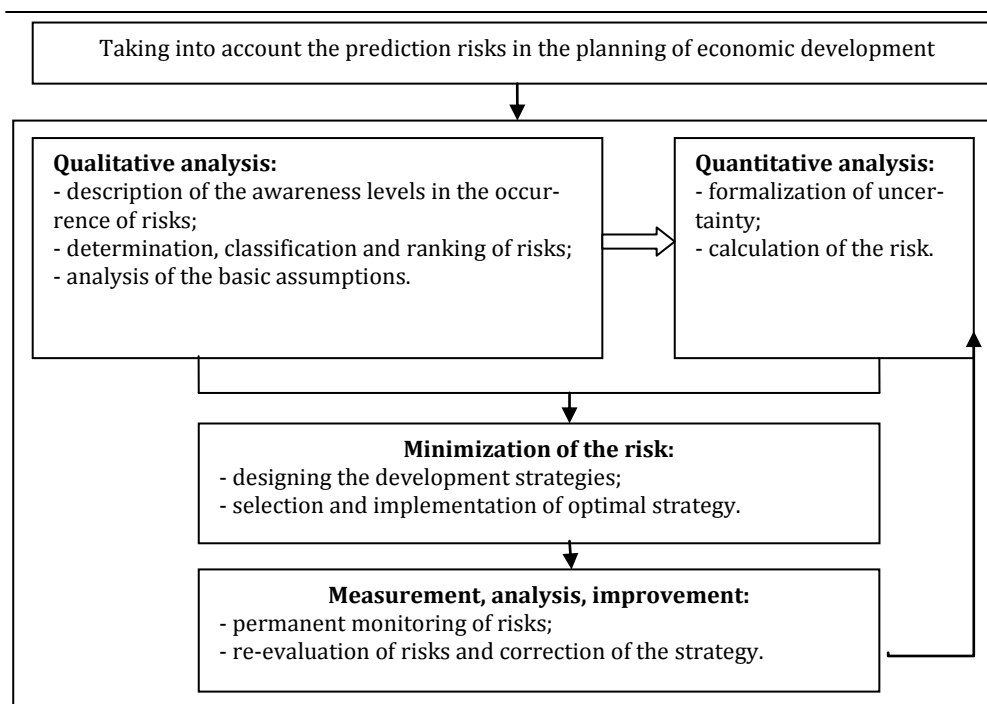
Fig. 1 Management of the risks of forecasting SED of a region

The purpose of the qualitative analysis of risks is to identify the factors of appearance of risks, and also to construct a typology of risks after their identification (Davidson, 2003). The quantitative analysis of risks presupposes the quantitative measurement and determination of the numerical value corresponding to the strength of a particular risk. To calculate the risks, the techniques and methods of mathematical statistics, probability theory and the theory of operations research are applied. In the practice of regional forecasting, the method of scenarios is applied most often.

A general algorithm of managing the prediction risks can be arranged in the following sequence:

Table 2 – General algorithm for managing the risk

Stage	Content of work
1	Studying the external environment
2	Determination of the degree of influence of risks (strong and weak signals)
3	Processing of the obtained information about the risk
4	Qualitative estimation of the forecasting risks
5	Quantitative analysis
6	Determination of the possibility, the measures of minimization of the risk
7	Discussion of the ways to minimize the risk, the choice of the most appropriate methods to reduce it
8	Determination of the measures to reduce the external strategic vulnerability;
9	Increasing the adaptability of the internal management system
10	Development of the program to eliminate this or that riskiness

| 12 | Implementation of the program; |
| 13 | Introduction of the correcting measures |

This algorithm makes it possible to more accurately determine how to incorporate the risk management into the system of forecasting of a region.

