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Article

Methodological Approach to Assessment Socio-Economic Development of the Chuvash Republic (Subject of the Russian Federation)

Tatyana Ladykova ¹, Tatyana Ivanova ^{2,*}, Viktor Streltsov ³, Anatoly Sayganov ⁴ and Ekaterina Ladykova ⁵

¹ Faculty of Economics, Moscow State University Named after M.V. Lomonosov, 1 Leninskiye Gory, Moscow 119991, Russia

² Center for Human Development, Institute of Economics of the Russian Academy of Sciences, 32 Nakhimovsky Ave., Moscow 117218, Russia

³ Presidium of the Russian Academy of Sciences, Russian Academy of Sciences, 14 Leninsky Ave., Moscow 119991, Russia

⁴ Department of Labor and Social Relations, Institute for System Research in the Agroindustrial Complex of the National Academy of Sciences of Belarus, 103 Kazintsa Str., 220108 Minsk, Belarus

⁵ Faculty of Mechanics and Mathematics, Moscow State University Named after M.V. Lomonosov, 1 Leninskiye Gory, Moscow 119991, Russia

* Correspondence: ivanovatv85@mail.ru; Tel.: +7-987-577-9864

Abstract: The article develops a methodological approach to the assessment of socio-economic development of the Chuvash Republic, which allows to consider the factors with heterogeneous metrics. The scientific novelty of the study lies in the combination of methods used and the sequence of stages implemented: (1) index analysis of thirty-two indicators divided into seven macro-regional blocks (income, labor, business, ecology, social, prospects, finance); (2) development of formulas for each of them and calculation of integral indicators characterizing their dynamics; (3) development of a formula to determine the rate of socio-economic development; (4) one hundred graphs for forecasting socio-economic development were constructed; (5) thirty-one legal and regulatory acts were analyzed and the dependence by year between the indicator of the rate of socio-economic development developed by the authors and the number of legal and regulatory acts implemented in the country and the region was revealed; (6) a refined classification of the rate of socio-economic development was proposed. Having determined the current situation (2020 is a state close to sustainable—the rate of 99.5%, respectively), and based on the calculated forecast values of the rate of socio-economic development of the Chuvash Republic, it is possible to influence this process depending on the objectives for the medium term, taking the necessary regulatory legal acts, aimed at financing specific macroeconomic blocks. This methodical approach is a universal calculation tool and has great potential for further research. It can be used to assess not only the impact of certain indicators on socio-economic development, it is also applicable to other sectors and spheres of activity.

Keywords: socio-economic development; methodical approach; evaluation; forecasting; regulatory impact; Chuvash Republic



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1. Introduction

A methodological approach to assessing socio-economic development is necessary for regions to determine the current state of socio-economic conditions and predict their further development. This approach allows you to set priorities and determine the most effective strategies and measures to achieve the development goals of the region. In addition, it allows you to analyze the strengths and weaknesses of the region, determine the causes of failures and problems, and develop recommendations to improve the quality of life of the population and improve the economic situation. It also helps to evaluate the effectiveness of the measures taken and adjust the development strategies of the region

Table 1. Cont.

Indicator	Country								Total
	USA	Great Britain	France	Germany	Russia	China	Japan	India	
Income inequality	+	+	+	+	+	+	+	+	8
The level of education	+	+	+	+	+	+	+	+	8
Access to health care and its outcomes	+	+	+	+	+	+	+	+	8
Housing affordability	+	+	+						3
Racial and ethnic inequality	+								1
Regional inequality		+	+	+	+	+	+	+	7
Environmental quality				+	+	+	+	+	5
GDP growth					+	+	+	+	4
Total	8	8	8	8	8	8	8	8	64

Note. Compiled by the authors based on the following list: (Materials of the Economic Policy Institute 2020; Materials of the Social Metrics Commission 2020; Materials of the French National Observatory on Poverty and Social Exclusion 2020; Materials of the Federal Ministry for Economic Affairs and Energy 2020; Materials of the Federal State Statistics Service 2020; Materials of the National Bureau of Statistics 2021; Materials of the Statistics Bureau of Japan 2021; Materials of the Central Statistics Office 2021).

Russian methods for assessing the socio-economic development of the region are presented in detail in the article by (Girina 2013) (Table 2). However, neither Russian nor foreign methods for assessing the socio-economic development of the region incorporate the combination of methods and stages proposed in the methodological approach presented in this research.

Table 2. Comparative characteristics of the targets for the development of a methodology for assessing the socio-economic development of the region.

The Purpose of the Development and Application of the Methodology	The Content of the Methodology	Author of the Methodology
Determining the degree of need for regions in additional funding	The assessment methodology includes thirteen basic indicators characterizing the production, investment and budgetary potential of the region	(Decree of the Government of the Russian Federation of 11 October 2001 “On the Federal Target Program “Reducing Differences in the Socio-Economic Development of the Regions of the Russian Federation (2002–2010 and up to 2015)” (as Amended on October 20, 2006) n.d.)
Assessment of the degree of interregional differentiation of regions	Developed on the basis of a methodology approved by the Decree of the Government of the Russian Federation, but contains nine indicators, one of which has been replaced	(Skuf’Ina and Baranov 2005)
Elimination of unevenness in the levels of socio-economic development of regions	The methodology uses only five of the nine main indicators used by Baranov S.V. and Skufina T.P.	(Samarina 2008)
Evaluation of the effectiveness of managing the socio-economic development of the region	The author uses indicators characterizing the economic, financial and social sphere of the region	(Pedanov 2004)

Table 2. Cont.

The Purpose of the Development and Application of the Methodology	The Content of the Methodology	Author of the Methodology
Analysis and forecasting of socio-economic development of regions	The methodology consists of a wide range of indicators characterizing the standard of living of the population	(Methods of Analysis and Forecasting of Socio-Economic Development of Regions Center for Social and Economic Problems of Federalism of the Institute of Economics of the Russian Academy of Sciences n.d.)

Note. Source ([Girina 2013](#)).

The main modern problem of assessing the rate of socio-economic development of the Chuvash Republic is the incompatibility of macroeconomic parameters used in indicative planning of regional socio-economic systems. Thus, we analyzed the forecasts for the socio-economic development of the subjects of the Volga Federal District, placed in the state autonomous system—“management”. Of the 14 regions included in it, forecasts were presented for 7: the Kirov region (73 forecast indicators were used), the Penza region (40), the Samara region (37), the Chuvash Republic (32), the Nizhny Novgorod region (31), the Republic of Mari El (24) and the Republic of Tatarstan (23 indicators) ([Register of Strategic Planning Documents n.d.](#)).

In the forecasts of all analyzed regions, only 10 general indicators were used: the number of resident population (average annual), gross regional product, index of gross regional product in comparable prices, index of industrial production, agricultural production in all categories of farms, index of agricultural production, retail turnover trade, the index of the physical volume of retail trade turnover, investments in fixed capital, the index of the physical volume of investments in fixed assets ([Ladykova and Bersenyov 2018](#)).

Thus, it can be noted that in the forecasts of all analyzed regions, there is a certain “core” of indicators (18), reflecting socio-economic processes common for different regions. At the same time, this set of indicators has certain significant shortcomings in the methodological aspect, which we considered in ([Ladykova and Bersenyov 2018](#)). We believe that the indicators used to assess the rate of socio-economic development of the Chuvash Republic should comply with the following principles: consistency; fixability; reasonable sufficiency; comparability across regions of names and units of measurement of indicators; adequacy. Therefore, based on the foregoing, we have identified seven macro-regional blocks (income, labor, business, ecology, society, prospects, finance) that characterize the rate of socio-economic development, calculated them for 2010–2020 and presented their forecast until 2024.

Forecasting is an integral element of the state management and regulation system of any country and its regions, especially in a situation of global shocks and in the context of growing interdependence of individual sectors and areas. The general function of the forecast is to reduce the uncertainty in decision making. The probabilistic nature of the forecast means that there are various alternatives (possibilities) for the future state of the object, which gives rise to the very problem of forecasting ([Register of Strategic Planning Documents n.d.](#)).

The purpose of this study was, on the basis of statistical data with heterogeneous metrics, to develop a methodological approach to assessing the socio-economic development of the Chuvash Republic and present qualitative forecasts for the main indicators that form macroeconomic blocks (income, labor, business, ecology, society, prospects, finance) and the rate of social-economic development of the region until 2024, as well as to identify their dependence on the regulatory legal acts adopted in the region aimed at their regulation.

Analyzing foreign papers in recent years by ([Beckert 2013](#); [Hilty and Aebischer 2015](#); [Center for Global Development 2020](#); [Chen et al. 2018](#); [Lee et al. 2017](#); [Liu et al. 2013](#); [Njøs and Jakobsen 2016](#); [Poly et al. 2015](#); [Reichardt 2022](#); [Shani and Coghlan 2019](#); [Yoon 2017](#)), the authors came to the conclusion that the research technologies used in them are based

only on analysis, which does not allow for forecasting. In the works of (Boyadjiev 2019; Gungor et al. 2019; Lennert 2018), despite the construction of mathematical models, the approach for accounting for indicators with different units of measurement is not taken into account.

Having developed technologies for assessing the socio-economic (Orlov et al. 2022b) and innovative development of the economy of the Russian Federation (Orlov et al. 2021), as well as forecasting reproductive processes in agriculture (Ivanova et al. 2022), social infrastructure (Orlov et al. 2022a), and the rate of agricultural production (Ivanova et al. 2021), the authors present a methodological approach to assessing the rate of socio-economic development of the Chuvash Republic.

2. Materials and Methods

Calculation and construction method, correlation and regression analysis, technology of index and integral calculation of indicators, forecasting with the development of optimistic, probabilistic and pessimistic scenarios, mathematical modeling, calculation of confidence intervals of predicted values were used as research methods.

At the first stage, a selection of the most significant indicators was formed to assess the rate of socio-economic development of the Chuvash Republic, divided into seven macro-regional blocks (income, labor, business, ecology, society, prospects, finances).

Initially, the first macro-regional block “Income” included seven indicators: the number of people whose monthly incomes range from 14,000 to 45,000 rubles, population with incomes below 10,000 rubles, the number of people with incomes below the subsistence level, funds ratio, GDP (GRP) per capita, the ratio of GDP (GRP) to actual final consumption (per capita), increase (decrease) in the population’s money (in % of total cash income).

However, considering that during the analyzed period some statistical methods of calculation changed, some indicators were calculated periodically and not annually, we will exclude them from further calculations. Thus, a selection of the most significant indicators of the macro-regional block “Incomes” was formed (Appendix A, Table A1). The selected indicators are brought to the index value for the possibility of taking them into account when calculating the integral indicator. The index analysis method allows aggregating a wide range of quantitative indicators for assessing socio-economic development, which have different units of measurement and cannot be compared with each other without standardizing the values.

Based on the information in Table 1, Formula (1) is developed, which calculates an integral indicator characterizing the macro-regional block “Income” in the Chuvash Republic in 2011–2020 (II_I), in %:

$$II_I = \sqrt[3]{I_{BSL} * I_{IDC} * I_{GDPC}} \quad (1)$$

where I_{BSL} —index of change in the population with incomes below the subsistence level, %; I_{IDC} —index of change in income differentiation coefficient, %; I_{GDPC} —index of change in GDP per capita, %.

