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Elements of the new industrialization in the regional industrial complex

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***Abstract*—In the era of new industrialization in the Russian Federation, there is a need for accelerated development of enterprises of a regional industrial complex. Within the frame of this work, the authors set a target to measure the process of the influence of information technologies, as an element of the new industrialization, on production processes in the regions of the Russian Federation by building a correlation model.**
A hypothesis was put forward to show the dependence of industrial production in the region on the level of development of information technology. The study is based on economic and mathematical modeling of empirical spatial data for regions of the Russian Federation.
The study made it possible to determine the nature of the influence of information technologies on production processes in the regions of the Russian Federation, to propose using a correlation model with high quality to describe this effect, and also to prove that enterprises of a regional industrial complex have significant reserves for development in the era of new industrialization.

Keywords—new industrialization; information technology; correlation model.

I. INTRODUCTION

The use of information technologies in the development of a regional industrial complex today is an integral part of the process of new industrialization, which requires an increase in the level of justification of the solutions being developed through, inter alia, the circulation and storage of information. Certain information technologies ensure the decisions made, directed at the effective management of the regional industry and its development, and allow improving the system of managing industries as single complexes. Accelerated development of modern industry imposes increased requirements to work with information, applying new technologies that help the region gain new competitive advantages.

Thus, due to the well-established information exchange system in the industrial complex, productivity growth in industries is ensured, non-production losses are reduced, etc. In addition, information technologies in the region are aimed at the development and improvement of the interaction of enterprises and industrial complex organizations and authorities. Thus, information technologies are a tool for implementing the region's industrial strategy, which plays an important role in solving the problem of the availability and openness of information in the field of industrial production. In this context, the authors of the work tried to consider information technology as a factor determining the direction of development of the regional industrial complex.

II. LITERATURE REVIEW

The term modern information technology has become widespread since the early 90s of the twentieth century, which is associated with the emergence of more innovative information processing tools that have become available as a means of providing various spheres of human activity in modern society. First of all, information technologies include telecommunication networks and the Internet, related equipment, satellite communication, and software. Among their main characteristics are the following: the ability to machine information processing, storage and work with large data arrays, the transfer of information in short terms.

Consideration of the features of the use of information technology in the regional management was done by such researchers as I. B. Shevchuk [1], S. M. Egorov. [2], Zaitsev SM [3], which clarified the terminological context and classification of this concept. In turn, V.Pugachev [4] emphasized the need for the development of information technologies, including in the sphere of interaction of the region with enterprises and organizations in the production sphere.

As methods, the authors schose tools of economic and mathematical modeling, which are widely used to analyze individual production processes and allow quantitatively expressing various kinds of relationships between factors reflecting the level of development of information technologies and an indicator characterizing production volumes in the industry [5-6]. Similar measurements with reference to countries were carried out by Nosov V.V., Aznabayeva A.M. [7]. Pshenichnikova S.N., Romanyuk I.D. [8], Afanasyev A.A., Ponomareva O.S. [9], Antipov V.I. [ten]. Regional measurements can be seen in the studies of Sokol, GA, Adamadzieva, KR, Khalilova, MA [11] et al.

It is necessary to summarize that economic and mathematical methods can reasonably express the dependence of independent factors (in our case, the level of development of information technologies) and the resulting indicators (level of development of production). Such measurements [12-15], in turn, can be used in adjusting and strategizing the development of both individual enterprises and industries, industrial complexes in the region [16-18].

III. RESEARCH METHODOLOGY

The authors aimed to prove the direct relationship between the level of development of production in the region and the level of development of information technologies in the regions of the Russian Federation, which can provide the subject with additional competitive advantages in the era of new industrialization, and identify a number of problems that hinder the progressive industrialization of the regional industrial complex region as a whole. The specified dependence is calculated by the authors on the bases of creation of a correlation model, which is based on data of regions of the Russian Federation.

In addition, the authors set the task to detail the possible informational advantages of the regional industrial complex, as well as the problems arising on the example of certain subjects.

The object of the research is the entire set of industries and subsectors of Russian regions.

Guided by the general principles of statistical research, the level of development of production is an indicator reflecting the volume of production in the region. It should be noted that this indicator does not include such components as: non-market services, banking sector, foreign trade, export and import activities. As a factor affecting the level of production in this work is the level of development of information technology. Thus, information technologies include: costs of technologies using microelectronics and technical means for organizing the circulation and storage of information.

The number of factors was chosen in accordance with the recommendations of A. G. Granberg, which simplifies the necessary calculations and economic interpretation of the results obtained. Thus, the level of development of information technologies acts as a key factor, and the level of production development is the resulting indicator. Selection of datahas spatialcharacter and includes data of all territorial subjects of the Russian Federation.

The study included several stages: collecting and processing of basic statistical data; forming a set of data by regions and industries of the Russian Federation, linearization of data obtained at the primary stages, which characterize independent factors and the resulting indicator for the samples, building a correlation model using the least squares method, considering theoretical and practical results arising from the analysis of the developed production functions and capabilities using them, checking the developed functions for autocorrelation, functions using correlation coefficients, the coefficient of determination and the Fisher criterion. The chosen method makes it possible to define quantitavely the characteristics of the development of a regional industrial complex depending on specific factors, and at the same time it makes it possible to prove the need of forecasting the development of individual industries in dynamics [19-22].

