Levels in Factor Analysis of External Environment in Rural Production

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ABSTRACT: The paper shows the calculations justifying the influence of external environment on the agrarian production that is affected by a large number of factors. A methodological approach that differentiates this aggregate by a combination of factor elements at the global, national, regional and industry levels is presented. This approach is positioned as hierarchical, subordinating, and defined by the term multi-levelness. The composition of the factor elements of each of these levels is represented by the parameters that are co-ordinated towards each other, reflecting a different type of connection between them, characterized by their location in the same row, without reflecting the hierarchy. The groups of factor elements are highlighted: environmental, social, political, legal, technological, natural, environmental, informational. The idea of studying the influence of the external environment on agricultural production has been implemented, combining the definition of the degree of influence by hierarchical levels of influence, as well as on the coordinating groups of factor elements in each level. On this basis, territorial differences in the degree of influence of the external environment on the state and trends of agriculture in the economic regions of the Russian Federation have been revealed.

Keywords: levels, factorial components, influence, rural production, subordination, coordination.

INTRODUCTION

The nature of transformation in the social order of society aimed at the use of market relations increases the importance of research in the competitive environment of enterprises and industries of material production. In its composition, the role of agricultural production is always quite significant. This is a clear and undeniable basis for the relevance of studying the factors that affect it. The authors are convinced that now, compared to the previous period of the late 20th century with other ownership forms and economic entities organization, the priority of the impact of external environment factors is manifested on agricultural enterprises in Russia more than of internal ones. If the influence of internal factors – land, labor, capital, technology and information, contributes to a justified conclusion about the possibility to optimize their ratio within a functioning enterprise, the influence of external factors opens up other

opportunities, as well as creates some difficulties of targeting them. It is multidimensional and includes an assessment of the completeness of occupied market niches, meeting the vital needs of the population, the requirements of buyers of resource, the assessment of the investment environment, tax and other policies of the state, natural, legal, information other manifestations of the external environment. In this regard, the question is based on the appropriateness position of using system analysis as a methodological approach to studying the impact of the external environment on agricultural production. It allows us to present the agriculture and its environment as a complex structured system. It requires an analysis of the impact of a combination of separate environmental factors on the economy, ranking them by the influence degree. This methodological approach has contributed to the formation of an adequate and structured view of the external environment in the form of four hierarchically subordinated levels – global, national, regional and industrial spaces, each represented by economic, social, political, legal, technological, natural, environmental and information factor elements.

Methodologically philosophical reflection of the authors is based on the definition of the studying the formulated problem, the use of a large array of source information, the systemization of it according to selected classification criteria and application of statistical processing using mathematical transformations. An important methodical basis for research in the influence of environmental factors is to determine the value of the integral indicator of factor elements of each level (global, national, regional, industrial). To this end, four stages of calculations have been made on the number of levels of influence, each of which has three successive operations: 1) matching and determining multidimensional medium factor elements; 2) charting the impact of factor elements on each other; 3) calculating the integral effect of the external environment of this level.

Briefly describing the study of the formulated problem, we have highlighted a number of works published that served the authors of this paper as a certain setting – either in making the necessary decision on the use of the method, or in the interpretation of the important concepts that define the phenomena studied and the processes that act as the names for the factor elements of the influence of the external environment on production activities and their results. Having formulated the idea of a multi-level approach to studying the influence of the external environment on such an important part of material production as agricultural, the search for already completed developments was justifiably directed to the existing publications from the position of the chosen division into factors of global, national, regional and industry scale. Focusing more heavily on the publications of domestic scientists, it was possible to assess the existing works that make up the scientific baggage on the problem studied in terms of identifying criteria for assessing factors of national, regional and industry scale, and, conversely, the lack of works that characterize the factors of the global level.