To determine the average rate of change index, we will use Formula (2) to calculate the geometric mean. The formula is employed in cases where the individual values of the attribute are, as a rule, relative values of the dynamics, built in the form of chain values, as a ratio to the previous level of each level in the dynamics series, that is, it characterizes the average growth factor.

The geometric mean is calculated by extracting the root of the degree n from the products of individual values—variants of the feature x :

$$\bar{x} = \sqrt[n]{x_1 * x_2 * ... * x_n} \quad (2)$$

where \bar{x} —is the chain growth factor (variable sign); n —is the number of periods.

Analysis II_I , shows that for 2011–2020, despite the fact that the average rate of the population with incomes below the subsistence level was 98.9%, the income differentiation

coefficient was 98.2%, GDP per capita increased to 108.7%, which demonstrates an increase in the average rate in the macro-regional block “Income” by 11.6 p.p. This is due to the fact that all indicators have a positive impact on the average rate and amounted to $(100.0\% - 98.9\%) + (100.0\% - 98.2\%) + (108.7\% - 100.0\%) = 1.1 \text{ p.p.} + 1.8 \text{ p.p.} + 8.7 \text{ p.p.} = 11.6 \text{ p.p.}$

Thus, when calculating the ‘vertical’ changes (the last column), the average rate of change in the integral indicator characterizing the ‘Revenues’ macro-regional block in the Chuvash Republic increased by 11.6 percentage points. On the other hand, when calculating the ‘horizontal’ changes (last line), the increase was 1.8 percentage points $(101.8\% - 100.0\% = 1.8 \text{ p.p.})$.

This once again confirms that the analysis of socio-economic processes cannot be limited only to mathematical methods. Their excessive and incorrect exploitation can lead to such negative consequences as the violation of logical, cause-and-effect relationships in economic analysis and the desire to prove unfounded hypotheses (Ministry of Agriculture of Russia 2013) using mathematical methods.

Mathematical methods demonstrate only an increase or decrease in indicators, without describing the actual situation, since they do not take into account the very wording of economic terms, which is paramount for determining the direction of influence (positive/negative) on the final indicator. Therefore, we carry out calculations both vertically and horizontally, which is important for the objectivity of the study and identifying the relationship between the indicator of the rate of socio-economic development of the Chuvash Republic developed by the authors and the regulatory legal acts adopted in the country and the region.

Next, a selection of the most significant indicators is formed to assess the rate of socio-economic development that characterize the second macro-regional block “Labor” in the Chuvash Republic.

Initially, it had seven indicators:

1. The level of employment
2. Unemployment rate
3. Composition of the employed population by level of education
4. The ratio of the labor force to the average annual number of employees
5. The ratio of the need for workers declared by employers to state employment service institutions to the number of unemployed
6. Arrears on wages as a percentage of the monthly wage fund of organizations with arrears
7. Arrears of wages per one employee to whom there is an arrears.

However, taking into account the transformation of methodological recommendations for their calculations and insignificant fluctuations of some of them over ten years, four indicators of the macro-regional block “Labor” will be used for further calculations, for which the indices of their changes are calculated (Appendix A, Table A2).

Then, using the materials of Table 2, Formula (3) is developed, which calculates the integral indicator characterizing the macro-regional block “Labor” in the Chuvash Republic (II_L), in %:

$$II_L = \sqrt[4]{I_{LEP} * I_{LU} * I_{LFPR} * I_{AWE}} \quad (3)$$

where I_{LEP} —index of change in the level of employment of the population, %; I_{LU} —index of change in the level of unemployment, %; I_{LFPR} —index of change in labor force participation rate, %; I_{AWE} —index of change in arrears of wages to employees of organizations, %.

An analysis of the indices of change in indicators included in II_L indicates that for 2011–2020 the average rate of all four tended to decrease. However, given the direction of the influence of specific indicators, it can be seen that:

- positive impact indicators totaled $(100.0\% - 95.7\%) + (100.0\% - 84.9\%) = 4.3 \text{ p.p.} + 15.1 \text{ p.p.} = 19.4 \text{ p.p.}$;
- negative $(100.0\% - 99.2\%) + (100.0\% - 98.8\%) = 0.8 \text{ p.p.} + 1.2 \text{ p.p.} = 2.0 \text{ p.p.}$

This means that the indicators included in the Labor macro-regional block improved by 19.4 p.p. – 2.0 p.p. = 17.4 p.p. (calculated vertically). But when calculating horizontally, using only mathematical methods, II_L deteriorated by 5.6 p.p. ($100.0\% - 94.4\% = 5.6$ p.p.).

The next step is to form a sample of the most significant indicators of the third macro-regional block “Business”.

Initially, it had eight indicators, namely:

1. The number of small enterprises per 10,000 people of the population.
2. Turnover of small enterprises per 10,000 people.
3. The share of the average number of employees of small enterprises in the total number
4. Employed people
5. Balanced financial result (profit minus loss) of organizations’ activities per 10,000 people of the employed population.
6. Profitability of sold goods, products (works, services) of organizations, expressed as a percentage, for those engaged in crop production.
7. Percentage of people engaged in livestock activities.
8. The number of enterprises and organizations per 10,000 people.

However, for the period of 2010–2020, some indicators were calculated not annually but periodically. As a result, we will exclude those indicators from further calculations. For the selected indicators, the indices of their changes are determined (Appendix A, Table A3).

Further, on the basis of Table 3, Formula (4) is developed, which calculates the integral indicator that characterizes the macro-regional block “Business” in the Chuvash Republic (II_B), in %:

$$II_B = \sqrt[5]{I_{TSE} * I_{NESE} * I_{BFR} * I_{PSG} * I_{NEO}} \quad (4)$$

where I_{TSE} —index of change in the turnover of small enterprises per 10,000 people, %; I_{NESE} —index of change in the share of the average number of employees of small enterprises in the total number of employed population, %; I_{BFR} —index of change in the balanced financial result (profit minus loss) of the activities of organizations per 10,000 people employed population, %; I_{PSG} —index of change in the profitability of sold goods, products (works, services) of organizations, %; I_{NEO} —index of change in the number of enterprises and organizations per 10,000 people population, %.

Table 3. The rate of socio-economic development of the Chuvash Republic in 2011–2020, %.

Indicator	Year										Average Rate	Final Impact, p.p. *
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020		
II_I	107.7	101.7	101	100.7	100.5	104.9	98.8	101.4	101.6	99.9	101.8	+11.6
II_L	89.9	73.4	56.5	163.7	99.6	130	65.4	90.3	131.7	91.8	94.4	+17.4
II_B	114.7	108.6	74.6	106.2	80.2	98.5	93.7	113.7	95.4	99.2	97.6	+14.2
II_E	67.8	106.1	91.5	110.1	123.2	91.5	109.2	112.9	93.9	87.8	98.2	+1.6
II_S	107.8	98.6	99.6	96	98.4	94.3	101.3	93.3	93	110	99.1	−4.4
II_P	108.1	104.6	99.3	96.7	100.8	101	101.3	103	115	92.2	102.0	+8.5
II_F	105.1	111.2	102.3	103.2	99.3	104.7	105.9	108.3	104.2	115.5	105.9	+0.4
$R_{S.E.D.}$	100.2	100.6	89.3	110.9	100.3	103.6	96.5	103.3	105.0	99.5	100.8	+49.3

Source—compiled by the authors. * Indicator values are taken from the comments to the annex, Tables A1–A7.

Table 4. Forecast of changes in the main indicators characterizing the rate of socio-economic development Chuvash Republic until 2024.

Option Forecast	The Equation	Year					2024 by 2020
		2020	2021	2022	2023	2024	
GRP per capita, thousand rubles—macroeconomic block “Income”							
Optimistic	$y = 0.2122x^2 + 13.693x + 120.08$	289.5	322.3	338.4	354.0	369.8	127.7%
Probabilistic	$y = 0.0062x^2 + 15.689x + 116.72$		305.9	321.7	337.5	353.3	122.0%
Pessimistic	$y = -0.1941x^2 + 17.713x + 113.17$		294.1	307.5	319.9	338.0	116.8%
Unemployment rate, %—macroeconomic block “Labor”							
Optimistic	$y = 9.0228x^{-0.292}$	6.1	4.4	4.1	3.9	3.6	−2.5 p.p.
Probabilistic	$y = 9.3394x^{-0.324}$		4.1	3.8	3.5	3.2	−2.9 p.p.
Pessimistic	$y = 9.5804x^{-0.347}$		3.8	3.6	3.3	3.0	−3.1 p.p.
Turnover of small businesses per 10,000 people population, million rubles—macroeconomic block “Business”							
Optimistic	$y = 1.0963x^2 + 69.023x + 837.12$	1642	1860	1941	2023	2100	127.9%
Probabilistic	$y = 0.0633x^2 + 79.033x + 820.32$		1778	1858	1938	2018	122.9%
Pessimistic	$y = -0.9758x^2 + 89.124x + 803.34$		1696	1775	1854	1935	117.8%
Capturing atmospheric pollutants from stationary sources per capita, kg—macroeconomic block “Ecology”							
Optimistic	$y = 0.0016x^2 - 0.4459x + 10.567$	5.8	5.5	5.1	4.7	4.4	75.9%
Probabilistic	$y = -0.004x^2 - 0.386x + 10.455$		5.2	4.8	4.3	3.9	67.0%
Pessimistic	$y = -0.0079x^2 - 0.3498x + 10.397$		4.9	4.4	4.0	3.6	62.1%
The total area of residential premises per inhabitant (at the end of the year, sq. m.)—macroeconomic block “Socium”							
Optimistic	$y = 0.0088x^2 + 0.4491x + 22.864$	28.8	29.8	30.4	30.9	31.4	109%
Probabilistic	$y = 0.5409x + 22.691$		29.2	29.7	30.3	30.8	107%
Pessimistic	$y = -0.0064x^2 + 0.5933x + 22.628$		28.4	29.2	29.6	30.2	105%
The degree of depreciation of fixed assets, %—macroeconomic block “Prospects”							
Optimistic	$y = 0.0319x^2 + 0.8899x + 51.014$	64.8	67.0	68.3	69.5	70.8	+6.0 p.p.
Probabilistic	$y = 50.673e^{0.0214x}$		65.5	66.8	68.1	69.4	+4.6 p.p.
Pessimistic	$y = -0.0054x^2 + 1.2616x + 50.37$		64.6	65.3	66.6	67.8	+3.0 p.p.
Income of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic), thousand rubles per capita—macroeconomic block “Finance”							
Optimistic	$y = 0.0901x^2 + 1.8949x + 24.526$	63.4	62.1	65.3	68.4	69.4	109.5%
Probabilistic	$y = 0.0682x^2 + 2.06x + 24.346$		59.1	62.2	65.4	68.5	108.1%
Pessimistic	$y = 0.0315x^2 + 2.4192x + 23.738$		56.3	59.3	62.4	65.6	103.5%
The rate of socio-economic development (actual), %							
Optimistic	$y = 0.011x^2 + 0.2428x + 100.44$	99.5	103.0	103.3	103.6	103.9	+4.4 p.p.
Probabilistic	$y = 0.0095x^2 + 0.2299x + 100.48$		102.7	103.1	103.4	103.7	+4.2 p.p.
Pessimistic	$y = 0.0087x^2 + 0.2011x + 100.56$		102.3	102.8	103.2	103.5	+4.0 p.p.
The rate of socio-economic development (in case of absence of a COVID-19 pandemic), %							
Hypothetical	$y = -0.0116x^2 + 0.8153x + 99.379$	103.9	104.5	105.1	105.7	106.2	+2.3 p.p.