The technology of forecasting includes a number of consecutive stages: pre-forecasting orientation, organizational phase, the reporting stage, analysis and improvement (Fig. 2). The risk management begins already at the stage of pre-forecasting orientation.
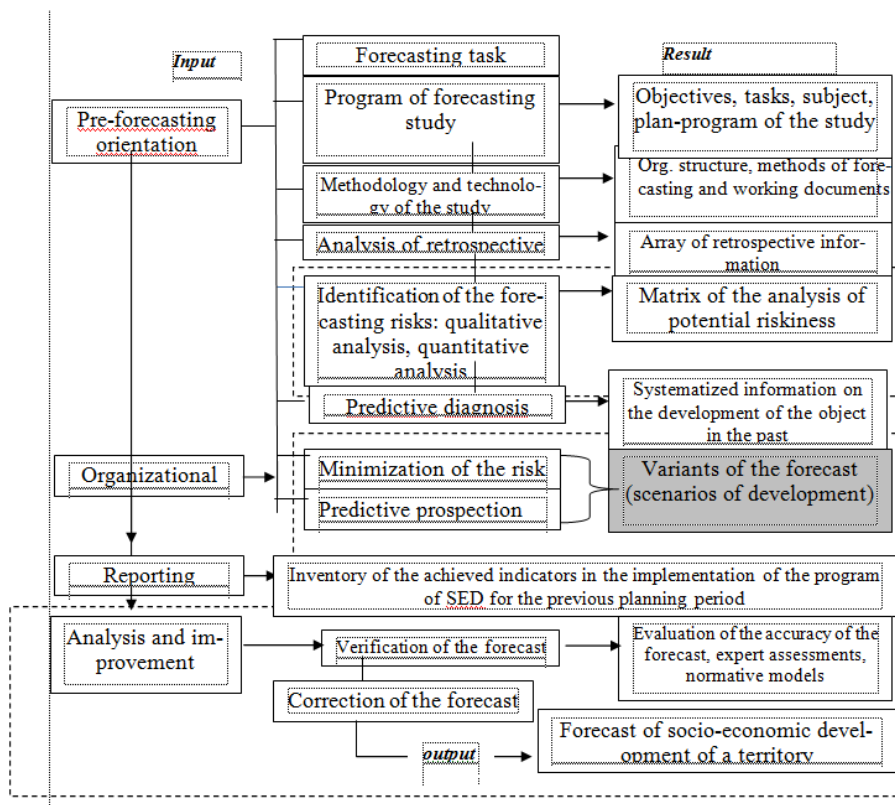

Fig. 2 The main stages of forecasting with the description
of input information and the results

The organization of forecasting is based on the properties of this model. It includes the following elements:
- organization of the system (project);
- the order and sequence of work;
- the system of used information;
- performers (Kacapyr, 2011).

It should be noted that the systems approach and systems analysis is a natural methodological basis for solving the problems of socio-economic forecasting as an essential component of the management processes (Tsygichko, 2009). The methodology of systems studies insists on developing a single conceptual model of the object of prediction (Higgins *et al.*, 2011).

Result 3

The proposed methodology of calculating the impact of risks on the estimated figures of socio-economic development of a territory is based on the methodology of calculating the risks of the company developed by I. Ansoff. Let us build a table on the basis of the analysis of forecasting risks, taking into account the classification scheme of the factors of forecasting risk. The columns of this matrix will be the indicators of the awareness level, the rows – the corresponding zones of economic management. The role of a strategic unit, responsible for the design of development strategy of a region in all areas of economic management, is given to a regional body of the Ministry of Economic Development. In this case, the "zones of economic management" will be understood to be the branches of the regional economy: industrial production, agriculture, etc. In this management model it is very important to ensure the systems approach.

For a territory one can list the major branches of economy, according to the basic indicators. For each direction of economy, a column is assigned in the table in accordance with the level of awareness about it (Table 3). Thus, a matrix is formed, the rows of which correspond to the zones of economic management, while the columns – to the corresponding estimates of risks, which vividly demonstrates the sources of risk appearance. Note that the structure of the matrix corresponds to the classification scheme of the factors of the prediction risks. The value of the risk is determined by an expert, based on his/her considerations of the importance of the risk: values of the particular risk are assigned from the interval (0, 100) as a percentage of the value of the average error of the projected figure for the previous period.