In particular, O.S. Sukharev's monographs (2014; 2015) outline institutional and structural factors that affect economic dynamics in the state, as well as the possibilities of managing structural changes in the economy, in which this author considers the dynamics of prices as a very important direction. The study by E.A. Pavlova (2008) in the analysis of the competitive market environment shows a set of indicators, through which it is possible to assess the degree of market competitiveness and the development of the competitive environment at the national level. The importance of state policy to achieve food security is demonstrated by Clark's study (Clark, 2012), which shows the

role of the management factor in achieving the required production volume and the quality of the products produced. The study of national technological factors in the works of V.A. Melnikov (2015), K. Menger (2005), P. Drucker (2010), the authors of scientific papers assessing the reality of the Russian economy and predicting its modernization (Modernization of the Russian economy, 2015) reflect the importance of studying the influence of these factors. These works have had some impact on the selection of the most significant ones.

The works by I.M. Dzialoshinsky (2001), A.V. Manoilo (2003), represent national information factors, considering concepts such as information openness, information filters, information resources, information space. These concepts and their interpretation, as well as the assessment of the role of information technologies by M.M. Varnitskaya (2013) proved to be very useful and applicable in understanding the criteria for classifying the economic and social factor elements.

Reflections on the composition of factor elements in the group of regional factors were based to some extent on published materials assessing the role of regional policy, the use of budgetary resources in production made by a number of researchers (Povarova, 2013; Sulashkin et al., 2007), the social risks reflecting the result of economy management (Kokhno, 2014), the importance of incomes of the population (Economic indicators, n.d.), manifesting themselves. Numerous statistical sources of information for the purpose of calculating quantitative arguments of the influence of different level factor groups and the aggregates of factor elements within each level (Aseyeva, 2014; Investfunds, n.d.; Livejournal, n.d.; U.S. Energy Information Administration, n.d.) are used in the presented research work. Elements of the classification approach are perceived by the authors in relation to the taxonomic method of assessing external factors, outlined by D.D. Radulov (2014), as well as the expert method described in the work of N.N. Kunitsyna and G.G. Pleshkov (2008).

Previous developments by one of the authors (Michurina, 2019; Tenkovskaya, Michurina, 2017) are pre-submitted and reflect the extent of the current knowledge of the problem.

The setting of the problem, outlined in the introduction, determined the feasibility of identifying the systemic impact of environmental factors on agricultural production in stages – on the basis of quantitative expression of the degree of influence of the selected set of factor elements located coordinatingly in relation to each other at four hierarchically subordinate levels. The empirical study of the impact of the external environment on Russia's agricultural production was carried out using a statistical basis over a 25-year period from 1991 to 2015 to determine the change in the degree of environmental impact in the new economic environment both within the internal territorial public systems and the state in general.

To achieve the goal, all the aggregates of quantitative indicators of factor elements reflecting the influence of the economy, politics, law, society, technology, information, ecology and nature are presented in a comparable form, mathematically transformed in view of their relationship and mutual influence, and then brought to a single integral indicator.

On the global level, the result of this indicator is shown in table 1.

Table 1. Global integral indicators

Years	The sum of factor elements, shares	Multidimensional average factor elements, shares	Global integral indicator (ratio)
1991	59.618	0.710	1.497
1992	60.064	0.715	1.531
1993	62.372	0.743	1.714
1994	66.421	0.791	2.070
1995	66.268	0.789	2.056
1996	66.105	0.787	2.041
1997	65.506	0.780	1.986
1998	66.327	0.790	2.061
1999	70.600	0.840	2.486
2000	77.062	0.917	3.233
2001	72.792	0.867	2.725
2002	71.856	0.855	2.621
2003	73.905	0.880	2.851
2004	78.093	0.930	3.364
2005	82.279	0.980	3.935
2006	88.364	1.052	4.874
2007	96.800	1.152	6.407
2008	98.563	1.173	6.764
2009	93.354	1.111	5.747
2010	102.214	1.217	7.543
2011	107.511	1.280	8.778
2012	113.301	1.349	10.274
2013	113.804	1.355	10.411
2014	120.857	1.439	12.469
2015	125.963	1.500	14.118