IV. EXPERIMENTAL RESULTS

Based on the analysis of the studied statistical data, the authors hypothesized that the relationship between all possible values of the independent factor (level of development of information technology) and the resulting indicator (level of production) is linear. As a result of calculations of regression parameters, the authors obtained a regression equation:

y = 7.7705 x + 232486.6, and reflecting the relationship between the level of development of information technologies and the level of production in the region. Further calculations of selective linear coefficient were made.

$$\tau_{xy} = \frac{\bar{x}\bar{y} - \bar{x}\,\bar{y}}{S(x) \cdot S(y)} = \frac{822568981,254 - 9144,05 \cdot 80340,546}{7584,359 \cdot 80830,465} = 0,7 \quad (1)$$

As a result, it was concluded that there is a high and direct relationship between the independent factor and the resulting indicator.

In order to determine the proportion of the variation of the resultant trait by the variation of the factor trait, we calculate the coefficient of determination.

$$R^2 = 0.729^2 = 0.53 \quad (2)$$

those. in 53.2% of cases, a change in the level of development of information technologies leads to a change in the level of development of production. Furder the authors carried out the dispersive analysis in order to assess the quality of the model obtained (table 1).

TABLE I. DISPERSIVE ANALYSIS OF THE DEPENDENT VARIABLE

Source of variation	***Sum of square***	***Number of degrees of freedom***	***Dispersion value for 1 degree of freedom***	***F-value***
Model (explained)	48625569726,1	1	48625569726.1	13.6
Residual	42844326527.3	12	3570360543.9	1
Overall	91469896253.5	14-1		

Based on the data of Table 1, the authors calculated the quality indicators of the regression equation (Table 2).

TABLE II. QUALITATIVE INDICATORS OF THE REGRESSION EQUATION

As a result of the obtained calculations, it can be summarized that in the situation under study, 53.1% of the total variability of the regional level of production is explained by the change in the level of information technology. Calculations indicate the statistical significance of the model, that is, a change in the level of development of information technology by one conventional unit leads to an increase in the level of production by an average of 7.77 conventional units.

Next, we will conduct an analysis aimed at detecting autocorrelation.

Let’s calculate the autocorrelation coefficient and check its significance using the standard error criterion:

$$r_1 \approx \frac{\sum \varepsilon_t \varepsilon_{t-1}}{\sum \varepsilon_t^2} = \frac{\text{[illegible]}}{42844326527{,}343} \quad (3)$$

Using -0.58 <r1 = -0.38 <0.58, we conclude that the independence of the residuals is observed, and therefore there is no autocorrelation.

Let's make check of normality of component distribution of the remains. To do this, we have to calculate the RS-criterion:

$$RS = \frac{122285{,}009-(-76639{,}}{57408{,}339} \quad (4)$$

where εmax = 122285.0 (maximum value of remains), εmin = -76639.5 (minimum level of a number of remains). Thus, the calculated value of the RS-criterion is in the range from 2.7 to 3.7, which indicates the compliance with the property of the normal distribution.

V. CONCLUSIONS AND DISCUSSION OF THE RESULTS

The proposed correlation model is a tool for analyzing the development of a regional industrial complex in the context of new industrialization, and can also be used as a management tool that allows assessing the effectiveness of the use of investments in information technology, both in the region and in certain industries. The results of the analysis, have a scientific and practical application. They can be used in research and monitoring the development of branches of the regional industrial complex, determining resource requirements, necessary for the introduction of information technology, the development of sectoral and integrated projects and programs for the development of regional industry.

From the above analysis, it is obvious that the use of the development and implementation of information technology leads to an increase in the level of production. In this regard, there is a question of creation and improvement of the information environment in each of the regions.

The processes of development of information technology in the Russian regions are extremely uneven. Among the leaders in this direction it is possible to note Moscow, St. Petersburg, the Tomsk region, the Republic of Chuvashia and Tatarstan, etc. These regions actively introduce information technologies in industrial production, which is facilitated by the created portals providing interactive communication with enterprises and organizations.

Other regions are quite far behind in terms of the use of information technologies from the leading regions (for example, Vladimir, Ivanovo regions, etc.). As a rule, this is due to the low level of economic development of the region as a whole.

The process of information development at the regional level goes at a different rate. First of all, in most regions, measures are being taken to create a favorable environment for interaction between government bodies and enterprises. In addition, measures have been developed to create our own production of software products that are competitive with foreign analogs. In this regard, the issue of measuring the effectiveness of development in this area, as well as predicting the impact of measures taken in the form of growth of key performance indicators, which requires special economic and mathematical tools, becomes particularly relevant. The application of a correlation model can act as that.

In Russia in general, and in the regions, in particular, such a significant territorial diversity and peculiarity of interregional features create a big problem for the application of information technologies. These conditions cause a difference in the technical equipment of industries.

It is necessary to summarize that there is a significant informational imbalance, which is shown in horizontal and vertical sections. A horizontal cross-section causes a different level in the level of informatization of industries and enterprises, and a vertical one is a difference in the provision of information technologies to the management sphere (at the federal, regional and municipal levels). It creates additional barriers on the way of industrialization.

Thus, at this stage of the application of information technologies, it is possible to speak about the following problems: the low level of access of enterprises to the opportunities of technological equipment of the region; industrial inequality is an obstacle to the realization of the opportunities of information technology; inadequate legal and regulatory framework.

Most of the projects on the implementation of information technologies in the regions in various spheres of interaction between the state and enterprises are not implemented due to the insufficiency of the regulatory framework allowing to consider the emerging relations within the legal framework. Despite of this, information technologies as a factor of the industrial development of a regional industrial complex has a significant impact, which is direct and high.

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