We have tried to describe the general procedure for the assessment starting from collecting information and the mathematical tools for its implementation. The expert evaluation of the prediction risks is realized in two stages: the survey itself and the statistical analysis of the survey results.

This methodology has been presented for review and consideration of the possibility of its use in the development of SED forecasts to the experts of the Ministry of Economy of the Republic of Buryatia, the results of testing are confirmed by a certificate. The estimates of experts according to the proposed methodology are arranged into a summary table, the Matrix of the analysis of potential riskiness (Table 3).

For the calculation of the prediction risk there are used indicators such as the average value of the projected values, variance and coefficients of variation of estimates. The value of the prediction risk is determined by the formula:

$R = (\Delta_{abs} \times r_x)/100,$

where Δ_{abs} is the average among the forecasting errors (difference between the predictive and actual indicators) of the previous period, r_x is the rank of the corresponding risk of forecasting from the matrix of analysis of potential riskiness.

Table 3 – Generalized opinion of experts. The summary matrix
of the analysis of potential riskiness

Object of study	Estimate of competency								
	Awareness of riskiness				Source of riskiness		Scale of riskiness		Weight coefficients
	Org.	Tech.	Inf.	Subject	Ext.	Int.	Primary	Second	
Industry	60	15	90	15	95	90		40	57,9
Agriculture		15		15	95	90	40		76
Construction		15		15		90		90	52,5
Transportation and communication				15		90			52,5
Education and science	30			15	95			90	57.5
Health care				15	95				55
Foreign trade		15		15	95	90			53.8
Market of goods and services				15	60		17.5	60	38.1
Living standards of the population		65		15					40
Labor market				15		60			37,5
Demography	60	30		15	95	90	40		55
Overall risk	50	18	90	15	90	85,7	32,	70	**53,6**

The risks will be calculated in relation to the magnitude of these errors. That is, in the process of expert evaluation it is necessary to find out the share of this or that risk in the total value of error of this indicator for the previous period. An expert, assessing the risk, assigns it a rank, which expresses the share of this risk in the obtained errors of the past period. We will use the results of the expert evaluation which we conducted during testing the methodology for assessing the prediction risks.

As an example, we present the calculations for the indicator "resident population size". In assessing the prediction risks in the corresponding "zone of economic management", i.e. the demographic situation, the expert assigned them the rank of 55. This means that, according to the opinion of the expert, the share of the risk in the value of error for the previous period amounts to 55%. The corresponding mean errors are as follows: for the conservative scenario it is 6.98 thousand people, whereas, for the optimistic scenario, 6.9 thousand people. Expressing the proportions from the calculated errors, we obtain the values of the prediction risks in the two versions of the forecast: 3.84 thousand people and 3.848 thousand people, respectively. Let us turn then to the forecast indicators, developed by the Ministry of Economy of the Republic of Buryatia. Using the methods of extrapolation and deflation, the value is obtained of the indicator "resident population size", equal to 976.5 thousand people and 976.6 thousand people for two variants of development. Subtracting from these quantities the calculated values of risks, we obtain 972.66 thousand people and 972.76 thousand people, respectively. In what follows, the calculations are performed using a similar scheme. The experts assigned the rank

of 54 to the prediction risks related to the "gross regional product" indicator. The average values of absolute errors for the previous period equal: 14.08 and 5.6 million roubles according to the conservative and optimistic variants of development, respectively. Thus, the value of prediction risks for the conservative variant of development is 7.6 million roubles, whereas for the optimistic one, 3.02 million roubles. Let us adjust the values of this indicator of the SED forecast for the corresponding variants of development. The calculation results for the remaining most significant indicators of SED of the Republic of Buryatia are presented in Table 4.

