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# An Industrial Region: Nature, Criteria, and Indicators

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**Abstract**

The purpose of the present article is to identify the industrial regions within Russia using different criteria (economic, but also social and ecological). In addition to this, a number of the indicators for regional development analysis are offered. An industrial production share in a gross regional product is accepted as a key criteria of selection a region as industrial.
Statistical selection is presented by the regions of Central Federal District of Russia. Finally, the interrelationship between an industrial production share in a gross regional product and the following indicators is analyzed: the income of the consolidated budget, the size of the average per capita income of the population, and the expected average life expectancy of the population.


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*Keywords:* industrial production, industrial region, development of the industrial region, sustainable development of the region.

## 1. Introduction

The present subject is important because of the necessity to outline a new strategy of economic growth and regional sustainable development in the Russian Federation. Discussions about ways of economic growth achievement are carried out in modern Russian economic science and it is possible to say that one of the serious research directions is a reindustrialization concept. Reindustrialization usually is understood as industrialization based on the latest technological advancements. The prospective purpose of a reindustrializtion is the transition to modern technological ways. So a question of main purposes and mechanisms and the industrial policy's objects (including meso-level) determination becomes sharply important. For the decision of this task, in our opinion, it is necessary to study the industrial regions' entity, the features and factors of their development, in order to reveal criteria and indicators for selection of industrial regions. Similar research is necessary when planning industrial

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regional policy. Besides, the research of industrial regions, specifics of their development, and also problems that these regions face, is necessary for outlining their sustainable development from the ecological point of view. Environmental problems are most seriously expressed in industrial regions. So it is necessary to consider the ecological limitations while planning an industrial policy in these regions.

The main approaches to defining the term "industrial region" are considered in this work. It is important to define this term, because Russia is a predominately industrial country and industrial policy is significant here. Despite numerous analyses in the field of regional economy, this term still has no accurate definition. In the 1970s, the concept "old industrial region" has entered a scientific use. This type of region is distinguished from problem regions, which are characterized by serious technological lag despite the available resources and personnel potential. As a rule, these regions are defined as depressive because they show lower growth indicators in comparison with averages around the country. The concept of the industrial region is used in many classifications; however, an accurate definition of this term in Russian regional economics is absent.

Gilmanova R. I. (2011) defines an industrial region as the administrative subject of the Russian Federation, where a share of gross value added by the industry to a gross regional product is not less than 33%. However, in our opinion, one criterion for definition of an industrial region is not enough, and the author does not prove the suggested level of a share of industrial production of 33% in any way. While using a share of production of industrial output in GRP as a criterion for defining an industrial region, it is necessary to understand what belongs to industry today. According to the federal law number 488 from 31.12.2014, "About industrial policy in Russian Federation" industry is understood as "the set of the types of economic activity relating to mining, the processing production, ensuring with electric energy, gas and steam, air conditioning, water supply, water disposal, the organization of collecting and recycling, and also elimination of pollution defined on the basis of the All-Russian Classifier of Economic Activities".

M. K. Kumaneeva (2014) uses the concept "regions of industrial type" in research of regional sustainable development problems, but without giving an accurate definition to this concept. This author gives the main signs of the industrial region: a large resource base (and as a result – high resource intensity of economy); weakness of agrarian sector (less than 10% in GRP); use of traditional technologies and low innovation of regional economy. These factors are combined with high ecological tension, the prevalence of urban population and more. However, in our opinion, these signs are not exhaustive, on the one hand, on the other hand if to speak about separate branches in certain regions, they can be rather hi-tech. Also the author does not provide a metric to estimate the level of ecological tension in industrial regions, despite the problem of ecologically sustainable development of industrial regions, in our opinion, being particularly important today. This problem has complex and cross-disciplinary considerations as stability can be understood in physical, economic, ecological, geopolitical and other meanings. O. L. Kuznetsov, P. G. Kuznetsov, B.E Bolshakov, R. A. Flight, A. L. Novoselov, I. B. Genkut, L. L. Kamenik, etc. deal with problems of ecologically sustainable development in domestic science. The questions connected with sustainable development of regions, clustering, and the competition between regions of the Ural Federal District (industrial regions) are deeply investigated in A. I. Tatarkin, Yu. G. Lavrikova, O. A. Romanova's works, etc.

