Methodology for assessing the development potential of the AIC of the Federal District

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Abstract. The article presents the methodological foundations of AIC functioning, formation of its potential as an element of strategic space planning. The purpose of the study is to create a methodology that allows us to assess the level of AIC development potential of a federal district, a territorial entity consisting of regions, subjects of the Federation. The potential of the federal district is considered as an aggregate value, which is based on the potentials of its components - the potentials of the regions, set in the form of values resulting from the integration of the elements of the potential, reflecting the current state of AIC in the field of: harvesting and processing of products, investment in fixed capital of AIC, expenditures on scientific research.

The algorithm of the methodology implies the calculation of indicators: reflecting the comparison of the rate of transformation of the value of gross output and the rate of change in its physical volume; comparing the rate of change in the amount of investment in the results of applied scientific activity with the rate of change in the value of investment in R&D, which determines the relevance of further investment activity in view of the achieved level of demand for the results of scientific activity. The methodology is intended for researchers whose research is related to solving the problems of regulation of socio-economic development at the local level, at the level of the subject of the Federation and at the macro level for making managerial decisions. The results of the research will serve as methodological tools for assessing the achieved level of development of local territories of the federal district, forecasting the values of components and the level of development of AIC, based on the planned values of indicators of economic development of the territory.

1 Introduction

AIC is a priority area of research of agricultural scientists. The works describing the strategies for the development of effective models for improving the AIC structure, methods for assessing the potential of AIC development, the role and level of activity of the state in AIC management are relevant. Of particular interest are the works devoted to the study of methods for assessing the AIC development potential from the point of view of considering them as a component of strategic space planning and sustainable development of rural areas. Resources act as a material basis for the capabilities of economic growth.
The potential of AIC development is revealed in the provision of conditions for AIC functioning, means of achieving goals. The system approach is necessary to assess the maximum level of AIC capabilities using unified approaches to analyze the components of the system [3]. Strategic planning in the classical sense is a prerequisite for long-term management, in the long term associated with increasing economic benefits (minimizing losses) as a result of activity and formation of advantages for economic entities of AIC in the processing of agricultural products [4-6]. Capacity building produces the degree of activation of the best (optimal) factors of stable economic growth, development of means of production [7]. Traditionally, there is a concept that the potential can be increased by two opposite technologies: intensive through the introduction of R&D results and extensive through the physical increase in the presence of resources. The first technology requires one-time capital investment. Maintaining a high level of AIC modernization will require periodic investment. The potential of AIC, which is a guarantee of its efficiency, can be expressed as an integral value of implemented modern technologies [8]. Introduction of innovations in AIC, especially in the field of administration, in particular, control, is a guarantee of high performance. Creation of R&D products in AIC is a financially costly process, but its payback can be realized at a rapid pace due to the reduction of resource consumption in the future, obtaining products in greater volume and higher quality. Therefore, we should not underestimate the role of such an improvement tool as innovation, which directly affects the level of efficiency, ensuring the viability of the system [9-11]. Constructive and consistent policy of the state, which is the main "administrator" in the field of AIC, investing funds from the federal budget in fixed assets within the framework of state programs, is aimed, in part, at attracting private investment to multiply the potential of this sphere in achieving high results [12]. Personnel support is one of the main factors in the development of AIC potential and implies the availability of highly qualified specialists in the agricultural sector as a prerequisite for sustainable development of rural areas [13-14]. The modern level of requirements to an employee in the field of AIC, in addition to the availability of quality professional education, also puts forward the request for knowledge in the field of digital economy, the key to ensuring the prospects of improving the efficiency of agriculture [15-19].

2 Materials and Methods
The current state of AIC in the field includes the collection of products and their processing, investments in fixed capital, and expenditures on scientific research. Components of the AIC potential are formed from indicators of agricultural activity (numerical material for their analysis is presented in sources [24-25]).

1. Industrial (P):

   1.1. Production, thousand tons (N), including crop production (N_r) and animal husbandry (N_z), and by product type (N_r_j, N_z_j);

   1.2. Production, mln rub. (G), including crop production (G_r) and animal husbandry (G_z);

2. Industrial (M):

   2.1. Processed products, thousand tons (H), including crop production (H_r) and animal husbandry (H_z), and by product type (H_r_j, H_z_j);

   2.2. Processed products, mln rub. (C), including crop production (C_r) and animal husbandry (C_z);

3. Investment (I):

   3.1. Cash investments, mln. rub. (I);

4. Innovative (S):

   4.1. Research and development, mln. rub. (S). By means of index analysis, the initial (absolute) values according to the geometric mean formula are converted into relative values, in the coefficient form. Determination of component index values and the level of the model depends on the initial indicators:

   - N and H: product type - industry - indicator - component;
   - G and C: industry - indicator - component;
   - I and S: indicator - component.