Table 4 – Forecast indicators of SED of the Republic of Buryatia for the years 2015-2017, taking into account the forecasting risks

Indicators	Unit of measure-ment	Rank of the fore-casting risk	Abso-lute error of the fore-cast (var 1/ var 2)	The value of the fore-casting risk (var 1/ var 2)	Forecast by years					
					2015		2016		2017	
					alter-native 1	alter-native 2	alter-native 1	alter-native 2	alter-native 1	alter-native 2
1. Demographic indicators										
Popula-tion	thousand people	55	6.98 / 6.9	3.84 / 3.848	972.66	972.76	974.36	974.66	975.96	976.66
2. Production of goods and services										
2.1. Gross regional product (GRP)										
GRP	mln roubles	54	14.08 / 5.6	7.6 / 3.02	227,706.1	229,127.7	254,413.1	257,600.9	283,434	287,721.8
2.2. Industrial production										
Mining										
The vo-lume of the own-pro duced goods, works and ser-vices	mln roubles	58	2.13 / 1.83	1.24 / 1.06	14,558.8	14,607.4	14,666.4	14,718.2	14,794.4	14,854.1
2.3. Agriculture										
Agricul-tural produc-tion	mln roubles	76	1.9 / 2.6	1.44 / 1.98	15,388.76	15,621.12	16,050.66	16,335.72	17,042.06	17,360.32
2.4. Construction										
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Amount	mln	52.	3.6	1.9	23,73	23,924.	24,781.	25,106.	25,850.	26,295.

of work	roubles	5	3 / 3.3	1 / 1.7 3	4.69	37	99	07	69	47
3. Trade and services for the population										
Retail turnover	mln roubles	38.1	13.23 / 42.1	5.04 / 16	150,680.76	152,733	164,217.76	168,066.7	177,618.26	183,703.1
4. Foreign economic activity										
Export of goods, works and ser-vices	mln USD	53.8	441.05 / 304.9	237.3 / 164.04	841.2	994.96	865.7	1,046.96	880.2	1,100.36
Import of goods, works and ser-vices	mln USD	53.8	26.6 / 27.9	14.31 / 15.01	136.99	163.59	96.4	104.39	87.19	108.69
5. Money income and expenditure of population										
Per ca-pita money income (per month)	roubles	40	2,500 / 2,720	1,000 / 1,090	22,783.7	22,859	24,397.9	24,604.7	26,067.5	26,760
6. Labor and employment										
Eco-nomi-cally active popula-tion	thousand people	37.5	28.8 / 27	10.8 / 10.13	441.6	442.67	440.2	441.47	438.4	440.17
Unem-ployment number	thousand people	37.5	9.7 / 5.7	3.64 / 2.14	34.86	35.06	33.16	33.86	31.36	31.86

The calculation results show that the greater the deviation of the estimated indicators of the previous period from the actual ones, the greater the prediction risks. Therein lies the uniqueness of the proposed methodology of assessment and calculation of the forecasting risks: in ensuring the continuity of the predicted values from the results of previous years.

Conclusion

In our opinion, the use of this methodology solves two important problems: it contributes to the prevention of large deviations of the predicted values from the

actual ones in the future, which improves the quality of the forecast, and also creates confidence that the prediction errors, committed during the previous period, are fully taken into account. This allows narrowing down the range of issues in finding the causes of discrepancies between the forecasts and real state of affairs, eliminating the issues of organization of the forecasting processes and the associated risks.

The performed work differs from other studies in this area in that it is concentrated precisely on the issues of creating a mechanism of management of risks of forecasting the socio-economic development of a region and the description of a model of a systems approach to the development of regional forecasts, as well as improving the methodological support of the processes of development of a forecast in regard to identification and evaluation of the prediction risks.

The use of systems and comparative analysis, the generalization of theoretical and methodological studies, assessment of the trends and dynamics of socio-economic development of the Republic of Buryatia will increase the efficiency of regional forecasting in general.

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МЕТОДИКА РАСЧЕТА ПРОГНОЗНЫХ ПОКАЗАТЕЛЕЙ
СОЦИАЛЬНО-ЭКОНОМИЧЕСКОГО РАЗВИТИЯ ТЕРРИТОРИЙ
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В статье описывается уникальная методика прогнозирования социально-экономического развития территорий, которая, в отличие применяемых, дает возможность учитывать риски прогнозирования.

Ключевые слова: прогнозирование социально-экономического развития, риски прогнозирования, оценка рисков прогнозирования, расчет рисков прогнозирования.