A.I. Tatarkin and S. V. Doroshenko (2011) suggest considering the region as a spontaneous system. They understand self-development as the "ability of the region to provide expanded gross regional product reproduction based on available potential of own resource opportunities and profitable sources in interests of realization both the macroeconomic purposes and national priorities, and regional purposes in the conditions of its environment". Thus, for sustainable development, the region needs to provide not only an increase in GRP using internal sources, but it also needs to develop necessary regional institutions. In international literature devoted to regional development, today the dominant theory is the cluster theory (Wolman H., Hincapie D., 2015). The cluster theory suggests firms that are part of clusters acquire additional competitive advantages, which has a positive effect on economic growth and business activity in the region. C. S. Fowler and R. G. Kleit (2014) justify the influence of industrial regional clusters on lowering poverty in regions, showing the main regularities of this process.

In Peter Nijikamp's papers (2016) such concept as the "resource" region within the analysis of new strategy of regional growth is researched. Indicating the need of integrating regional policy, this author posits a concept of the resource region, which outlines a set of opportunities and conditions necessary for development. The combination and optimization of the present possibilities becomes the main task of regional policy.

Also in some studies, attention to problems of old industrial regions development abroad is examined. For example, Lars Coenen, Jerker Moodysson and Hanna Martin (2015) research opportunities and restrictions of innovative regional policy, including the capacity, barriers, and restrictions of development in old industrial regions. They conduct this study using the regions of Northern Sweden occupied with forestry as an example. Birch, K., MacKinnon, D., Cumbers, A. (2010) and Hassink, R. (2005) also explored the problem of old industrial regions' development. Henderson, S. R. (2015) studies the ways of transforming old industrial regions in England.

## 2. Methodology and data

There is a set of techniques to analyze the industrial region and to estimate the level of its development. In particular, A. I. Tatarkin and D. A. Tatarkin (2009) suggest using three criteria for an assessment of the region's ability for self-development:

- excess of average value across the Russian Federation of a GRP gain during the long term;
- the profitable sources capability of GRP growth;
- positive balance of trade and financial (payment) balance of the region.

However, these criteria, in our opinion, are insufficient as they don't consider two major spheres in regional development: ecological and social, Further, they are focused only on measurement of the productive and economic sphere of regional development.

A.I. Tatarkin and G. A. Gershanyuk (2006) have developed a technique of sustainable development assessment based on measurements of social, economic, and ecological capacity of territories. In their opinion, an excess of capacity leads to an unstable condition in regions. The authors conclusion suggests that capacity means not only limits of physical and chemical environmental opportunities whose exhaustion caused by economic activity leads to undesirable changes (expressed as a shift of ecological equilibrium), but also capacity is a regional environment's ability to support functions of the population as its central biotic essence.

The authors' approach to the analysis of regional ecological capacity is particularly interesting. Ecological capacity is understood as the ability of a territorial ecosystem to produce $O_2$ and to absorb $CO_2$ formed as a result of economic activity. The size of economic capacity is defined by the following ecological and economic characteristics of the territory: 1) area of the deciduous woods; 2) area of coniferous forests; 3) other forest area; 4) area of agricultural grounds; 5) area of a surface of the water; 6) other non-forested areas. The woods (among them – coniferous) have the greatest assimilatory ability, the other non-forested areas possess the smallest. The relation of actual consumed energy in the region in unit of time to the level of economic capacity of a regional ecosystem is defined in order to assess the regional ecological stability condition only after quantifying all indicators. In the event that the final indicator is less than the unit, economic activity in the region does not result in violation of its natural ecosystems, therefore, the ecological condition of the region can be considered steady. If the indicator is more than the unit, the natural system of the region is in an unstable state. The average world value of this indicator $\approx 10$. Therefore, as a first approximation for the territorial ecological system it is possible to consider that excess of this value will demonstrate influence decreasing universal stability in an ecological sense.

There is a large number of classifications of the regions and researchers use various criteria for identification of various types of regions. The purpose of this work is not the full review of the available classifications, rather the description of some attempts at identification of industrial regions. For example, in L. M. Grigoriev, Yu.V.Urozhayeva and D. S. Ivanov's (2016) several synthetic classification criteria are used: economic, social, and institutional. The authors used primary indicators to group the regions: population, GRP, output, the volume of investment, volume of foreign investments, number of students, a share of urban population, dependence on subsidies of the consolidated regional budget, and also stage of technological development (agrarian, industrial or post-industrial).