Source—compiled by the authors.

Table 5. Regulations affecting rates socio-economic development of the Chuvash Republic.

Year	Legal Act
	<i>Finished action:</i>
2013	<ul style="list-style-type: none"> - FTP “Social development of the countryside until 2012” (Ministry of Agriculture of Russia) (Ministry of Agriculture of Russia 2013); - FTP “Preservation and restoration of soil fertility of agricultural lands and agrolandscapes as a national treasure of Russia for 2006–2010 and for the period up to 2013” (Ministry of Agriculture of Russia) (Ministry of Agriculture of Russia 2006); - FTP “Improving the efficiency of use and development of the resource potential of the fishery complex in 2009–2013” (Rusfishing) (FTP “Improving the Efficiency of Use and Development of the Resource Potential of the Fisheries Complex in 2009–2013”, Approved by the Decree of the Government of the Russian Federation Dated 07.05.2008 no. 681-R n.d.)
	<i>Decrees of the Government of the Russian Federation were adopted:</i>
2014	<ul style="list-style-type: none"> - “On Approval of the State Program of the Russian Federation “Social Support for Citizens” dated 15 April 2014. N 296 (Resolution of the Government of the Russian Federation of 15.04.2014. N 296 “On Approval of the State Program of the Russian Federation “Social Support of Citizens” (as amended on 27.01.2022) n.d.); - “On Approval of the State Program of the Russian Federation “Environmental Protection” dated 15 April 2014. N 326 (Resolution of the Government of the Russian Federation of 15.04.2014. N 326 (ed. of 12.11.2020) “On Approval of the State Program of the Russian Federation “Environmental Protection” n.d.); - “On the federal target program “Research and development in priority areas of development of the scientific and technological complex of Russia for 2014–2021” dated 21 May 2013. N 426 (Official Internet Portal of Legal Information 2013); - “On Approval of the State Program of the Russian Federation “Information Society” dated 15 April 2014 N 313 (Resolution of the Government of the Russian Federation of 15.04.2014 N 313 (ed. of 16.12.2020) “On Approval of the State Program of the Russian Federation “Information Society” (with Amendments and Additions, Entered into Force on 26.12.2020) n.d.); - “On Approval of the State Program of the Russian Federation “Public Financial Management and Regulation of Financial Markets” dated 15 April 2014 N 320 (Resolution of the Government of the Russian Federation of 15.04.2014 N 320 (ed. of 30.12.2020) “On Approval of the State Program of the Russian Federation “Public Finance Management and Regulation of Financial Markets” n.d.); - As well as Decree of the President of the Russian Federation of 20 April 2014 No. N 259 “On approval of the Concept of the state policy of the Russian Federation in the field of international development assistance” (Decree of the President of the Russian Federation No. 259 of 20.04.2014 “On Approval of the Concept of the State Policy of the Russian Federation in the Field of International Development Assistance” n.d.)
	<i>Accepted:</i>
	<i>Decrees of the President of the Russian Federation:</i>
2017	<ul style="list-style-type: none"> - “On Approval of the Foreign Policy Concept of the Russian Federation” dated 30 November 2016. N 640 (Decree of the President of the Russian Federation No. 640 Dated 30.11.2016 “On Approval of the Concept of Foreign Policy of the Russian Federation” n.d.); - “On the Strategy for the Economic Security of the Russian Federation for the period up to 2030” dated 13 May 2017. N 208 (Decree of the President of the Russian Federation No. 208 Dated 13.05.2017 “On the Strategy of Economic Security of the Russian Federation for the Period Up to 2030” n.d.);
	<i>Decrees of the Government of the Russian Federation:</i>
2017	<ul style="list-style-type: none"> - “On approval of the Federal scientific and technical program for the development of agriculture for 2017–2025” dated 25 August 2017. N 996 (Resolution of the Government of the Russian Federation of 25.08.2017 N 996 (ed. of 28.05.2020) “On Approval of the Federal Scientific and Technical Program for the Development of agriculture for 2017–2025” n.d.); - “On approval of the state program of the Russian Federation “Development of the transport system” dated 20 December 2017. N 1596 (Resolution of the Government of the Russian Federation of 20.12.2017 N 1596 (ed. of 28.09.2020) “On Approval of the State Program of the Russian Federation “Development of the Transport System” n.d.);

Table 5. Cont.

Year	Legal Act
	<ul style="list-style-type: none"> - “On approval of the state program of the Russian Federation “Providing affordable and comfortable housing and utilities for citizens of the Russian Federation” dated 30 December 2017. N 1710 (Resolution of the Government of the Russian Federation of December 30, 2017 N 1710 “On Approval of the State Program of the Russian Federation “Provision of Affordable and Comfortable Housing and Communal Services to Citizens of the Russian Federation” (with Amendments and Additions, Intro. Effective from 01.01.2018) n.d.); - On approval of the state program of the Russian Federation “Development of the transport system” dated 20 December 2017. N 1596 (Resolution of the Government of the Russian Federation of 20.12.2017 N 1596 (ed. of 28.09.2020) “On Approval of the State Program of the Russian Federation “Development of the Transport System” n.d.); - On the approval of the state program of the Russian Federation “Development of Education” dated 26 December 2017. N 1642 (Resolution of the Government of the Russian Federation of 26.12.2017 N 1642 (ed. of 11.06.2019) “On Approval of the State Program of the Russian Federation “Development of Education” n.d.); - Decree of the Government of the Russian Federation dated 25 September 2017 No. N 2039-r approved “Strategy for improving financial literacy in the Russian Federation for 2017–2023” (Decree of the Government of the Russian Federation of 25.09.2017 N 2039-r “On Approval of the “Strategy for Improving Financial Literacy in the Russian Federation for 2017–2023” n.d.)
	<i>Implementation of National projects:</i>
2018	<ul style="list-style-type: none"> - “Housing and urban environment” (The Passport of the National Project “Housing and Urban Environment” Was Developed by the Ministry of Construction of the Russian Federation Pursuant to the Decree of the President of the Russian Federation Dated 7 May 2018 No. 204 “On National Goals and Strategic Objectives of the Development of the Russian Federation for the Period Up to 2024” (Implementation period: October 2018–2024 Inclusive) n.d.); - “Ecology” (National Project “Ecology” 2018), including the federal project “Clean Water” (attachment to the minutes of the meeting of the project committee for the national project “Ecology” dated 21 December 2018 No. 3) (Passport of the Federal Project “Clean Water” (Appendix to the Minutes of the Meeting of the Project Committee on the National Project “Ecology” dated 21.12.2018 No. 3) n.d.); - The Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects dated 24 December 2018, protocol No. 16, approved the passport of the National Project “Small and Medium Enterprises and Support for Individual Entrepreneurial Initiatives” (Passport of the National Project “Small and Medium-Sized Entrepreneurship and Support for Individual Entrepreneurial Initiative”, Approved by the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects dated 12/24/2018, Protocol No. 16 n.d.)
	<i>Implementation of National projects:</i>
2019	<ul style="list-style-type: none"> - “Demography” dated 24 December 2018. Protocol No. 16 (Passport of the National Project “Demography” (Approved by the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects, Protocol No. 16 dated 12/24/2018) (Implementation Dates 01.01.2019–12/31/2024) n.d.); - “Health” dated 24 December 2018. Protocol No. 16 (Passport of the National Project “Healthcare” (Approved by the Presidium of the Council under the President of the Russian Federation for Strategic Development and National Projects, Protocol No. 16 dated 12/24/2018) n.d.); - “Digital public administration” dated 28 May 2019. Protocol No. 9 (Passport of the Federal Project “Digital Public Administration” (Approved by the Presidium of the Government Commission on Digital Development, the Use of Information Technologies to Improve the Quality of Life and Business Conditions) n.d.); - “Digital Economy of Russia” dated 4 June 2019, protocol No. 7 (National Project “Digital Economy of Russia” The Government of the Russian Federation Has Formed the National Program “Digital Economy of the Russian Federation”, Approved by the Minutes of the Meeting of the Presidium of the Council under the President of the Russian Federation on Strategic Development and National Projects Dated 04.06.2019 No. 7 n.d.) and others;
	<i>Decrees of the Government of the Russian Federation were adopted:</i>
	<ul style="list-style-type: none"> - “On approval of the state program “Integrated development of rural areas” dated 31 May 2019. No. 696 (Resolution of the Government of the Russian Federation of 05/31/2019 No. 696 (ed. of 12/30/2020) “On Approval of the State Program of the Russian Federation “Integrated Development of Rural Areas” and on Amendments to Certain Acts of the Government of the Russian Federation” n.d.);

Table 5. Cont.

Year	Legal Act
	<ul style="list-style-type: none"> - “On approval of the state program of the Russian Federation “Scientific and technological development of the Russian Federation” dated 29 March 2019. No. 377 (Decree of the Government of the Russian Federation of 29.03.2019 No. 377 (ed. from 31.03.2020) “On Approval of the State Program of the Russian Federation “Scientific and Technological Development of the Russian Federation” n.d.); - “On approval of the state program “Integrated development of rural areas” dated 31 May 2019. No. 696 (Resolution of the Government of the Russian Federation of 05/31/2019 No. 696 (ed. of 12/30/2020) “On Approval of the State Program of the Russian Federation “Integrated Development of Rural Areas” and on Amendments to Certain Acts of the Government of the Russian Federation” n.d.); <p>Orders approved Government of the Russian Federation:</p> <ul style="list-style-type: none"> - “The concept of improving the efficiency of budget expenditures in 2019–2024” dated 31 January 2019. No. 117-r (The Concept of Increasing the Efficiency of Budget Expenditures in 2019–2024, Approved by the Decree of the Government of the Russian Federation of 31.01.2019 No. 117-r n.d.); - action plan “Transformation of the business climate” dated 17 January 2019 No. 20-p (The Action Plan “Transformation of the Business Climate” Approved by the Decree of the Government of the Russian Federation No. 20-r dated 17.01.2019 n.d.)
2020	New National Projects were not accepted (Portal of the Authorities of the Chuvash Republic—On the Implementation of National Projects in the Chuvash Republic n.d.)

Source—compiled by the authors.

Table 6. The relationship between the number of adopted regulatory legal acts and the rate of socio-economic development of the Chuvash Republic in 2011–2020.

