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Spatial Econometric Modeling And Forecasting The Socio-Economic Development Of The Region.

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ABSTRACT

The current socio-economic situation of the Russian Federation is characterized by the presence of a number of negative trends and crisis phenomena that restrain the dynamic development and modernization of the country. These include regional differentiation and polarization, low rates of economic growth and incomes of the population, inadequate development of the market and social infrastructure, low investment activity, etc. Overcoming the crisis in the country and its individual territories is impossible without eliminating the existing shortcomings and inconsistencies in the management system itself, manifested in the established sectoral approach to the formation of regional authorities, duplication of their management functions at hierarchical levels and ineffective interaction between them, insufficient competence of management personnel and, in general, the lack of a clear understanding of the functioning of the governance mechanism in federal districts.

Keywords: socio-economic system, socio-economic development, econometric modeling, forecasting, Stavropol Region.

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INTRODUCTION

For effective management of the regional economy, aimed not so much at ensuring the economic sovereignty of the constituent entities of the Russian Federation, determining their political status and delimiting economic interests, but rather on restructuring and modernizing the economy, there is an urgent need for a comprehensive study of regional development processes, identifying their patterns and studying the emerging trends [1, 2, 3, 17].

Thus, current modern regional development strategies should be reduced to the formation of an innovative model of regional development, ensuring sustainable economic growth, improving the quality of life of the population and its level of employment in key sectors of the economy, improving the efficiency of production resources and increasing labor productivity and increasing the level of self-sufficiency of the population of Stavropol edges of the main types of agricultural products [4, 5, 6, 15]. The implementation of the regional development goals stated above is ultimately intended to contribute to the fullest possible satisfaction of the needs of the inhabitants of a particular Region and to take into account, in general, national development priorities [7, 8, 1].

MATERIALS AND METHODS

The system of economic management of the macroregion is implemented in the regional policy. Improving the management system requires improving the regional socio-economic policy, clarifying the goals of strategic plans and sectoral development programs [9, 14].

An effective management system traditionally agrarian region in modern conditions should be based on scientifically based approaches to the formation of the forecast and planned values of the main indicators of socio-economic development. For this, an algorithm for econometric modeling and forecasting was developed (Figure 1).

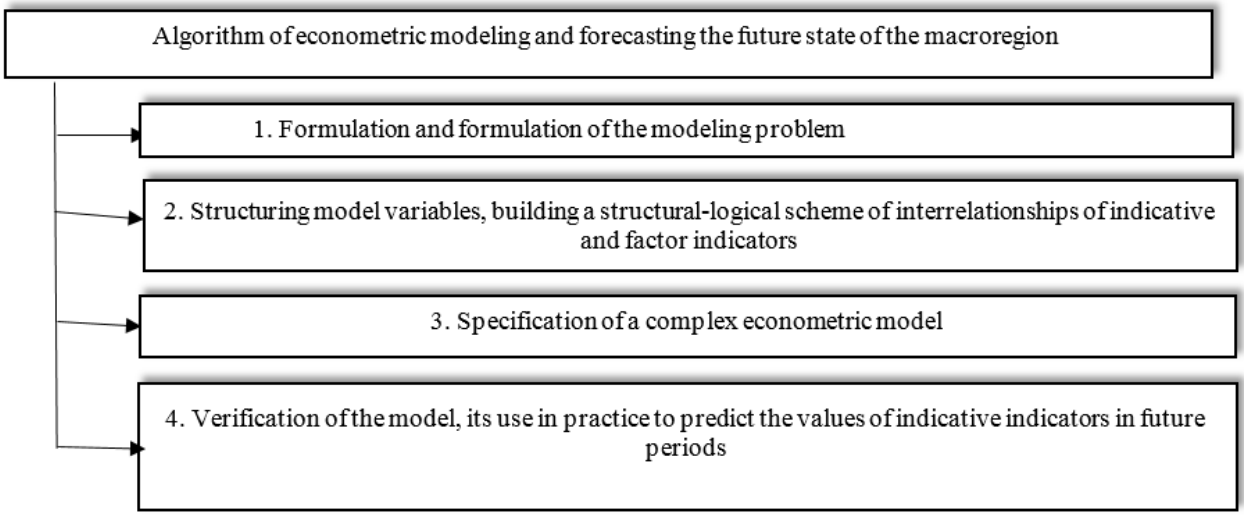

Figure 1: Algorithm for econometric modeling and forecasting the future state of the macro region