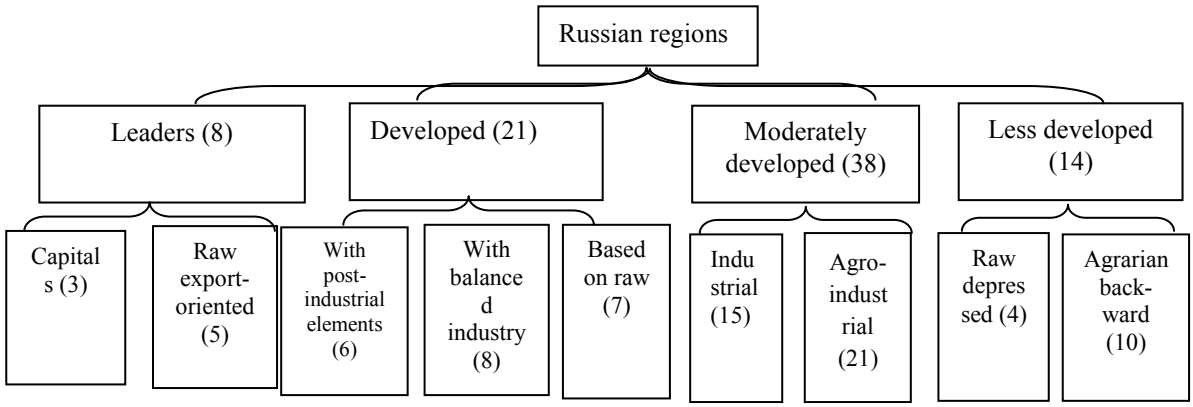



Fig. 1. Synthetic classification of regions

Source: Grigoriev, L.M., Urogaeva, U.V., & Ivanov, D. S. (2016). Synthetic regional classification: a basis of regional policy. URL: http://pandia.ru/text/78/153/24957.php. Accessed 05.05.2017.

Despite all advantages of this classification, it should be noted that it ignores the important criteria of regional development – ecological state.

Table 1. Indicators of industrial development of the region

| Industrial and economic sphere | Social sphere | Ecological sphere |
|---|---|---|
| Industrial production output | An average salary in the region | Volume of atmosphere pollution |
| A share of industrial production in GRP | A level of unemployment | Volume of soil pollution |
| Growth rate of industrial production | A level of main products consumption | Volume of water pollution |
| Resource intensity | A level of social infrastructure capacity | Ecological capacity |
| A share of able-bodied population working in industries | | |
| Concentration and localization coefficients of main industries | | |
| The level of budget capacity | | |
| A share of industrial production import | | |
| Labor productivity | | |
| Population density | | |

The theoretical and methodological basis of our research is the problem of the industrial region's analysis and also a problem of an assessment of its development level, including the ecological indicators. The research is based on the statistical reports submitted by official state statistics departments, in particular the section of the collection with indicators across Central Federal District.

As methodical tools, general scientific methods of economic science, including methods of the graphic and comparative analysis, synthesis, inductive, and deductive systems approach have been applied.

## 3. Results

Industrial production has a key significance for the Russian economy in general and for the economy of any region. Therefore there is an important question about the positive consequences of industrial development of

regions, and about their ability to "block" negative things caused by industries. If to consider that subjects of any region are producers and consumers (the population), then it is important to estimate the effect of industrial production and its influence on the population of the region where this production is located. As a result, we can explore, first, the financial effect that is expressed in growth of monetary income of the population and, secondly, the social effect, expressed in increased life expectancy. On the other hand, industrial production has to also have a budgetary effect, so is it is necessary to estimate fiscal return for the third subject – the states represented by municipality.

The information this research is based on was furnished by the statistical reports submitted by official bodies of state statistics. In particular, our research is devoted to the analysis of Central Federal District of Russia.

We analyze correlation between a share of industrial production in a gross regional product (Y, %) and the following indicators: the average per capita income of the population ($X_1$, rub per month), the income of the consolidated budget of the area ($X_2$, million rubles) and life expectancy ($X_3$, the number of years) in presented research. The Central Federal District of Russia includes 17 regions and 1 federal city – Moscow. We used specified indicators from 2005 for 2015 for our research. Coefficient of correlation has been calculated for each of the 18 subjects. Results of the correlation analysis are given in Table 2. We use correlation analysis on the first step of our research but further we would use different other types of analysis.