Indicator	Year										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Number of completed actions											
Federal target programs	3										
Number of adopted normative legal acts											
Decrees of the President				2				2			
Government Decrees				5				5	3		
Government orders approved							1				2
Implementation of National projects								3	4		
Total				7				8	3	9	
$R_{S.E.D.}, \%$	100.2	100.6	89.3	110.9	100.3	103.6	96.5	103.3	105.0	99.5	

Source—compiled by the authors.

Table 7. Classification of the rate of socio-economic development of the region.

Range of the Rate	Characteristic
110–120	High level of sustainable socio-economic development of the region
100–110	Sustainable socio-economic development of the region
90–100	Socio-economic development of the region is close to sustainable
80–90	Socio-economic development of the region with some signs of instability
70–80	Unstable, pre-crisis socio-economic state of the region
60–70	Socio-economic crisis

Source—compiled by the authors.

II_B shows that over the analyzed period, the average rate of indices fluctuated slightly from 98.8% (change in the number of enterprises and organizations per 10,000 population) to 108.5% (change in the net financial result). Let us determine the cumulative impact of all five indicators on II_B :

- positive impact $(105.4\% - 100.0\%) + (101.7\% - 100.0\%) + (108.5\% - 100.0\%) = 5.4$ p.p. + 1.7 p.p. + 8.5 p.p. = 15.6 p.p.;
- negative $(100.0\% - 99.8\%) + (100.0\% - 98.8\%) = 0.2$ p.p. + 1.2 p.p. = 1.4 p.p.

This means that the indicators included in the macro-regional block “Business” improved by 15.6 p.p. – 1.4 p.p. = 14.2 p.p. (calculated vertically). When calculating horizontally, the average rate II_B worsened by 2.4 p.p. ($100.0\% - 97.6\% = 2.4$ p.p.).

Next, a selection of the most significant indicators is formed to assess the rate of socio-economic development that characterize the fourth macro-regional block “Ecology” in the Chuvash Republic.

Initially, it proposed to use seven indicators:

1. Emissions of pollutants into the atmospheric air from stationary sources per capita
2. Capturing air pollutants from stationary sources per capita
3. Fresh water usage per capita
4. Discharge of polluted wastewater into surface water bodies per capita
5. Volume of recycled and consistently used water per capita
6. Ratio of GDP (GRP) to total land area
7. Ratio of agricultural output to total land area.

However, five were used for further calculations, since two of them remained almost unchanged over a ten-year period. For the selected indicators, the indices of their changes are calculated (Appendix A, Table A4).

Based on the data in Table 4, a Formula (5) is developed that calculates an integral indicator that characterizes the macro-regional block “Ecology” in the Chuvash Republic (II_E), in %:

$$II_E = \sqrt[5]{I_{EP} * I_{CP} * I_{FWU} * I_{DPW} * I_{RSUW}} \quad (5)$$

where I_{EP} —index of change in emissions of pollutants into the atmospheric air from stationary sources, %; I_{CP} —index of change in capture of air pollutants from stationary sources, %; I_{FWU} —index of change in fresh water use, %; I_{DPW} —index of change in the discharge of polluted wastewater into surface water bodies, %; I_{RSUW} —index of change in volumes of recycled and sequentially used water, %.

The analysis of II_E indicates that for 2010–2020 the average rate of indices for three out of five indicators tended to decrease (98.2; 93.6; 96.5%, respectively). The index of change in fresh water use remained unchanged at 100.0%. And only the average rate of volumes of recycled and consistently used water increased to 102.7%.

However, in this case, reducing the parameters does not necessarily indicate a worsening situation, as their phrasing implies the need for reduction. In this regard, it would be correct, in our opinion, taking into account the direction of their influence, to determine the final value of the rates as:

- positive $(100.0\% - 98.2\%) + (100.0\% - 100.0\%) + (100.0\% - 96.5\%) + (102.7\% - 100.0\%) = 1.8$ p.p. + 0 p.p. + 3.5 p.p. + 2.7 p.p. = 8.0 p.p.
- negative $(100.0\% - 93.6\%) = 6.4$ p.p.

This means that the indicators included in the macro-regional block “Ecology” improved by 8.0 p.p. – 6.4 p.p. = 1.6 p.p. (calculated vertically). The horizontal calculation indicates a deterioration in II_E by 1.8 p.p. ($100.0\% - 98.2\% = 1.8$ p.p.).

Then a selection of the most significant indicators is formed to assess the rate of socio-economic development that characterize the fifth macro-regional block “Society” in the Chuvash Republic.

Initially, the sample included seven indicators, namely:

1. Total fertility rate (number of births per 1000 population)

2. General mortality rate (number of deaths per 1000 population)
3. Infant mortality rate (number of children who died before the age of 1 year per 1000 live births)
4. Coefficient of natural population growth (per 1000 people)
5. Total area of residential premises per inhabitant on average (at the end of the year, in square meters)
6. Commissioning of residential buildings per 1000 people (in square meters of total area)
7. Incidence rate per 1000 people.

However, only six will be involved in the calculations, since the rate of natural population growth already includes birth and death rates. For the selected indicators, the indices of their changes are determined (Appendix A, Table A5).

Then, using the materials of Table 5, Formula (6) is developed, which calculates the integral indicator that characterizes the macro-regional block “Society” in the Chuvash Republic (II_S), in %:

$$II_S = \sqrt[6]{I_{TFR} * I_{CDR} * I_{IMR} * I_{RPI} * I_{CRBP} * I_{IP}} \quad (6)$$

where I_{TFR} —index of change in total fertility rate, %; I_{CDR} —index of change in crude death rate, %; I_{IMR} —index of change in infant mortality rate, %; I_{RPI} —index of change in the total area of residential premises per inhabitant on average, %; I_{CRBP} —index of change in the commissioning of residential buildings per 1000 people population, %; I_{IP} —index of change in incidence per 1000 people population, %.

II_S shows that for the analyzed period there was a negative trend for three average rates, which ranged from 96.2% (commissioning of residential buildings per 1000 population) to 98.8% (morbidity per 1000 population). The infant mortality rate remained unchanged at 100.0%, while the overall mortality rate exhibited an upward trend, increasing by 100.7%.

It is essential to consider the direction of the impact of a specific indicator in this context. For instance, according to the latter, an increase does not necessarily indicate a positive impact. Conversely, an increase in the death rate has a negative effect on the integral indicator characterizing the macro-regional block “Society.” Then:

- indicators of a positive impact on the average rate amounted to $(102.1\% - 100.0\%) + (100.0\% - 98.8\%) = 2.1 \text{ p.p.} + 1.2 \text{ p.p.} = 3.3 \text{ p.p.}$;
- negative $(100.0\% - 96.8\%) + (100.7\% - 100.0\%) + (100.0\% - 96.2\%) = 3.2 \text{ p.p.} + 0.7 \text{ p.p.} + 3.8 \text{ p.p.} = 7.7 \text{ p.p.}$;

Therefore, $7.7 \text{ p.p.} - 3.3 \text{ p.p.} = 4.4 \text{ p.p.}$, that is, the indicators included in the macro-regional block “Society” deteriorated by 4.4 p.p. (calculated vertically). When calculating the average rate of change II_S horizontally, it decreased by 1.9 p.p. ($100.0\% - 99.1\% = 1.9 \text{ p.p.}$).

The next step is to form a selection of the most significant indicators for assessing the rate of socio-economic development that characterize the sixth macro-regional block “Prospects” in the Chuvash Republic.

Initially, the sample involved seven indicators:

1. The cost of fixed assets per capita
2. The degree of depreciation of fixed assets
3. Investment in fixed assets per capita (in actual prices, rubles)
4. The share of organizations that carried out technological, organizational, and marketing innovations in the total number of surveyed organizations (%)
5. Use of global information networks (as a percentage of the total number of surveyed organizations of the corresponding subject of the Russian Federation)
6. Organizations that had a website (as a percentage of the total number of surveyed organizations of the corresponding subject of the Russian Federation)
7. The number of students enrolled in bachelor’s, specialist’s, and master’s programs per 10,000 population.

However, six indicators will be used in further calculations, since the wording “the share of organizations that carried out technological, organizational, marketing innovations in the total number of surveyed organizations (%)” has somewhat transformed over the analyzed period. The list of innovations included in this indicator has changed, so it cannot be objective. For the selected parameters, the indexes of their changes are given (Appendix A, Table A6).

Based on Table 6, Formula (7) is developed, which calculates the integral indicator characterizing the macro-regional block “Prospects” (II_P), in %.

$$II_P = \sqrt[6]{I_{FA} * I_{DFA} * I_{FCI} * I_{GIN} * I_{OHV} * I_{BSM}} \quad (7)$$

where I_{FA} —index of change of fixed assets at full book value per capita, %; I_{DFA} —index of change in the degree of depreciation of fixed assets, %; I_{FCI} —index of change in fixed capital investment per capita, %; I_{GIN} —index of change in the use of global information networks, %; I_{OHV} —index of change of organizations that had a website, %; I_{BSM} —index of change in the number of students enrolled in bachelor’s, specialist’s, and master’s programs per 1000 people population, %.

Analysis II_P shows that for 2011–2020 the average value of all rates tended to increase, except for the change in the number of students enrolled in bachelor’s, specialist’s, and master’s programs per 1000 people. of the population—a decrease to 93.9%. At the same time, the maximum growth is characteristic of the average rate of change in fixed assets at the full book value per capita—112.5%.

Then the final value of the rates can be calculated as follows:

- indicators of a positive impact on the average rate amounted to $(112.5\% - 100.0\%) + (102.4\% - 100.0\%) + (100.7\% - 100.0\%) + (101.3\% - 100.0\%) = 12.5 \text{ p.p.} + 2.4 \text{ p.p.} + 0.7 \text{ p.p.} + 1.3 \text{ p.p.} = 16.9 \text{ p.p.}$;
- negative $(102.3\% - 100.0\%) + (100.0\% - 93.9\%) = 2.3 \text{ p.p.} + 6.1 \text{ p.p.} = 8.4 \text{ p.p.}$

Consequently, the average rate of indicators included in the macro-regional block “Prospects” improved by $16.9 \text{ p.p.} - 8.4 \text{ p.p.} = 8.5 \text{ p.p.}$ (calculated vertically). When calculating horizontally, II_P increased by 2.0 p.p. ($102.0\% - 100.0\% = 2.0 \text{ p.p.}$).

Next, a selection of the most significant indicators characterizing the seventh macro-regional block “Finance” in the Chuvash Republic is formed.

Initially, seven indicators were incorporated:

1. Revenues of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita
2. Expenses of the consolidated budgets of the subjects of the Russian Federation (Chuvash Republic) per capita
3. The ratio of revenues to expenditures of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita
4. The share of gratuitous receipts in the structure of incomes of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic)
5. The ratio of GDP (GRP) to the income of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita
6. The ratio of GDP (GRP) to the expenditures of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita
7. Share of unprofitable organizations.

However, since not all of them were calculated for the entire ten-year period and some insignificant changes were observed, we will exclude those indicators from further calculations. For the selected indicators, the indices of their changes are determined (Appendix A, Table A7).