RESULTS

During the analyzed period, the world economy has passed several stages of the economic cycle. The calculation of 25 values of the integral indicator of the global level in each year of the period allowed justifying the conclusion that the impact of the global space on the Russian agricultural economy increased more than 9 times. The dynamics of the integral indicator of factor elements is evidenced by this and is clearly presented by Figure 1.
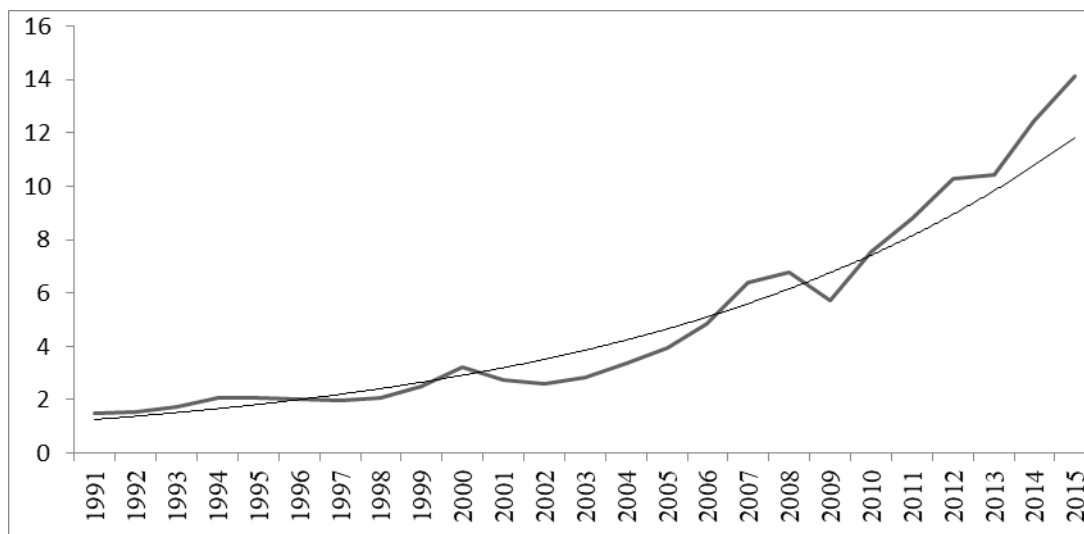
Figure 1. The dynamics of integral indicator of factor elements of the global level from 1991 to 2015

Using special terms, we can formulate the conclusion: the integral indicator of the global level has an exponential trend of influence on agricultural production, indicating that the processes of globalization are increasing exponentially.

Statistical analysis of the impact of national level factors on agricultural production performed in a similar way led to the conclusion that during the period under review, the degree of influence of national level factors on Russian agriculture increased more than 10 times.

Without giving the estimated statistics of indicators in a table form, we present a visual image of the trend dynamics of integral indicator of factor elements of the national level in Figure 2.
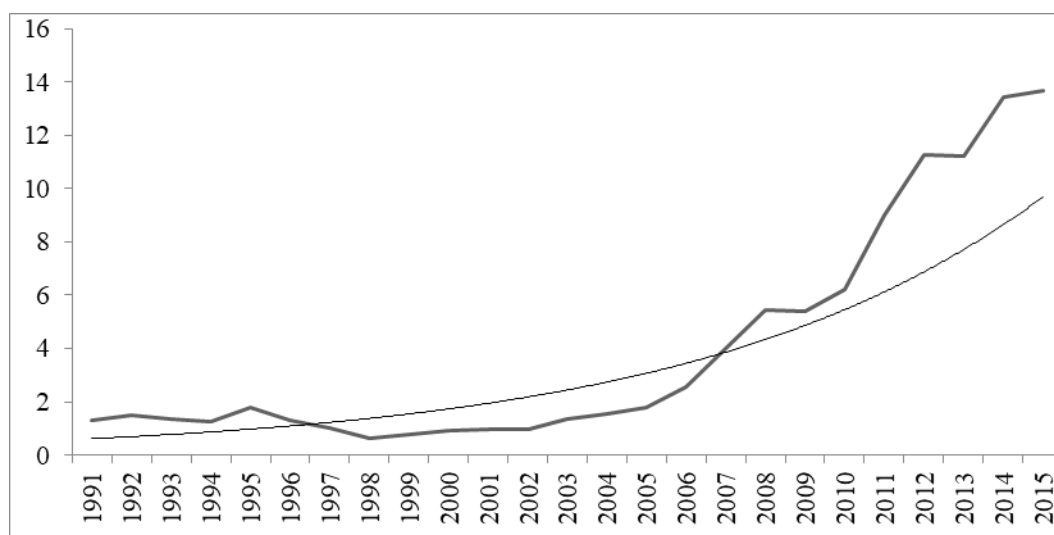