Table 2. Results of the correlation analysis

| № | The Region | Coefficient of Correlation | | |
|---|---|---|---|---|
| | | Y, $X_1$ | Y, $X_2$ | Y, $X_3$ |
| 1 | Belgorod region | -0.92 | -0.85 | -0.88 |
| 2 | Bryansk region | -0.34 | -0.49 | -0.54 |
| 3 | Vladimir region | 0.10 | -0.18 | -0.13 |
| 4 | Voronezh region | -0.87 | -0.95 | -0.94 |
| 5 | Ivanovo region | -0.86 | -0.75 | -0.82 |
| 6 | Kaluga region | 0.63 | 0.79 | 0.79 |
| 7 | Kostroma region | -0.10 | -0.03 | -0.04 |
| 8 | Kursk region | -0.90 | -0.78 | -0.78 |
| 9 | Lipetsk region | -0.67 | -0.70 | -0.50 |
| 10 | Moscow region | -0.96 | -0.96 | -0.95 |
| 11 | Oryol region | -0.92 | -0.97 | -0.96 |
| 12 | Ryazan region | -0.49 | -0.35 | -0.45 |
| 13 | Smolensk region | -0.94 | -0.96 | -0.97 |
| 14 | Tambov region | -0.48 | -0.29 | -0.26 |
| 15 | Tver region | -0.06 | -0.02 | 0.01 |
| 16 | Tula region | -0.76 | -0.75 | -0.70 |
| 17 | Yaroslavl region | -0.95 | -0.97 | -0.95 |
| 18 | Moscow | 0.13 | 0.21 | 0.13 |

Source: Calculated on the basis of indicators of the State committee of statistics (http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1138623506156)

The results allow us to make a conclusion on the ambiguity of correlation between the studied indicators. In a number of regions, correlation is absent: Vladimir, Kostroma, the Tver regions and Moscow. In a number of regions correlation is very close, even sometimes close to linear. These are the Belgorod, Voronezh, Ivanovo, Kursk, Moscow, Oryol, Smolensk, Tula and the Yaroslavl regions. In other areas the question remains open – whether there is a relation between specified indicators. On the one hand, it is impossible to tell that it is, but on the other hand, it is also incorrect to deny its existence. Nevertheless, the number of areas where significant relation is observed

exceeds the number of those areas where relation is weak or is absent at all. This observation is interesting: first, if relation is observed, then it is between all three pairs of indicators at once, and secondly, in the majority cases the relation is an indirect one. The Kaluga region is the only exception where a direct relation is observed.

It is possible to draw three conclusions proceeding from this analysis: 1. As the share of an industrial product in a gross regional product is higher, the income of the population is lower. 2. As the share of an industrial product in a gross regional product is higher, the income of the local budget is lower. 3. As the share of an industrial product in a gross regional product is higher, the life expectancy is lower.

The first statement allows establishing a negative fact: regions with the high share of industrial production are not the "richest" from the point of view of social effect . In other words, production "distortion" in favor of industry does not lead to growth of the population welfare, does not generate growth of the average incomes, and even, to the contrary, reduces those factors.

It is impossible to call the second statement positive also. It says that the structure of a gross product with a prevalence in the industrial part does not lead to positive fiscal effect. The income of the area is not formed from payments from the industrial enterprises placed in the region.

Finally, the third statement speaks for itself. The ecological effect that is expressed in the lack of obvious growth in population life expectancy indicates negative impact of industrial production of regions.

Let's make a hypothesis: "the share of industrial production in the region is higher, the relation between this share and the studied indicators is closer". For this purpose we analyzed the share of industrial production in a gross regional product for each of the 18 regions. The results of the calculations are presented in Table 3.

Table 3. Share of industrial production in a gross regional product of the region, %

| № | The Region | The Period | | | | | |
|---|---|---|---|---|---|---|---|
| | | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| 1 | Belgorod region | 104.37 | 99.32 | 96.97 | 93.03 | 93.94 | 95.11 |
| 2 | Bryansk region | 59.22 | 61.05 | 60.06 | 58.75 | 57.91 | 66.08 |
| 3 | Vladimir region | 94.95 | 95.83 | 96.18 | 99.36 | 106.67 | 110.4 |
| 4 | Voronezh region | 63.67 | 57.69 | 53.71 | 52.67 | 52.68 | 54.48 |
| 5 | Ivanovo region | 87.08 | 77.23 | 79.88 | 75.97 | 78.68 | 69.05 |
| 6 | Kaluga region | 157.02 | 158.81 | 153.82 | 153.70 | 147.12 | 138.67 |
| 7 | Kostroma region | 96.90 | 95.44 | 97.31 | 69.40 | 94.27 | 86.05 |
| 8 | Kursk region | 90.59 | 89.03 | 82.56 | 79.20 | 74.72 | 73.46 |
| 9 | Lipetsk region | 132.52 | 134.05 | 141.20 | 132.94 | 123.24 | 121.85 |
| 10 | Moscow region | 81.39 | 79.90 | 76.33 | 73.88 | 75.28 | 69.13 |
| 11 | Oryol region | 60.03 | 61.20 | 58.02 | 49.83 | 51.49 | 54.63 |
| 12 | Ryazan region | 89.55 | 85.64 | 82.30 | 82.36 | 79.96 | 81.82 |
| 13 | Smolensk region | 103.40 | 93.49 | 87.99 | 85.01 | 83.31 | 85.45 |
| 14 | Tambov region | 42.55 | 53.40 | 47.56 | 43.99 | 41.99 | 39.94 |
| 15 | Tver region | 84.25 | 81.20 | 88.60 | 88.43 | 88.30 | 78.81 |
| 16 | Tula region | 117.34 | 123.40 | 117.81 | 116.85 | 118.71 | 116.97 |
| 17 | Yaroslavl region | 79.80 | 77.97 | 76.85 | 74.95 | 73.31 | 74.66 |
| 18 | Moscow | 35.66 | 36.61 | 36.54 | 4.32 | 42.71 | 46.40 |