General view of the proposed to build a complex econometric model, which is a system of interrelated regression equations (A) - (C), next

$$\begin{cases} Y_1 = a_{10} + a_{11}X_{11} + a_{12}X_{12} + a_{13}X_{13} + a_{14}X_{14} + a_{15}X_{15} + a_{16}X_{16} + a_{17}X_{17} + \\ +a_{18}X_{18} + \alpha_{12}Y_2 + \alpha_{13}Y_3 + \varepsilon_1; & (A_1) \\ Y_2 = a_{20} + a_{21}X_{21} + a_{22}X_{22} + a_{23}X_{23} + a_{24}X_{24} + a_{25}X_{25} + a_{26}X_{26} + \alpha_{21}Y_1 + \\ +\alpha_{23}Y_3 + \varepsilon_2; & (B_1) \\ Y_3 = a_{30} + a_{31}X_{31} + a_{32}X_{32} + a_{33}X_{33} + a_{34}X_{34} + a_{35}X_{35} + a_{36}X_{36} + a_{37}X_{37} + \\ +\alpha_{31}Y_1 + \alpha_{32}Y_2 + \varepsilon_3; & (C_1) \end{cases}$$

High statistical characteristics obtained as a result of using step-by-step selection procedures make it possible to proceed to the stage of joint consideration of equations (A2) - (C2) within the framework of an integrated econometric model, which is a system of interrelated equations that can be summarized as follows:

$$\begin{cases} Y_1 = a_{10} + a_{13}X_{13} + a_{17}X_{17} + \alpha_{12}Y_2 + \alpha_{13}Y_3 + \varepsilon_1, & (A_2) \\ Y_2 = a_{20} + a_{21}X_{21} + a_{23}X_{23} + a_{25}X_{25} + a_{26}X_{26} + \alpha_{21}Y_1 + \alpha_{23}Y_3 + \varepsilon_2, & (B_2) \\ Y_3 = a_{30} + a_{32}X_{32} + a_{33}X_{33} + a_{34}X_{34} + a_{35}X_{35} + \alpha_{31}Y_1 + \alpha_{32}Y_2 + \varepsilon_3; & (C_2) \end{cases}$$

The presented system of econometric equations is over-identifiable, i.e. According to the coefficients of the above equations, it is possible to obtain several variants of the values of the coefficients of the structural equations. To estimate the parameters of such a system of simultaneous equations, the two-step least squares method (TSLSM) is traditionally used. This method involves the construction of a system of equations on the basis of the structural form of the model and the evaluation of its parameters in order to calculate the aligned values of indicative indicators acting as endogenous variables $\ddot{Y}_1$, $\ddot{Y}_2$ and $\ddot{Y}_3$. The reduced form of the model will be as follows.

$$\begin{cases} \ddot{Y}_1 = \beta_{10} + \beta_{11}X_{13} + \beta_{12}X_{17} + \beta_{13}X_{21} + \beta_{14}X_{23} + \beta_{15}X_{25} + \beta_{16}X_{26} + \\ \beta_{17}X_{32} + \beta_{18}X_{33} + \beta_{19}X_{34} + \beta_{110}X_{35} + \varepsilon_1, & (A_{2.1}) \\ \ddot{Y}_2 = \beta_{20} + \beta_{21}X_{13} + \beta_{22}X_{17} + \beta_{23}X_{21} + \beta_{24}X_{23} + \beta_{25}X_{25} + \beta_{26}X_{26} + \\ +\beta_{27}X_{32} + \beta_{28}X_{33} + \beta_{29}X_{34} + \beta_{210}X_{35} + \varepsilon_2, & (B_{2.1}) \\ \ddot{Y}_3 = \beta_{30} + \beta_{31}X_{13} + \beta_{32}X_{17} + \beta_{33}X_{21} + \beta_{34}X_{23} + \beta_{35}X_{25} + \beta_{36}X_{26} + \\ +\beta_{37}X_{32} + \beta_{38}X_{33} + \beta_{39}X_{34} + \beta_{310}X_{35} + \varepsilon_3 & (C_{2.1}) \end{cases}$$