First, the indices of all types of products of indicator industries (N and H) are determined; then indices of indicator industries (N, H, G, and C); then indices of indicators (N, H, G, C, I, and S); the next stage - calculation of component indices (P, M, I, and S). The algorithm is completed by integrating the previously obtained components - calculation of the region's AIC development potential (D):

\[ D = i_P \times i_M \times i_I \times i_S \]

where:

- \( i_P \) – production component index (P);
- \( i_M \) – industrial component index (M);
- \( i_I \) – investment component index (I);
- \( i_S \) – innovation component index (S).

Methodological settings of isolating the levels of the region's AIC development potential (D) are proposed as follows: [1.00; 1.25) - low; [1.25; 1.50) - moderate; [1.50; 2.00) - medium; [2.00; 2.50) - high; [2.50; 3.00] - sustainable. In the process of identifying the AIC development potentials of each region within the federal district, an index can be used. For example, the AIC development potential of region No. 1 will be labeled as \( D_1 \), the AIC development potential of region No. 2 will be labeled as \( D_2 \), etc. Each region within the federal district, despite the general properties inherent in a certain geographical space, also has specific characteristics, which, in the author's opinion, are the most important in the field of AIC, such as, for example, the number of rural population and the standard of living of the rural population, determined by the amount of average per capita cash income of the population engaged in agriculture.
calculating the AIC development potential of the federal district (F), it is necessary to adjust the previously calculated AIC development potentials of the regions (D_i) by the coefficients Q_i and Y_i:

\[ F = \sum_{i=1}^{n} F_i = \sum_{i=1}^{n} D_i \cdot Q_i \cdot Y_i \]

Here:
- \( F_i \) – local component of the AIC development potential of the federal district;
- \( i \) – ordinal number of the region within the federal district, \( i \in (1, \ldots, n) \);
- \( Q_i \) – share of rural population of \( i \)-th region in the structure of rural population of the federal district, coeff.
- \( Y_i \) – ratio of the average per capita cash income of the population employed in agriculture in \( i \)-th region to the average per capita cash income of the population employed in agriculture in the federal district, coeff.

The indicators of the AIC development potential of the region include \( V \) and \( W \), reflecting the comparison of the rate of transformation of the value of gross output and the rate of change in its physical volume:

\[ V = \frac{i_N}{i_G}; \quad W = \frac{i_H}{i_C} \]

Possible groups of values are:
- \( V, W < 1 \);
- \( V, W = 1 \) and \( V, W > 1 \), obtained by comparing the rate of transformation of the physical volume of production and the rate of change in the monetary value of production.

In the process of identifying indicators (coefficients \( V \) and \( W \)) of the AIC development potentials of each region within the federal district, an index can be used. Thus, for region No. 1 the coefficients \( V \) and \( W \) will be denoted as \( V_1 \) and \( W_1 \), for region No. 2 the coefficients \( V \) and \( W \) will be denoted as \( V_2 \) and \( W_2 \), etc.

The following criteria should be used to differentiate (group) regions within a federal district according to the values of the \( V \) and \( W \) coefficients:
- \( V_i, W_i < 1 \);
- \( V_i, W_i = 1 \) and \( V_i, W_i > 1 \).

Among the coefficients comparing the rate of change in the amount of investment in the results of applied scientific activity with the rate of change in the amount of R&D investment is the coefficient \( A \):

\[ A = \frac{i_S}{i} \]

Possible groups of values are:
- \( A < 1 \);
- \( A = 1 \); \( A > 1 \), they reflect the degree of relevance of further investment activity due to the achieved level of demand for the results of scientific activity.

In the process of identifying the coefficients \( A \) of the AIC development potentials of each region within the federal district, an index can be used. Thus, for region No. 1 the coefficient \( A \) will be labeled as \( A_1 \), for region No. 2 the coefficient \( A \) will be denoted as \( A_2 \), etc.

The following criteria should be used for differentiation (grouping) of regions within a federal district according to the coefficient \( A \) values:
- \( A_i < 1 \);
- \( A_i = 1 \); \( A_i > 1 \).