Then, on the basis of Table 7, Formula (8) is developed, which calculates the integral indicator characterizing the macro-regional block “Finance” (II_F), in %:

$$II_F = \sqrt[3]{I_{ICB} * I_{ECB} * I_{SUO}} \quad (8)$$

where I_{ICB} —index of change in the income of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita, %; I_{ECB} —index of change in expenditures of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita, %; I_{SUO} —index of change in the share of unprofitable organizations, %.

Analysis of II_F indicates that for 2011–2020, there is a positive trend in all indicators of the macro-regional block “Finance”. However, in our opinion, their combined impact should be taken into account as follows:

$$(109.1\% - 100.0\%) - (108.4\% - 100.0\%) = 9.1 \text{ p.p.} - 8.4 \text{ p.p.} = 0.7 \text{ p.p.}$$

(despite the fact that the expenditures of the consolidated budgets of the constituent entities of the Russian Federation (CR) per capita have increased and their orientation is positive, nevertheless, for the correctness of the calculation, their average rate should be subtracted from income in order to identify the difference between these indicators);

$$(100.3\% - 100.0\%) = 0.3 \text{ p.p. is an indicator of negative impact.}$$

Therefore, $0.7 \text{ p.p.} - 0.3 \text{ p.p.} = 0.4 \text{ p.p.}$ That is the average rate of change in indicators demonstrates an improvement in the financial situation in the region over the analyzed period (vertical calculation). When calculating horizontally, II_F increased by 5.9 p.p. ($105.9\% - 100.0\% = 5.9 \text{ p.p.}$).

3. Results

Next, we substitute the values of Formulas (1) and (3)–(8) into Formula (9) to calculate the rates of socio-economic development in the Chuvash Republic in 2010–2020 ($R_{S.E.D.}$), %:

$$R_{S.E.D.} = \frac{II_I + II_L + II_B + II_E + II_S + II_P + II_F}{7} \quad (9)$$

where II_I —integral indicator characterizing the macro-regional block “Income”, %; II_L —integral indicator characterizing the macro-regional block “Labor”, %; II_B —integral indicator characterizing the macro-regional block “Business”, %; II_E —integral indicator characterizing the macro-regional block “Ecology”, %; II_S —integral indicator characterizing the macro-regional block “Society”, %; II_P —integral indicator characterizing the macro-regional block “Prospects”, %; II_F —integral indicator characterizing the macro-regional block “Finance”, %.

The values of the indicator characterizing the rate of socio-economic development in the Chuvash Republic in 2010–2020 ($R_{S.E.D.}$) are entered in Table 3.

An analysis of the rate of socio-economic development $R_{S.E.D.}$ indicates that for 2011–2020 it ranged from 89.3% in 2013 to (minimum) to 110.9% in 2014 (maximum). For seven years out of ten, the indicator was positive; the average rate was 100.8%. The maximum impact on it is demonstrated by the integral indicators characterizing the macro-regional blocks “Labor” (II_L) +17.4 p.p., “Business” (II_B) +14.2 p.p. and “Income” (II_I) +11.6 p.p.

The minimum impact on the rate of socio-economic development of the region has an integral indicator characterizing the macro-regional block “Finance” (II_F) +0.4 p.p. Negative impact of −4.4 p.p. was provided by the “Socium” block (II_S).

Despite the fact that, in general, the average rate of socio-economic development of the Chuvash Republic for 2011–2020 amounted to 100.8%, when analyzing the influence of each parameter on the integral indicator of a particular macro-regional block (Appendix A, Tables A1–A7), it was found that the final value of $R_{S.E.D.}$ improved by 49.3 p.p. This once again confirms that the analysis of socio-economic development cannot be limited only to mathematical calculations. They do not describe the real situation, taking into account only an increase or decrease in certain indicators, without taking into account their wording, which is paramount for determining the direction of influence (positive/negative) on the final indicator.

4. Discussion

In order to further detail the problem under study, we will use forecasting tools. With the help of Excel, one hundred graphs were built (for thirty-three indicators in three forecast options: optimistic, probabilistic, pessimistic and hypothetical—in the absence of the COVID-19 pandemic). Table 4 presents data for seven indicators—one for each macroeconomic block (income, labor, business, ecology, society, prospects, finance), demonstrating the optimal ratio between the two parameters: both those that have the greatest impact on the integral indicator in their groups, and having the maximum quality of predictive values (that is, with the highest approximation coefficient R^2).

Based on the three forecast options (Table 4), it can be seen that the maximum growth is planned for the turnover of small enterprises per 10,000 people of the population (macroeconomic block “Business”)—127.9%. Even with a pessimistic forecast, there is an expected increase of 117.8% in 2024 compared to 2020. The second place in terms of growth rates is occupied by GRP per capita (macroeconomic block “Income”)—127.7%. Its value is very close to the first indicator and differs only by 0.2 p.p.

In general, there is an increase in five blocks of Table 4 out of seven. In third place is the change in the revenues of the consolidated budgets of the subjects of the Russian Federation (CR) (macroeconomic block “Finance”)—109.5% with an optimistic forecast. It is followed by a change: the degree of depreciation of fixed assets (macroeconomic block “Prospects”)—an increase of 6.0 p.p. and the total area of residential premises per inhabitant on average (macroeconomic block “Socium”)—109%.

The predicted indicators show a decrease in the unemployment rate (macroeconomic block “Labor”) and the capture of atmospheric pollutants from stationary sources per capita (macroeconomic block “Ecology”) with minimum values of −3.1 p.p. and 62.1%, respectively, based on a pessimistic forecast.

Figures 1–7 show predictive graphs for Table 1. These indicators have the highest value of the approximation coefficient R^2 . So, for GRP per capita in the Chuvash Republic until 2024 (Figure 1), R^2 has a maximum value with a probabilistic forecast of—0.9959. Therefore, there is a high probability, around 99%, that it will be implemented.

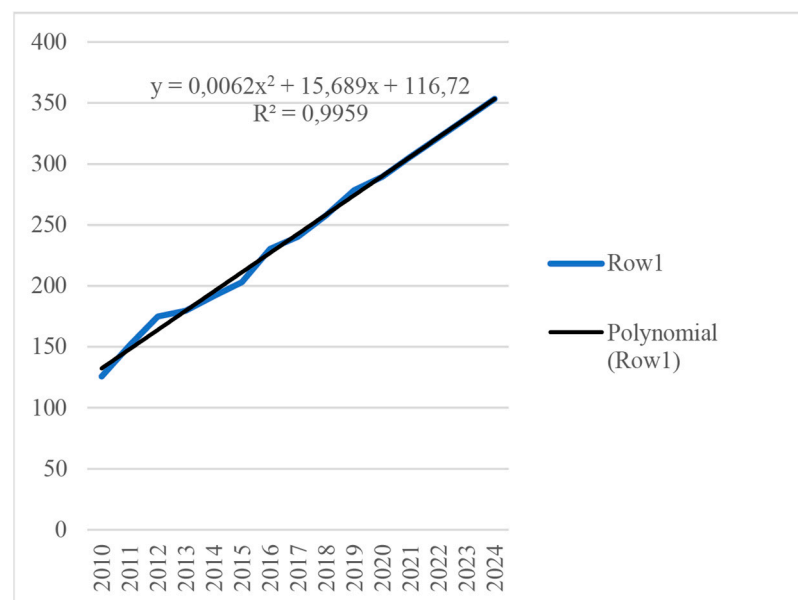


Figure 1. Probabilistic forecast of GRP per capita in Chuvash Republic, until 2024, thousand rubles.

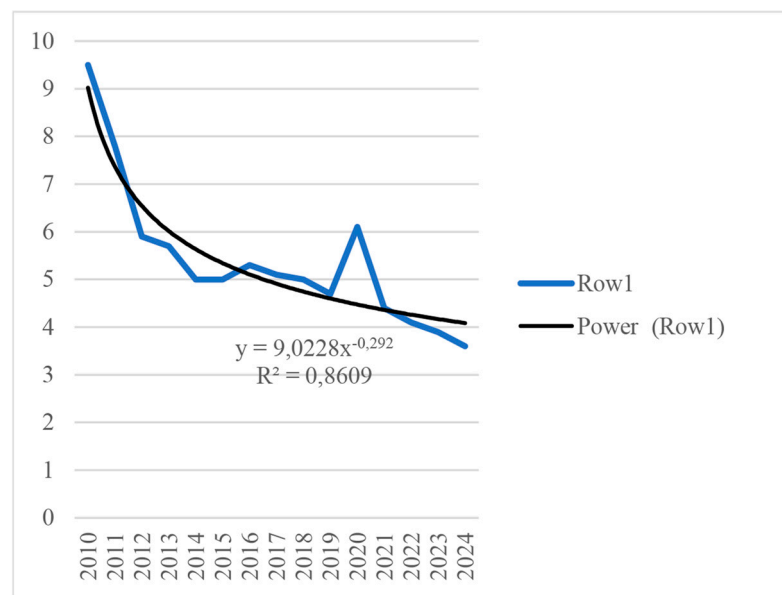


Figure 2. The optimistic forecast for the unemployment rate in Chuvash Republic until 2024, %.

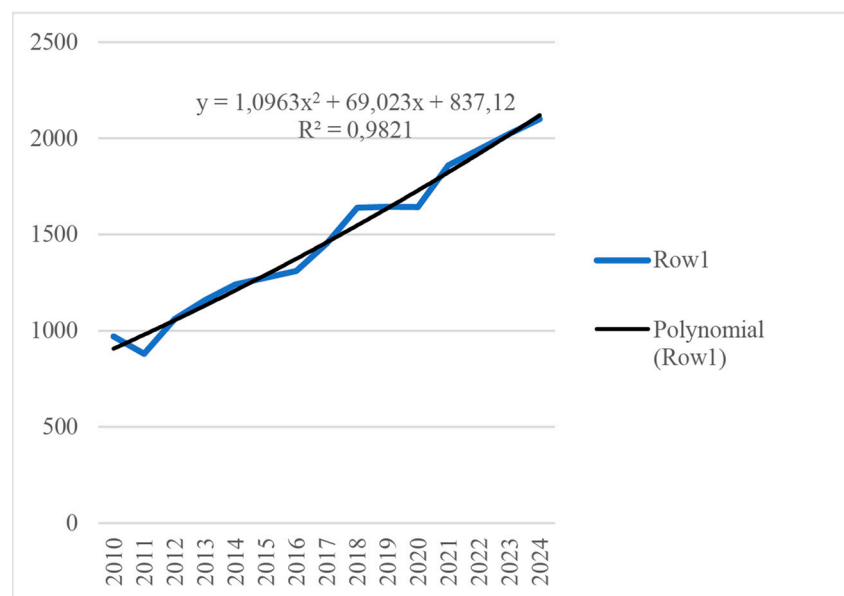


Figure 3. The optimistic forecast for the turnover of small enterprises per 10,000 people in the Chuvash Republic until 2024, million rubles.

For the unemployment rate in the Chuvash Republic (Figure 2), the R^2 value reaches its maximum with an optimistic forecast of—0.8609. This indicates that there is an 86% probability of its realization. For the remaining indicators in Table 1, the following forecasts will be fulfilled (Figures 3–7).