As a result of the described parameterization algorithm, due to the peculiarities of the relationship between predefined variables $\hat{Y}_1$-$\hat{Y}_3$, the complex econometric model in its final form has the following form:

$$\begin{cases} \hat{Y}_1 = a_{10} + a_{13}X_{13} + a_{17}X_{17} + \alpha_{12}\ddot{Y}_2 + \alpha_{13}\ddot{Y}_3 + \varepsilon_1, & (A_3) \\ \hat{Y}_2 = a_{20} + a_{21}X_{21} + a_{23}X_{23} + a_{25}X_{25} + a_{26}X_{26} + \alpha_{21}\ddot{Y}_1 + \alpha_{23}\ddot{Y}_3 + \varepsilon_2, & (B_3) \\ \hat{Y}_3 = a_{30} + a_{32}X_{32} + a_{33}X_{33} + a_{34}X_{34} + a_{35}X_{35} + \alpha_{31}\ddot{Y}_1 + \alpha_{32}\ddot{Y}_2 + \varepsilon_3; & (C_3) \end{cases}$$

At the final stage, the parameterization and identification of the equations of the system were made in the sequence as described above. Synthesized on the basis of the proposed methodology, the complex econometric model of indicators of socio-economic development for the subjects of the NCFD has:

$$\begin{cases} \hat{Y}_1 = -1113879,506 + 853,994X_{13} + 0,742X_{17} + 142,539\ddot{Y}_2 + \\ +1492557,559\ddot{Y}_3 + \varepsilon_1 & (A_3) \\ \hat{Y}_2 = 99,229 + 0,258X_{21} - 0,00177X_{23} + 0,00044X_{25} + \\ +0,218X_{26} + 0,00025\ddot{Y}_1 - 155,327\ddot{Y}_3 + \varepsilon_2 & (B_3) \\ \hat{Y}_3 = 0,458 + 0,0000171X_{32} - 0,001X_{33} + 0,00458X_{34} + \\ +0,00229X_{35} + 0,000000147\ddot{Y}_1 - 0,00156\ddot{Y}_2 + \varepsilon_3; & (C_3) \end{cases}$$

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RESULTS

The socio-economic development of any region is determined by a complex system of factors, among which the important importance is the target orientation, focus on solving the most important socio-economic problems of a particular region. Accounting for the cumulative impact of the whole diversity of scientific, technical, economic, social and political factors that determine the development of a region requires the use of new approaches and methods [6, 14]. The stage of forecasting regional processes is an integral part of management, on which the economic and social consequences of regional development, the efficiency of using labor, natural and material and material resources largely depend [7, 13].

Based on the obtained integrated model for the NCFD, a trend analysis and adaptive forecasting was performed for the indicative indicators presented according to the data of the Stavropol Region.

For the indicative indicator "GRP per capita" (), the resulting model has the following form:

$$\hat{Y}_1 = -1113879,506 + 853,994 X_{13} + 0,742 X_{17} + 142,539 \ddot{Y}_2 + 1492557,559 \ddot{Y}_3 + \varepsilon_1,$$

As a result of step-by-step extrapolation, three versions of forecasts were obtained for the indicator $\hat{Y}_1$ - GRP per capita in the Stavropol region (Figure 2)