3 Result and discussion
Table 1. Calculation of the region's AIC development potential.

<table>
<thead>
<tr>
<th>Type of manufactured products of industries</th>
<th>$N_rij$, $N_zij$</th>
<th>$G_r$, $G_z$</th>
<th>Type of processed products by industries</th>
<th>$H_rij$, $H_zij$</th>
<th>$C_r$, $C_z$</th>
<th>$I$</th>
<th>$S$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop production</td>
<td>$N_r$</td>
<td></td>
<td>Crop production</td>
<td>$H_r$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grain</td>
<td>$N_{r1}$</td>
<td></td>
<td>flour</td>
<td>$H_{r1}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>potatoes</td>
<td>$N_{r2}$</td>
<td></td>
<td>grits</td>
<td>$H_{r2}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vegetables</td>
<td>$N_{r3}$</td>
<td>$G_r$</td>
<td>bread and bakery</td>
<td>$H_{r3}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sugar beet</td>
<td>$N_{r3}$</td>
<td></td>
<td>sugar</td>
<td>$H_{r1}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fruits and berries</td>
<td>$N_{r4}$</td>
<td></td>
<td>meat</td>
<td>$H_z$</td>
<td>$I$</td>
<td>$S$</td>
<td></td>
</tr>
<tr>
<td>sunflower seeds</td>
<td>$N_{r5}$</td>
<td></td>
<td>meat by-products</td>
<td>$H_z$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>longan flax</td>
<td>$N_{r6}$</td>
<td></td>
<td>sausage products</td>
<td>$H_z$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock</td>
<td>$N_z$</td>
<td></td>
<td>fish</td>
<td>$H_z$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock and poultry</td>
<td>$N_{z1}$</td>
<td>$G_z$</td>
<td>vegetable oils</td>
<td>$H_z$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>milk</td>
<td>$N_{z2}$</td>
<td></td>
<td>milk</td>
<td>$H_z$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eggs</td>
<td>$N_{z3}$</td>
<td></td>
<td>butter</td>
<td>$H_z$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>wool</td>
<td>$N_{z4}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>honey</td>
<td>$N_{z5}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Indicator indices $N_r$, $G_z$ — $H_z$, $C_z$, $I$, $S$

Component indices $P$, $M$ — $F$

AIC development potential $D = i_p * i_M * i_I * i_S$

Table 2. Calculation of the AIC development potential of the Federal District.

<table>
<thead>
<tr>
<th>Federal District Region</th>
<th>$D_i$</th>
<th>$Q_i$</th>
<th>$Y_i$</th>
<th>$F_i$</th>
<th>$F$ = $\sum_{i=1}^n F_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region no. 1</td>
<td>$D_1$</td>
<td>$Q_1$</td>
<td>$Y_1$</td>
<td>$F_1 = D_1 * Q_1 * Y_1$</td>
<td>$F_1$</td>
</tr>
<tr>
<td>Region no. 2</td>
<td>$D_2$</td>
<td>$Q_2$</td>
<td>$Y_2$</td>
<td>$F_2 = D_2 * Q_2 * Y_2$</td>
<td>$F_2$</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Region no. $i$</td>
<td>$D_i$</td>
<td>$Q_i$</td>
<td>$Y_i$</td>
<td>$F_i = D_i * Q_i * Y_i$</td>
<td>$F_i$</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>Region no. $n$</td>
<td>$D_n$</td>
<td>$Q_n$</td>
<td>$Y_n$</td>
<td>$F_n = D_n * Q_n * Y_n$</td>
<td>$F_n$</td>
</tr>
<tr>
<td>Sum of values</td>
<td></td>
<td></td>
<td></td>
<td>$F = \sum_{i=1}^n F_i$</td>
<td>$F$</td>
</tr>
</tbody>
</table>
4 Conclusions

The review of studies in the field of AIC development potential allowed us to identify the methodological basis for the functioning of AIC, the formation of its potential as an element of strategic space planning. In the course of the study, a methodology was created to quantitatively assess the level of AIC development potential of a federal district—a territorial entity consisting of regions—subjects of the Federation. The potential of the federal district is presented as an aggregate value consisting of the potentials of the regions in the form of values resulting from the integration of the elements of the potential, reflecting the current state of AIC in the following areas: harvesting of products and their processing, investments in the fixed capital of AIC, expenditures on scientific research. The algorithm of the methodology implies the calculation of indicators: reflecting the comparison of the rate of transformation of the value of gross output and the rate of change in its physical volume; comparing the rate of change in the amount of investment in the results of applied scientific activity with the rate of change in the value of investment in R&D, which determines the relevance of further investment activity in view of the achieved level of demand for the results of scientific activity. The methodology is intended for researchers whose research is related to solving the problems of regulation of socio-economic development at the local level, at the level of the subject of the Federation and at the macro level for making managerial decisions. The results of the research will serve as methodological tools for assessing the achieved level of development of local territories of the federal district, forecasting the values of components and the level of AIC development, based on the planned values of indicators of economic development of the territory.

References