Figure 2. The dynamics of the integral indicator of the national level from 1991 to 2015

The following levels of analysis – regional and industry statistically – are more differentiated because of the need for a consistent calculation of three indicators for each region, which are internal territorial taxa of the state. Table 1 presents the names

of these indicators: the sum of factor elements, the multidimensional average factor elements, and the global integral indicator (ratio).

Since the estimated statistics for each region are very large, in this text we present the result of calculating only the final integral indicator (Table 2).

Table 2. Regional integral indicators

Economic regions / Years	Central	Central -Black soil region	Volga-Vyatka	Northern	Northwestern	Volga region	North Caucasus	Ural region	West Siberian	East Siberian region	Far Eastern region
1991	1.413	1.272	1.504	1.677	1.722	1.551	1.545	1.510	1.322	1.488	1.389
1992	1.431	1.279	1.508	1.632	1.729	1.575	1.560	1.506	1.315	1.451	1.391
1993	1.397	1.261	1.475	1.609	1.687	1.540	1.512	1.482	1.303	1.425	1.342
1994	1.406	1.266	1.488	1.532	1.664	1.517	1.580	1.510	1.345	1.436	1.295
1995	1.407	1.241	1.511	1.660	1.612	1.581	1.657	1.527	1.340	1.425	1.401
1996	1.384	1.324	1.483	1.649	1.601	1.570	1.533	1.545	1.405	1.454	1.289
1997	1.413	1.369	1.444	1.726	1.591	1.602	1.463	1.558	1.407	1.472	1.364
1998	1.450	1.355	1.483	1.661	1.651	1.590	1.393	1.590	1.447	1.481	1.326
1999	1.489	1.498	1.574	1.736	1.743	1.660	1.552	1.725	1.530	1.557	1.388
2000	1.484	1.479	1.691	2.141	1.920	1.769	1.525	1.778	1.626	1.637	1.384
2001	1.927	1.693	1.643	1.990	2.117	1.888	1.701	2.038	1.830	2.022	1.501
2002	1.709	1.911	1.844	2.118	1.819	2.004	1.898	1.938	1.904	1.639	1.784
2003	1.883	1.944	2.056	2.238	2.043	2.179	1.917	2.087	2.141	2.132	1.745
2004	2.100	2.224	2.109	2.389	2.229	2.309	1.905	2.451	2.234	1.967	3.157
2005	2.353	3.564	2.521	2.509	2.600	2.564	2.347	2.900	2.539	2.259	1.997
2006	3.210	3.010	2.896	3.550	3.309	3.078	3.064	3.350	3.199	3.065	2.913
2007	3.261	3.648	3.594	3.878	3.860	3.695	3.828	3.840	3.658	3.511	3.900
2008	4.090	4.171	3.798	4.297	3.713	3.854	3.923	4.006	3.912	3.668	4.123
2009	4.794	4.847	4.176	4.264	4.519	4.173	4.708	5.627	4.232	4.518	4.463
2010	5.371	5.363	5.077	4.533	4.856	5.376	5.111	5.141	5.515	6.001	5.397
2011	7.641	6.658	7.133	6.235	6.417	6.526	6.517	6.196	6.954	7.658	6.750
2012	8.718	8.423	9.981	7.670	7.257	8.509	7.828	7.435	8.482	8.397	8.307
2013	8.825	8.965	8.740	7.132	8.136	8.454	10.076	8.119	8.709	8.635	9.056
2014	10.431	10.176	9.376	7.938	8.304	8.801	9.321	8.162	10.667	9.463	12.798
2015	10.617	11.737	10.142	8.408	8.747	8.632	10.566	8.282	11.047	10.655	11.333