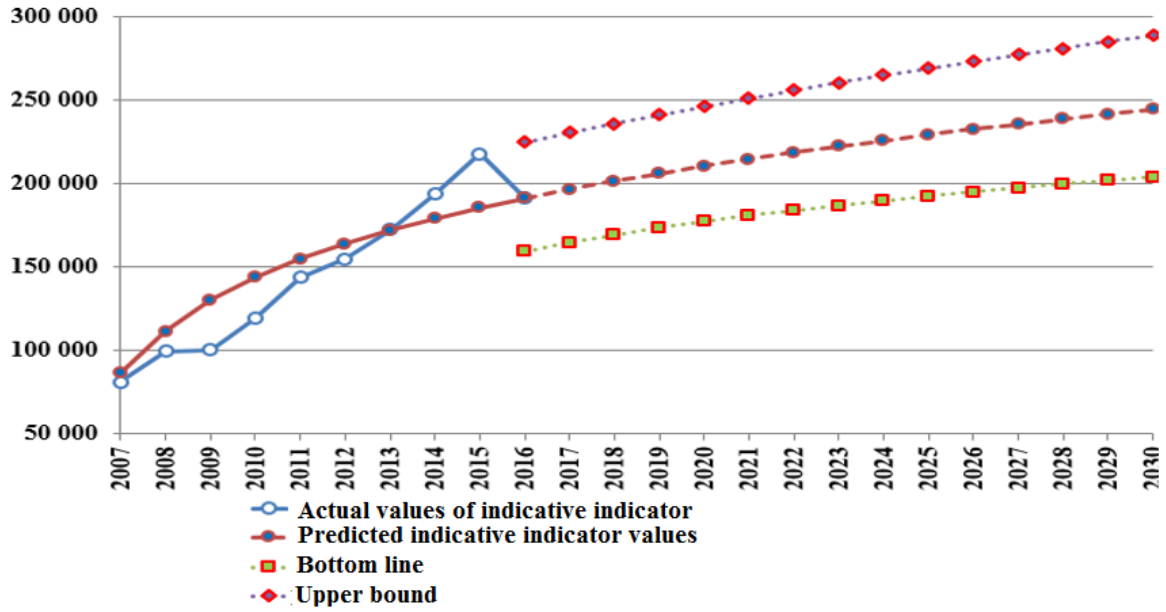

Figure 2: Results of forecasting the GRP per capita in the Stavropol Region, rub.

As the above figure shows, the indicative indicator has a clear tendency to increase. The annual growth rates on average by 1.77% (by 3,555 rubles) suggest that, if the most probable, realistic forecast is fulfilled, the GRP per capita by 2030 will be 244,328 rubles. per 1 inhabitant of the Stavropol Region. In accordance with the optimistic version of the forecast (the upper limit of extrapolated values), the indicative indicator will tend by 2030 to a value of 288365 rubles. per person, which exceeds the most likely development scenario by 44037 rubles. Pessimistic (lower limit of the forecast) suggests that the effective sign by 2030 will be only 203909 rubles, which is 16.5% lower than the most likely scenario of a change in the indicative indicator.

In the study of another indicative indicator - the proportion of the population with incomes below the subsistence minimum ($\ddot{Y}_2$) - the most accurate integrated model was determined, which has the following form:

ISSN: 0975-8585

$$\hat{Y}_2 = 99,229 + 0,258X_{21} - 0,00177X_{23} + 0,00044X_{25} + 0,218X_{26} + 0,00025\ddot{Y}_1 - \\ -155,327\ddot{Y}_3 + \varepsilon_2;$$

As a result of the stepwise extrapolation, three versions of the forecasts for the $\hat{Y}_2$ – the proportion of the population of the Stavropol Region with incomes below the subsistence minimum,%. (Figure 3). In this region of the North Caucasus Federal District, there is a tendency to reduce the proportion of the population with incomes below the subsistence minimum, which is certainly a positive trend in the social development of the Stavropol Region. At an annual rate of reduction of 11.3% compared with the previous values of the indicator, the share of the population by 2030, based on the obtained forecast values, will be only 2.4% of the total population of the Stavropol Region.