Optimistic forecasts for the turnover of small enterprises per 10,000 people of the population (Figure 3), the degree of depreciation of fixed assets (Figure 6), and revenues of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) (Figure 7) are expected to be realized, with probabilities of occurrence at 98.2%, 97.8%, and 96.5%, respectively. For the indicator of capturing air pollutants from stationary sources (Figure 4), a pessimistic forecast will be fulfilled, with a probability of 81.5%. And for the total area of residential premises, which is on average per inhabitant of the Chuvash Republic (Figure 5), a probabilistic forecast will be implemented, which is characterized by 99.9% of its execution.

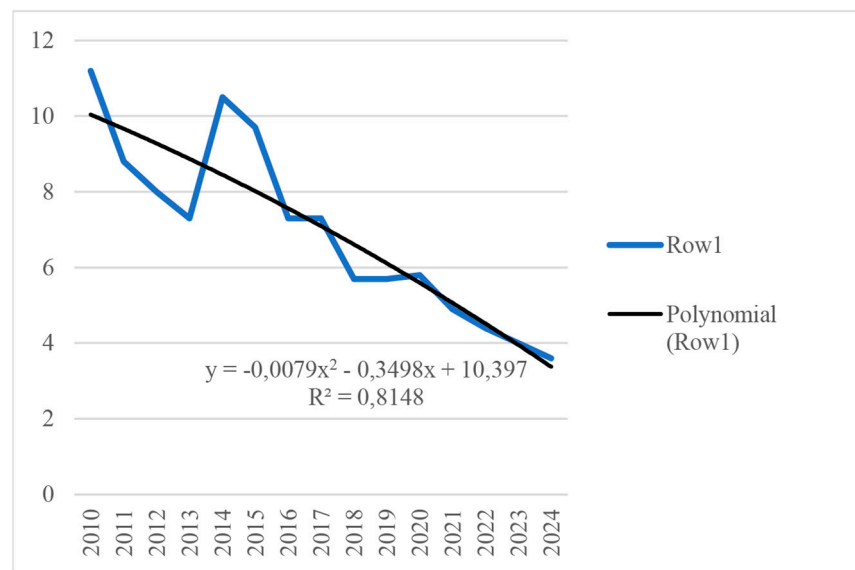


Figure 4. The pessimistic pollutant capture forecast atmosphere of substances emitted from stationary sources in Chuvash Republic until 2024, kg per capita.

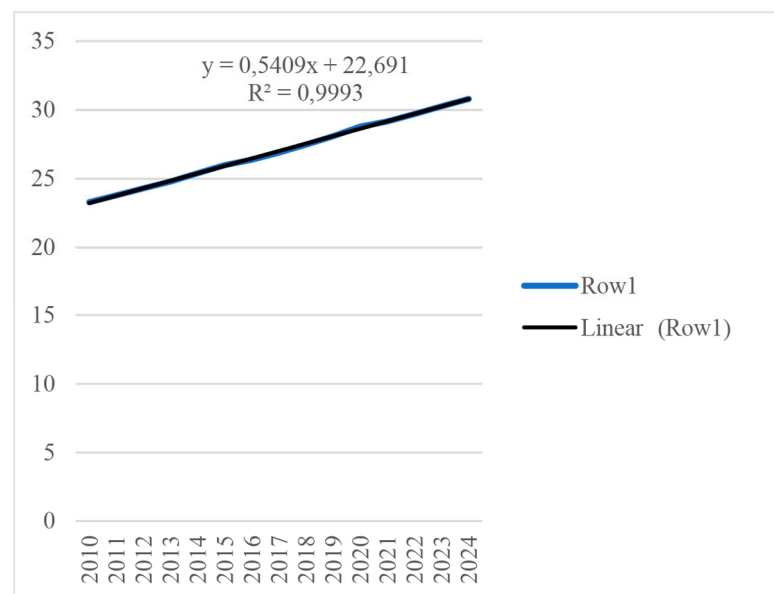


Figure 5. The probabilistic forecast for the average total area of residential premises per inhabitant (at the end of the year) in the Chuvash Republic until 2024 is expressed in square meters.

Due to the limited volume of the article, it is not possible to display all 100 graphs that were used in the writing of the article. However, it should be noted that out of the 21 graphs, the coefficient of approximation R^2 ranges from 0.9450 (for the probabilistic forecast of expenditures of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic)) to 0.9993 (for the probabilistic forecast of the total area of residential premises per average resident). R^2 is an indicator of forecast quality: the closer its value is to one, the higher the probability of execution. For 16 graphs, the approximation coefficient ranges from 0.8148 to 0.893, for fourteen graphs it ranges from 0.7322 to 0.7998, and for twelve graphs it ranges from 0.5851 to 0.6999. This means that the reliability of the calculations for 63 forecast options falls within the range of 59% to 99%. In other words, 63% of the constructed graphs demonstrate the high accuracy of the forecast values calculated by us.

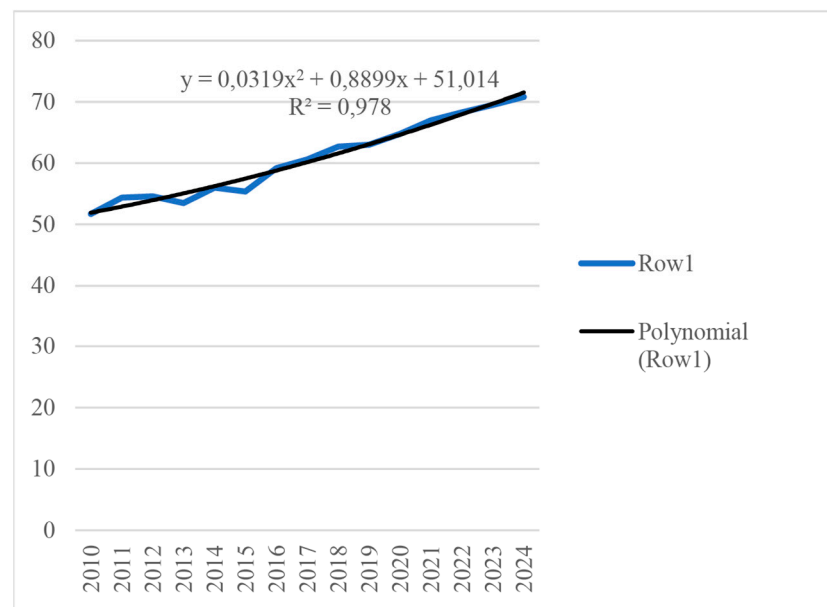


Figure 6. The optimistic forecast of the degree of depreciation of fixed assets in the Chuvash Republic until 2024, %. Source—compiled by the authors.

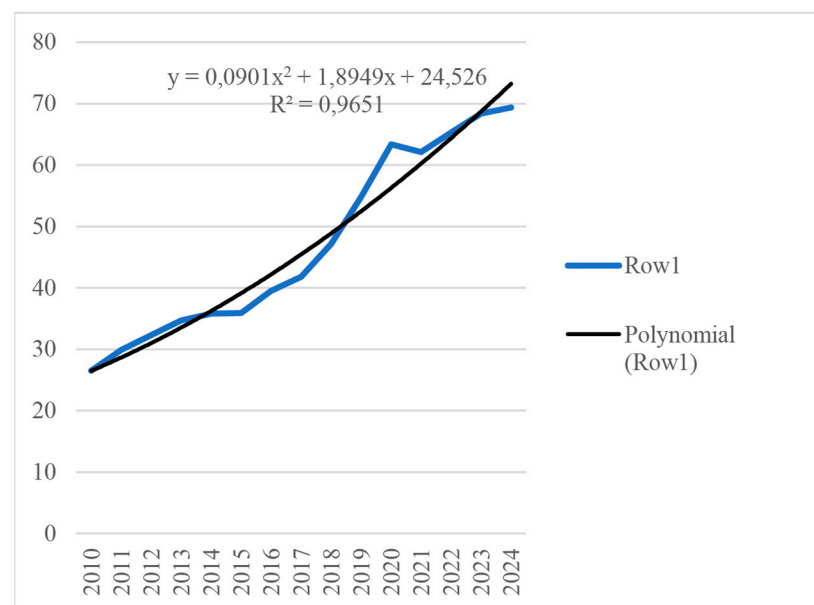


Figure 7. The optimistic income forecast for consolidated budgets of subjects of the Russian Federation (Chuvash Republic) until 2024, thousand rubles per capita.

Since 32 indicators from the period of 2010 to 2020 are involved in calculating the integral indicator of the rate of socio-economic development of the Chuvash Republic, each of them has a certain influence on it. This influence sometimes leads to significant fluctuations, making accurate forecasts challenging. Therefore, to calculate the forecast values of the integral indicator, the period starting from 2015 was selected to exclude the influence of sharp fluctuations in 2012–2013 (a decrease from 100.6% to 89.3%) and 2013–2014 (a growth from 89.3% to 110.9%) on the indicator.

Figure 8 shows a predictive chart (according to Table 4), showing the forecast for the rate of socio-economic development of the Chuvash Republic until 2024, which has the highest approximation coefficient for three types of forecasts (optimistic, probabilistic, pessimistic).

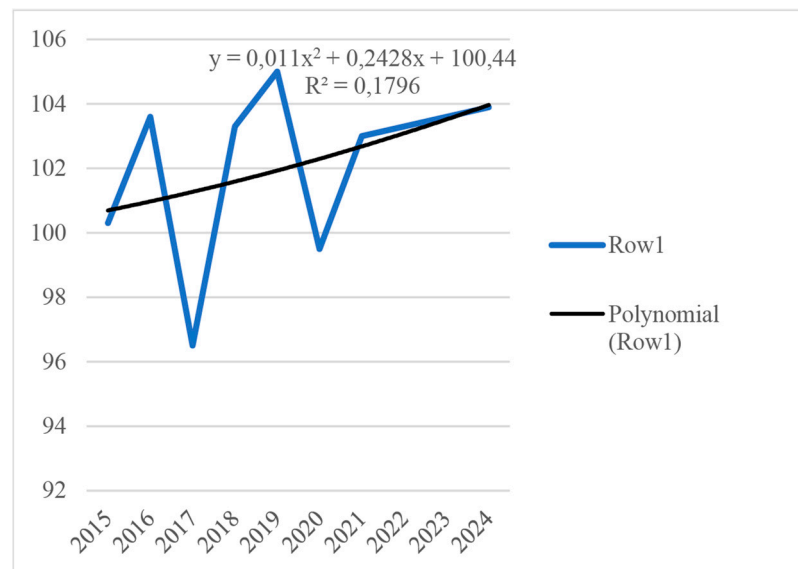


Figure 8. The optimistic forecast of the rate of socio-economic development of the Chuvash Republic until 2024, %.

As can be seen from the graph, R^2 has a value of 0.1796, that is, its attainability is only 18%. This circumstance can be explained by a sharp decrease in many integral indicators characterizing macroeconomic blocks (income, labor, business, ecology, society, prospects, finances) involved in calculating the rate of socio-economic development of the Chuvash Republic (Table 3).