The regional level of influence of factor elements on agricultural production is determined on the basis of the final calculation of the integral indicator for the same period of time (1991-2015), but for each domestic region of the country with the differentiation of its territory into large economic areas. Statistical calculation (Table 2) and the construction of the graph (Figure 3) have revealed the direction of the dynamics of the integral indicators for each major economic region. The differentiation of their values depends on the characteristics of these regions. Estimated values range from 1.2

to 12.8. In each economic region, there has been an increase in the impact of a combination of factor elements on economic activity, with fluctuations in the rate of increase in the impact of external factors at the regional level from 5 to 9 times.

The least impact was shown in four of the 11 economic regions of the Russian Federation – Northern, Northwestern, Volga and Ural economic regions.
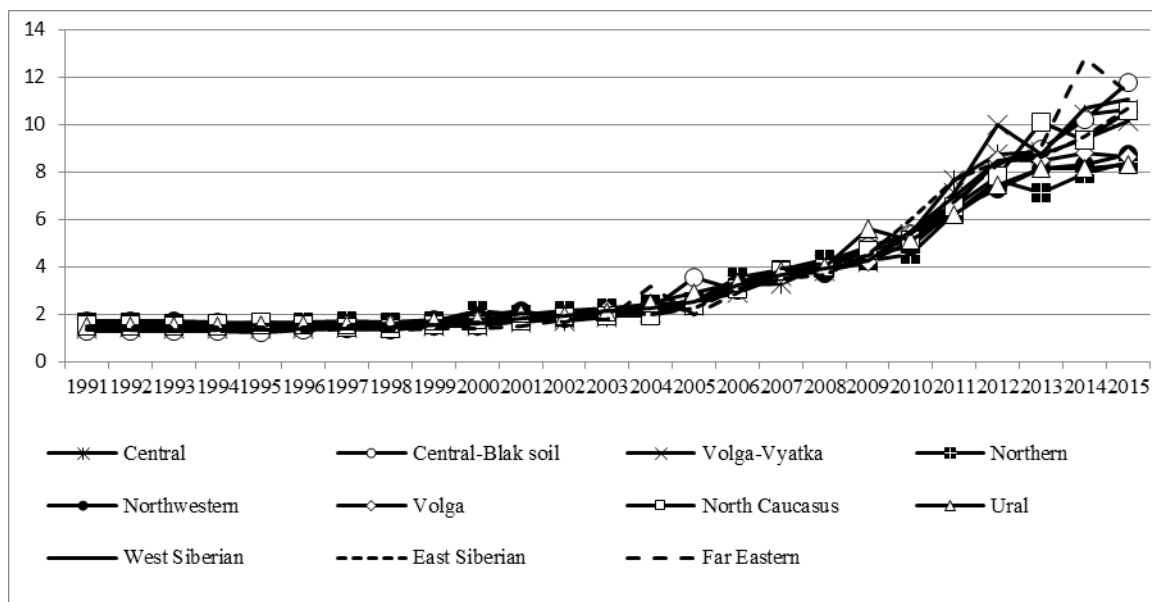

Figure 3. Dynamics of regional integrated indicators from 1991 to 2015

When studying the influence of external environmental factors on agricultural production, the impact at the industry level is determined, as well as at the regional level, using the division of territory into large economic areas. Fluctuations of integral indicators range between 1.6 and 7.3.