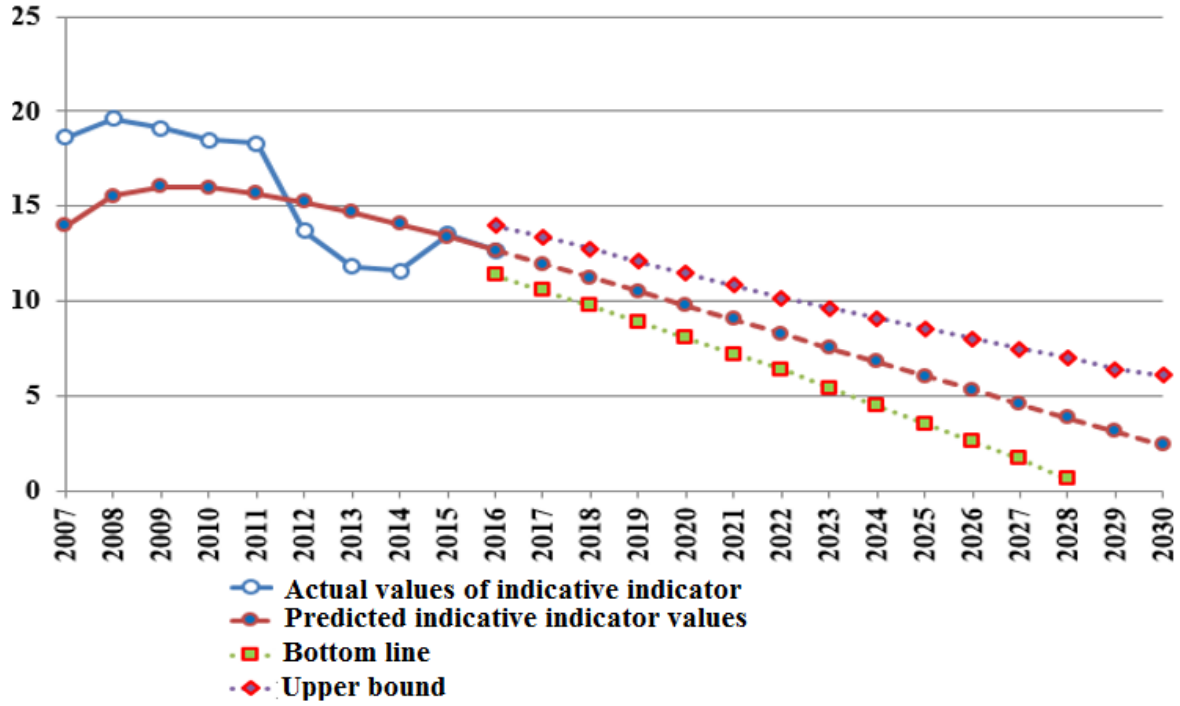

Figure 3: The prediction results of the Stavropol Region population share with incomes below the subsistence minimum,%

Also, extrapolation resulted in optimistic (lower bound) and pessimistic (upper bound) development options. In accordance with the first, by 2029, the population with incomes below the subsistence minimum will be absent. A pessimistic forecast implies a reduction in the performance indicator by 2030 from 13.5% to 6.1%.

In the study of the indicative indicator of cognitive development - the human development index (HDI) - the most accurate integrated model was determined, which has the following form:

$$\hat{Y}_3 = 0,458 + 0,0000171X_{32} - 0,001X_{33} + 0,00458X_{34} + 0,00229X_{35} + \\ +0,000000147\ddot{Y}_1 - 0,00156\ddot{Y}_2 + \varepsilon_3$$

As a result of step-by-step extrapolation, three versions of forecasts were obtained for the indicator $\hat{Y}_3$ - HDI (Figure 4)

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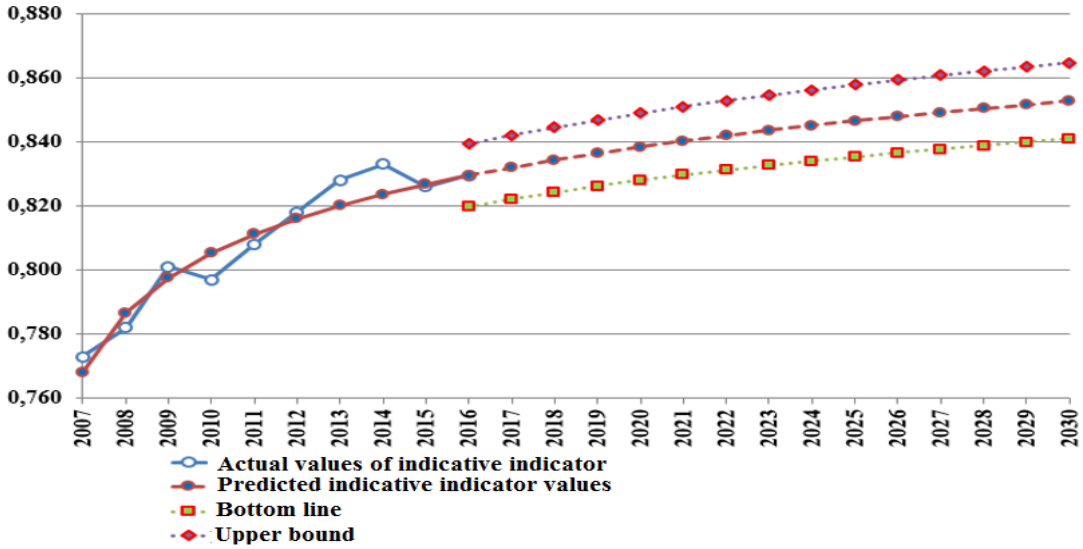