Thus, a decrease in the rate of changes in integral indicators in 2020 compared to 2019 (Table 3), characterizing the macro-regional block “Income”, amounted to 1.7 p.p.; “Labor”—39.9 p.p.; “Ecology”—6.1 p.p.; “Prospects”—22.8 p.p., respectively, which in total is 70.5 p.p. Whereas, an increase was observed in the integral indicators of the “Business” blocks by 3.8 p.p.; “Socium”—17 p.p.; “Finance”—11.3 p.p., their total value was 32.1 p.p. Thus, 70.5 p.p. – 32.1 p.p. = 38.4 p.p., or the declining rates of integral indicators exceeded the growing ones by 2.2 times. These calculations indicate a significant impact of the COVID-19 pandemic on the rate of socio-economic development of the Chuvash Republic in 2020.

In this regard, we will analyze a hypothetical situation: how the trend of changes in the rates of socio-economic development would have formed in 2020 if the COVID-19 pandemic had not occurred. In this case, $R_{S.E.D.}(hypoth.)$ would be in 2020—103.9%, in 2021—104.5, in 2022—105.1 in 2023—105.7 and in 2024—106.2%, respectively. Figure 9 shows their hypothetical forecast up to 2024.

Despite the fact that the approximation coefficient for the rate of socio-economic development of the Chuvash Republic until 2024 amounted to only 0.5047 (a hypothetical forecast), this is a good value, taking into account the fact that in total thirty-two indicators were used for its calculations. Accordingly, the proposed calculation method is quite effective. Low indicator of forecast quality (according to actual data) in 2020—0.1796 due to the fact that the end of 2019 and all of 2020 were aggravated by the COVID-19 pandemic and difficult-to-predict phenomena occurred. Thus, the actual rates of socio-economic development of the region differ from the hypothetical ones by 4.4 p.p. ($103.9 - 99.5 = 4.4$ p.p.).

Next, the confidence intervals of the predicted values (Y) for $R_{S.E.D.}$ for 2021–2024 are calculated for the optimistic forecast (since for it the approximation coefficient showed the highest value), which cover the following ranges:

$$\begin{aligned} 98.6414 \leq Y_{2021} \leq 104.559; & 99.0082 \leq Y_{2022} \leq 104.617; \\ 99.3211 \leq Y_{2023} \leq 104.701; & 99.5945 \leq Y_{2024} \leq 104.806. \end{aligned}$$

As can be seen from them, $R_{S.E.D.}$ for 2021 with a value of 103%, is included in the confidence interval for 2021, and in 2022–2024 this indicator is also included in the forecast intervals.

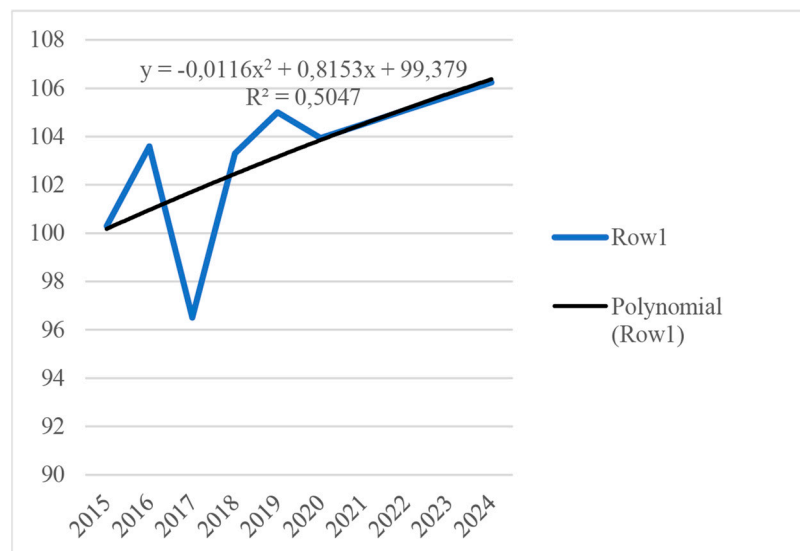


Figure 9. The hypothetical forecast of the rate of socio-economic development of the Chuvash Republic until 2024 (in the absence of the COVID-19 pandemic), %.

A similar procedure was carried out by us earlier in 2020, prior to the availability of actual statistical data in the public domain (hypothetical forecast). At that time, the $R_{S.E.D.}$ (Rate of Socio-Economic Development) for 2020 was calculated to be 103.9% and fell within the predicted range of $98.9419 \leq Y_{2020(hypoth.)} \leq 105.273$. The actual forecast for 2020 turned out to be 99.5%, which also fell within the calculated range of $98.917 \leq Y_{2020(actual.)} \leq 104.536$.

At the same time, $R_{S.E.D.}$ —103.9% for $Y_{2020(hypoth.)}$ is farther from the boundaries of the confidence interval to the right one—by 1.373 p.p. ($105.273 - 103.9 = 1.373$); to the left—by 4.9581 p.p. ($105.273 - 103.9 = 4.9581$). Whereas for $Y_{2020(actual.)}$ $R_{S.E.D.}$ —99.5% is in 5.036 p.p. to the right border ($104.536 - 99.5 = 5.036$) and 0.583 p.p. to the left ($99.5 - 98.917 = 0.583$). This once again mathematically confirms the impact of the COVID-19 pandemic on the change in predicted processes, since in the actual situation of 2020, the minimum value of 0.583 p.p. remained before the boundary of the confidence interval. and the approximation coefficient was 0.1796, which means a process that is difficult to regulate and difficult to predict in a situation of global shocks.

Thus, the COVID-19 pandemic was a bifurcation point, completely changing the trend of the socio-economic development of the Chuvash Republic, therefore, for further research, it is preferable to apply the theory of self-organized criticality¹. However, this goes beyond the purpose of this article—to present qualitative forecasts for the main indicators that form macroeconomic blocks (income, labor, business, ecology, society, prospects, finances) and the rate of socio-economic development of the Chuvash Republic until 2024, as well as to identify their dependence on the normative-legal acts adopted in the region aimed at their regulation.

Thus, at the next stage, we will compare the fluctuations in the rates of socio-economic development $R_{S.E.D.}$ (Table 3), with the adoption in the country and the republic of legislative normative legal acts relating to this area. This is clearly evidenced by the data in Table 5, compiled by the authors on the example of the Russian Federation.

Thus, the decline in the rate of socio-economic development in 2013 to a record 89.3% due to the fact that by the end of the year, three federal targeted programs at the level of the Russian Federation had expired. We believe that we should not limit ourselves to the

analysis of legal acts adopted at the level of the Chuvash Republic, since the region operates within the legal framework of the Federation. The documents adopted at the country level have a direct impact on the socio-economic development of its regions.

10 May 2012 Decree of the Cabinet of Ministers of the Chuvash Republic N 180 “On Approval of the Methodology for Evaluating the Effectiveness of State Programs of the Chuvash Republic” ([Resolution of the Cabinet of Ministers of the Chuvash Republic Dated 10.05.2012 N 180 “On Approval of the Methodology for Evaluating the Effectiveness of State Programs of the Chuvash Republic” n.d.](#)) was adopted. This circumstance was further complemented by the fact that it was the second year of implementation for the state programs of the Chuvash Republic. Significant changes in the program-target method of planning budget expenditures occurred last year, which set the direction for the work of the executive authorities of the Chuvash Republic.

Due to the amendments made to the Budget Code of the Russian Federation, which excluded the concept of ‘long-term target programs’ from 1 January 2014, a transformation process was initiated in 2013 in the Chuvash Republic. This involved converting all 63 republican target programs of the Chuvash Republic existing at the end of 2013 into subprograms of state programs.

In terms of the implementation of regional target programs, 2013 was atypical as no new programs were adopted, except for the first half of the year. During that period, the regional target program ‘Development of measures to support producers and processors of agricultural products in the Chuvash Republic based on mechanisms of domestic food assistance for 2013–2017’ was adopted ([FTP “Development of Measures to Support Producers and Processors of Agricultural Products in the Chuvash Republic on the Basis of Domestic Food Aid Mechanisms for 2013–2017”—Resolution of the Cabinet of Ministers of the Chuvash Republic Dated 30.05.2013 No 198 n.d.](#)) through participation in a competition organized by the Ministry of Agriculture of Russia.

In total in 2013, according to the approved state programs, there were 464 target indicators and indicators directly related to state programs and subprograms. Out of these, 364 (78.4%) ([Attachment No 1 to the Summary Report on the Results of the Implementation of the RCP in 2013 n.d.](#)) were fully implemented.

A sharp increase in the rate of socio-economic development in the Chuvash Republic to 110.9% in 2014 can be attributed to the extensive adoption of government programs. Our study results confirm that during the initial phase of implementing state measures, there is a significant surge in the targeted indicators. However, in subsequent periods, there tends to be a decrease in these indicators, despite continued financial injections. This phenomenon can be attributed to the process of adaptation and the influence of inflationary processes.

In 2017, there was a decrease in the rate of socio-economic development in the Chuvash Republic to 96.5%. This decline occurred despite the adoption of a wide range of legal acts aimed at the development of the studied sphere. However, if we examine the timing of these document adoptions (as shown in Table 5), we can observe that they were primarily adopted in the second half of the year. Consequently, their implementation did not have a significant impact on the indicators, which led to an increase in the rate of socio-economic development in the region in 2018 to 103.3%. Another characteristic of 2019 is the growth of this indicator to 105.0%, as it marked the beginning of the implementation of numerous national projects and state programs.

In total, the state programs of the Chuvash Republic (including subprograms) in 2017 aimed to achieve 927 target indicators and indicators. As of 1 August 2018, 812 of these targets, accounting for 87.6% ([Attachment No 1 to the Summary Report on the Results of the Implementation of the RCP in 2017 n.d.](#)), had been fully achieved. Subsequently, we will compile Table 6, which illustrates the relationship between the number of adopted legal acts and the rate of socio-economic development.

Although eight normative legal acts aimed at socio-economic development were adopted in 2017, it is worth noting that five of them were approved in November–December,

which could not have an immediate impact on the rates that decreased to 96.5%. However, in 2018, the situation changed, and the rates showed growth after the adoption of these acts, reaching 103.3%. In 2019, the majority of the nine legal acts were adopted in the first half of the year, leading to their implementation affecting the rate of socio-economic development, resulting in an increase to 105.0%.

In 2020, due to the absence of new National projects and the impact of the COVID-19 pandemic, the rate of socio-economic development decreased to 99.5%. Despite the challenging circumstances, the government's efforts to maintain the rates at an adequate level should be acknowledged. The decrease of only 0.5 percentage points indicates that the government has successfully fulfilled its primary task for 2020, which was to increase the income and quality of life of citizens ([Shall we Accelerate the Economy? Tasks of the Government of the Russian Federation for 2020: Broadcast by REGNUM News Agency on 25 December 2019 n.d.](#)).

Taking into account the interpretation of the threshold values of the results of the integral assessment of the sustainable socio-economic development of the region, presented in the article by ([Feraru and Orlova 2014](#)), we will propose its clarification and classification in accordance with the methodological approach developed by us (Table 7).