Figure 4 clearly shows that integral indicators have been changing the direction of the dynamics since 2003. The rate of increasing the influence of environment factor elements on agricultural production at the industry level differs markedly from region to region in the range from 66 to 281%. This evidences the differences in agricultural conditions and in its industry structure within each economic region.
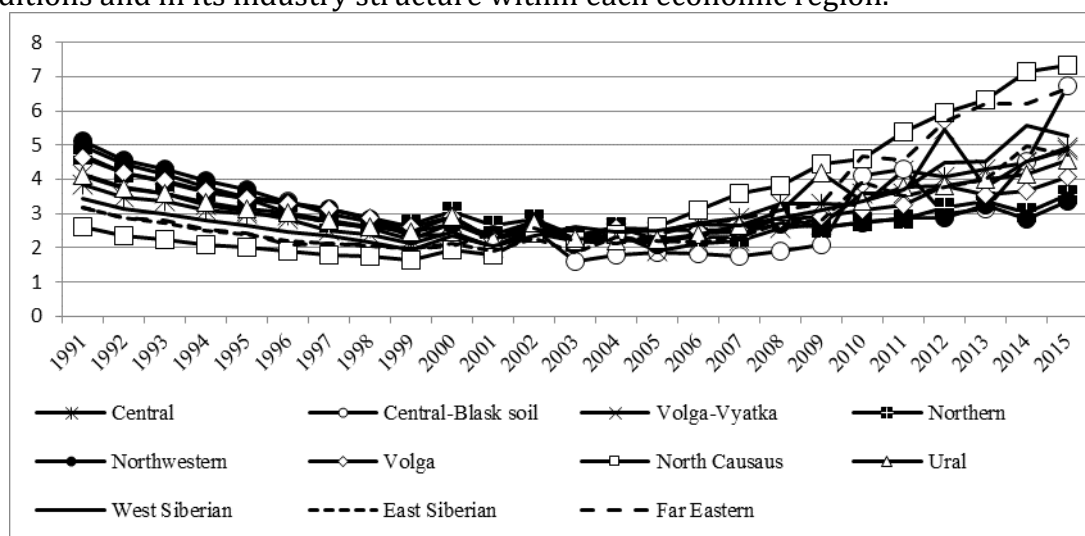

Figure 4. The dynamics of integral indicators at the industry level from 1991 to 2015

The information provided above has made it possible to identify the types of territories that have varying degrees of influence and a different combination of global, national, regional and industry-level factors.

The following six types revealed:

• Type I has a strong impact of global, national and industry level and a weak impact of regional level. The territories of Central and Volga economic regions belong to this type.

• Type II is characterized by a strong impact of global and national levels and weak impact of regional and industrial levels. These are the territories of Central-Black soil regions and West Siberian economic regions.

• Type III is strongly affected by the factors of national level and weakly influenced by global, regional and industrial factors. The territories of the Volga-Vyatka, Northern, Northwestern and Far Eastern economic regions belong to this type.

• Type IV has a strong impact of global and industrial levels and weak national and regional. The Northern Caucasian region belongs to it.

• Type V is characterized by a strong influence of global, regional and industrial levels and a weak impact of national level. This type is represented by the Ural economic region.

• Type VI is strongly affected by factors of global, national and regional levels and weakly by industry level. The East Siberian region is a representative of this type.

The differences identified in the nature of the environmental impact on agricultural production may serve the purpose of creating models of agricultural management mechanisms, taking into account the regional characteristics reflected by the study of the impact extent and trends in the real direction of this impact.

CONCLUSION

The multi-level approach to the study is characterized by the use of hierarchy in assessing the influence of the external environment. This approach is productively complemented by the study of another type of relationship – coordinating one, located in the same range of components corresponding to each hierarchical level. Producers operating in the agricultural economy are arranged in coordination. In Russia, it is advisable to consider them in three types: agricultural organizations, peasant farms, and households of the population. In relation to each other, they are arranged in coordination – without hierarchical subordination. Other factor elements of the external for agricultural production environment – economic, social, political, legal, technological, natural, environmental, information – are also in coordination towards each.

The result of finding the best combination of the two – hierarchical and coordination approaches in the study, allows determining the appropriate details of the study (e.g. the size of the selected taxa), the necessary degree of differentiation of the parameters studied and, in our opinion, can serve for developing both the science itself in its theoretical and methodical components, and be useful in justifying the proposals in management practice.

To evidence the effectiveness of this combination is the goal of the future study, which follows after the presented study, and that reflects the hierarchy of multi-layering and positions the importance of studying the coordinating groups of both factor elements and those involved in the material production of agricultural industries.

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