Figure 4: Results of forecasting the human development index of the Stavropol Region

When extrapolating the indicator, it was determined that if the most probable forecast is fulfilled, by 2030 the HDI will be 0.853, which exceeds the actual value of 2015 by 0.027. This suggests that the HDI will rise, but at a slow pace (the annual growth rate will be only 0.19%). The value of an indicative attribute with a pessimistic forecast will be 0.841, and with an optimistic development scenario, the HDI will take the value of 0.865 by 2030.

DISCUSSION

In general, according to the results of forecasting, it can be noted that the identified trajectories of changes in the aggregate indicators of the economic, social and cognitive components of the development of the subject of the North Caucasus Federal District can be assessed as positive in terms of all three options of the extrapolation scenarios presented (realistic, optimistic and pessimistic) [6, 7, 8, 9, 10, 12].

A set of measures aimed at the development of the socio-economic system of the North Caucasus Federal District (Figure 5) was proposed. Their execution will lead to a significant positive shift in the economic and social spheres of development of the macro-region.

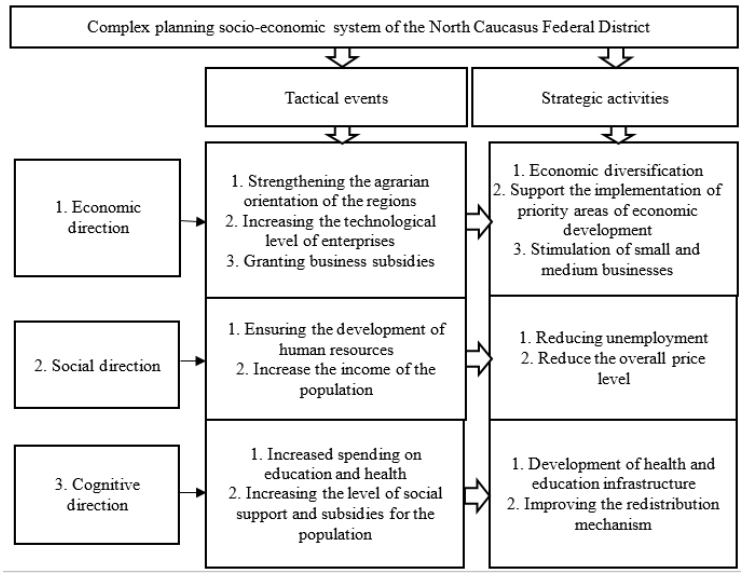

Figure 5: Complex planning socio-economic system of the North Caucasus Federal District

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CONCLUSION

The current socio-economic state of Russia is characterized by a large number of negative phenomena that constrain the dynamic development of the country. These include regional differentiation and polarization, low rates of economic growth and incomes of the population, inadequate development of the market and social infrastructure, low investment activity, etc [11].

A comprehensive study of the problems of socio-economic development at the regional level requires the use of large-scale diagnostics of important indicators of the development direction, in which three main ones were chosen - economic, social and cognitive - development directions.

The study was carried out using a group of factor indicators of the region's development; an assessment was made of the level of development achieved by the subject of the North Caucasus Federal District.

After careful and consistent selection, a complex econometric model was built, which included those exogenous indicators that have the greatest impact on the analyzed performance feature. In accordance with the synthesized model, there were obtained positive results of forecasting the level of social and economic development of the Stavropol Territory, which can be performed while executing a number of activities (developing strategic development programs for the long term, improving the redistribution of funds in the North Caucasus Federal District, improving the efficiency of budget expenditures, attracting investments).

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