Therefore, we can conclude that almost the entire analyzed period, the Chuvash Republic was characterized by sustainable socio-economic development (2011–2012, 2015–2016, 2018–2019), in 2017. and 2020—a state close to stable (96.5 and 99.5%, respectively), in 2014—high level (110.9%) and only in 2013. there was socio-economic development with some signs of instability—(89.3%).

5. Conclusions

Thus, by conducting an index analysis of thirty-two indicators from 2010 to 2020, categorized into seven macroeconomic blocks (income, labor, business, ecology, society, prospects, finance), we were able to calculate the integral indicators for each block. This analysis helps us determine which indicators within each block had the highest or lowest impact on the overall value of the aggregate indicator in specific years. Additionally, by examining the dynamics of each indicator within the blocks, we calculated the average rate for the entire analyzed period, enabling us to assess their overall impact and identify their influence on the aggregate indicator as a whole. Using these seven integral indicators, we then determined the rate of socio-economic development in the Chuvash Republic.

During the entire analyzed period, there is a dependence between these rates and legal acts adopted in the country and the republic. Analysis of the indicator of the rate of socio-economic development $R_{S.E.D.}$ (Table 6) indicates that for 2010–2020 it ranged from 89.3% in 2013 to (minimum) to 110.9% in 2014 (maximum). In 2017 it decreased again to 96.5%, in 2018–2019 there is an increase in rates in 2020 again reduced to 99.5%. These fluctuations are connected, in our opinion, with the adoption in the country and the republic of legislative normative legal acts relating to socio-economic development.

Using a methodological approach, we can also track the reliability of the forecasts presented. With its help, it is possible to assess not only the impact of certain indicators on socio-economic development, but also to substantiate the most effective options for implementing the activities of state targeted programs when assessing their regulatory impact. It is also applicable in other industries and fields of activity. It allows you to evaluate the impact of any groups of factors (innovative, economic, social, political, legal, environmental, and others) on the required object of study in order to ensure the sustainable development of the country, federal districts and regions.

The developed methodological approach serves as an effective tool for assessing the state of socio-economic development in a region, using the Chuvash Republic as an example. It allows for an examination of the relationship between socio-economic development and the implementation of regulatory legal acts, providing reliable forecasts of the future development of the situation. Consequently, based on the calculated forecasted rates of socio-economic development, it becomes possible to influence this process by aligning

it with medium-term goals and implementing the required regulatory legal acts such as national projects and targeted programs, which provide the necessary financing.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Dynamics of changes in indicators characterizing the macro-regional block “Revenues” in the Chuvash Republic in 2011–2020, %.

Index of Change in	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Population with incomes below the subsistence level	105.8	82.6	102.9	99.2	109.1	104.9	97.5	96.2	97.3	95.8	↑98.9
Income differentiation coefficient	98.2	110.0	97.5	96.6	87.7	97.0	94.8	101.1	100.0	100.0	↑98.2
GRP per capita	120.2	115.7	102.7	106.6	106.0	113.4	104.4	107.3	107.9	104.0	↑108.7
II_I	107.7	101.7	101	100.7	100.5	104.9	98.8	101.4	101.6	99.9	101.8

Source—compiled by the authors based on Rosstat data ([Materials of the Federal State Statistics Service n.d.](#)). Table materials do not have copyright issues. Note: A sign (↑ or ↓) is put next to each indicator of the last column, indicating its positive or negative impact on the average rate of change of the integral indicator.

Table A2. Dynamics of changes in indicators characterizing the macro-regional block “Labor” in the Chuvash Republic in 2011–2020, %.

Index of Change in	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Employment rate	102.9	101.7	102.6	103.8	99.1	96.8	88.5	99.3	99.1	98.6	↓99.2
Unemployment rate	82.1	75.6	96.6	87.7	100.0	106.0	96.2	98.0	94.0	129.8	↑95.7
Labor force participation rate	100.9	99.6	102.5	103.0	99.2	96.9	88.4	99.4	98.7	100.0	↓98.8
Labor force participation rate	76.7	38.0	10.0	766.7	100.0	287.0	24.2	68.8	327.3	55.6	↑84.9
II_L	89.9	73.4	56.5	163.7	99.6	130	65.4	90.3	131.7	91.8	94.4

Source—compiled by the authors based on Rosstat data ([Materials of the Federal State Statistics Service n.d.](#)). Table materials do not have copyright issues. Note: A sign (↑ or ↓) is put next to each indicator of the last column, indicating its positive or negative impact on the average rate of change of the integral indicator.

Table A3. Dynamics of changes in indicators characterizing the macro-regional block “Business” in the Chuvash Republic in 2011–2020, %.

Index of Change in	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Turnover of small businesses per 10,000 people population	90.6	120.6	109.2	107.0	102.8	102.7	111.0	112.7	100.3	99.9	↑105.4
The share of the average number of employees of small enterprises in the total number of employed population	117.9	99.4	103.7	98.8	86.9	101.4	102.7	94.7	132.6	86.4	↑101.7
Balanced financial result (profit minus loss) of the activities of organizations per 10,000 people employed population	199.7	138.2	23.6	119.4	32.9	1237.1	75.4	114.6	62.7	132.0	↑108.5
Profitability of sold goods, products (works, services) of organizations	95.9	88.3	83.1	102.9	111.3	94.9	88.0	159.1	101.9	89.7	↓99.8
The number of enterprises and organizations per 10,000 people population	96.9	103.2	104.2	104.0	101.4	99.5	95.7	97.5	92.8	93.9	↓98.8
II_B	114.7	108.6	74.6	106.2	80.2	98.5	93.7	113.7	95.4	99.2	97.6

Source—compiled by the authors based on Rosstat data ([Materials of the Federal State Statistics Service n.d.](#)). Table materials do not have copyright issues. Note: A sign (↑ or ↓) is put next to each indicator of the last column, indicating its positive or negative impact on the average rate of change of the integral indicator.

Table A4. Dynamics of changes in indicators characterizing the macro-regional block “Ecology” in the Chuvash Republic in 2011–2020, %.

Index of Change in	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Emissions of pollutants into the atmospheric air from stationary sources	90.7	117.8	88.3	124.4	74.9	92.7	172.8	98.3	88.6	68.1	↑98.2
Capturing atmospheric pollutants from stationary sources	78.6	90.9	91.3	143.8	92.4	75.3	100.0	78.1	100.0	101.8	↓93.6
Use of fresh water	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100
Discharge of polluted wastewater into surface water bodies	11.6	110.0	92.0	90.1	409.6	100.0	89.6	256.3	86.9	80.4	↑96.5
Volumes of recycled and sequentially used water	172.7	114.0	86.6	100.4	100.1	92.1	100.2	93.2	94.6	93.6	↑102.7
II_E	67.8	106.1	91.5	110.1	123.2	91.5	109.2	112.9	93.9	87.8	

Source—compiled by the authors based on Rosstat data ([Materials of the Federal State Statistics Service n.d.](#)). Table materials do not have copyright issues. Note: A sign (↑ or ↓) is put next to each indicator of the last column, indicating its positive or negative impact on the average rate of change of the integral indicator.

Table A5. Dynamics of changes in indicators characterizing the macro-regional block “Society” in the Chuvash Republic in 2011–2020, %.

Index of Change in	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Total fertility rate	100.0	108.5	100.0	99.3	99.3	95.7	85.6	93.8	89.6	97.9	↓96.8
Crude death rate	93.8	97.8	98.5	101.5	98.5	100.8	95.5	100.0	98.4	125.0	↓100.7
Infant mortality rate	151.4	90.6	91.7	75.0	97.0	100.0	137.5	68.2	70.0	166.7	100

Table A5. Cont.

Index of Change in	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
The total area of residential premises per inhabitant	102.1	102.1	102.1	102.4	102.4	101.5	101.9	102.2	102.2	102.5	↑102.1
Commissioning of residential buildings for 1000 people population	101.7	92.5	102.6	103.3	96.7	75.6	96.3	99.4	110.5	88.5	↓96.2
Morbidity per 1000 people population	106.4	101.0	103.3	98.1	96.5	95.0	98.2	101.3	93.0	95.8	↑98.8
II_S	107.8	98.6	99.6	96	98.4	94.3	101.3	93.3	93	110	99.1

Source—compiled by the authors based on Rosstat data ([Materials of the Federal State Statistics Service n.d.](#)). Table materials do not have copyright issues. Note: A sign (↑ or ↓) is put next to each indicator of the last column, indicating its positive or negative impact on the average rate of change of the integral indicator.

Table A6. Dynamics of changes in indicators characterizing the macro-regional block “Prospects” in the Chuvash Republic in 2011–2020, %.

Index of Change in	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Fixed assets at full book value per capita	114.1	105.3	111.3	101.8	107.8	106.3	104.3	102.8	186.7	103.7	↑112.5
Depreciation rates of fixed assets	105.2	100.4	98.0	104.7	98.9	106.9	102.4	103.5	100.5	102.9	↓102.3
Investment in fixed assets per capita	130.6	118.0	92.4	89.0	104.4	90.2	104.4	108.5	116.5	80.6	↑102.4
Use of global information networks	102.6	101.4	102.0	99.1	96.0	104.4	98.5	102.3	101.8	99.2	↑100.7
Organizations with a website	111.1	112.4	105.9	97.6	108.9	104.8	100.3	103.9	103.2	71.8	↑101.3
The number of students enrolled in bachelor’s, specialist’s, master’s programs per 1000 people population	89.3	92.2	88.0	88.9	90.1	94.8	98.0	97.6	100.7	100.7	↓93.9
II_P	108.1	104.6	99.3	96.7	100.8	101	101.3	103	115	92.2	102

Source—compiled by the authors based on Rosstat data ([Materials of the Federal State Statistics Service n.d.](#)). Table materials do not have copyright issues. Note: A sign (↑ or ↓) is put next to each indicator of the last column, indicating its positive or negative impact on the average rate of change of the integral indicator.

Table A7. Dynamics of changes in indicators characterizing the macro-regional block “Finance” in the Chuvash Republic in 2011–2020, %.

Index of Change In	Year										Average Rate
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Income of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita	112.8	108.0	107.4	103.2	100.3	110.0	105.8	112.9	116.1	115.7	↑109.1
Expenditures of the consolidated budgets of the constituent entities of the Russian Federation (Chuvash Republic) per capita	105.7	114.5	105.6	107.5	99.0	99.7	110.8	108.1	111.4	124.0	↑108.4
The share of unprofitable organizations	97.3	111.2	94.3	99.0	98.6	104.5	101.3	104.2	87.6	107.4	↓100.3
II_F	105.1	111.2	102.3	103.2	99.3	104.7	105.9	108.3	104.2	115.5	105.9

Source—compiled by the authors based on Rosstat data ([Materials of the Federal State Statistics Service n.d.](#)). Table materials do not have copyright issues. Note: A sign (↑ or ↓) is put next to each indicator of the last column, indicating its positive or negative impact on the average rate of change of the integral indicator.

Note

- Self-organized criticality is a property of dynamic systems to stabilize the development of a process in the presence of bifurcation points. Behavior in the vicinity of the point is characterized by the fact that, with a small perturbation, the system can pass the bifurcation point, completely changing its behavior model.

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