Source: Calculated on the basis of indicators of the State committee of statistics (http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1138623506156)

In several cases the share of an industrial product in a gross regional product exceeds 100%. This is explained by features of the calculation. We use the following formula (created by authors) for calculation of the indicator:

$$Y=(Z\_1+Z\_2+Z\_3)/GRP\times 100\%$$

where Y is the share of an industrial product in a gross regional product, %;

Z_1 is the quantity of the shipped goods of own production, mining, million rubles;

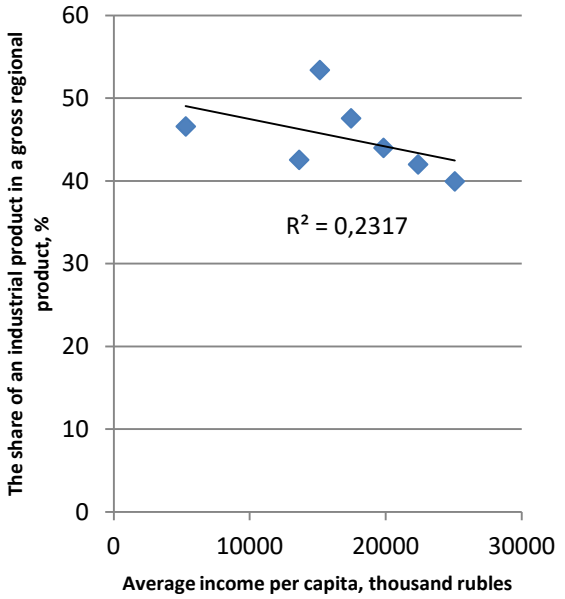
Z_2 is the quantity of the shipped goods of own production, the processing productions, million rubles;

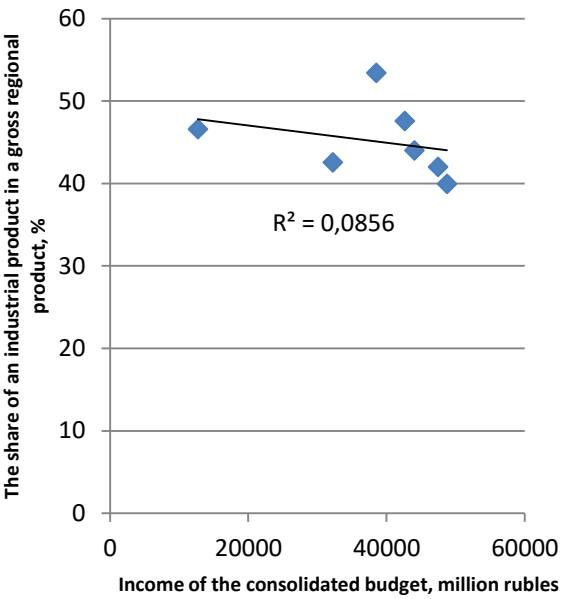
Z_3 is the quantity of the shipped goods of own production, the production and distribution of the electric power, gas and water, million rubles;

GRP is the gross regional product, million rubles.

In view of the fact that indicators form the numerator as a result of the shipped production, also the products made within the previous periods can get here. The denominator includes values of the product made strictly for the considered period.

On the one hand, the hypothesis formulated above is partially confirmed. And we can see it in the example of the Tambov region and the city of Moscow. The share of an industrial product in these regions for all considered periods is lower than 50%. In other words, these regions don't belong to industrial ones. And for these regions, the analysis shows the lack of the correlation between the indicators. On the other hand, there is no obvious direct dependence between the growing share and the growing values of coefficients correlation, too. The result of the correlation analysis for the Tambov region and the city of Moscow is presented in Figures 2-3.



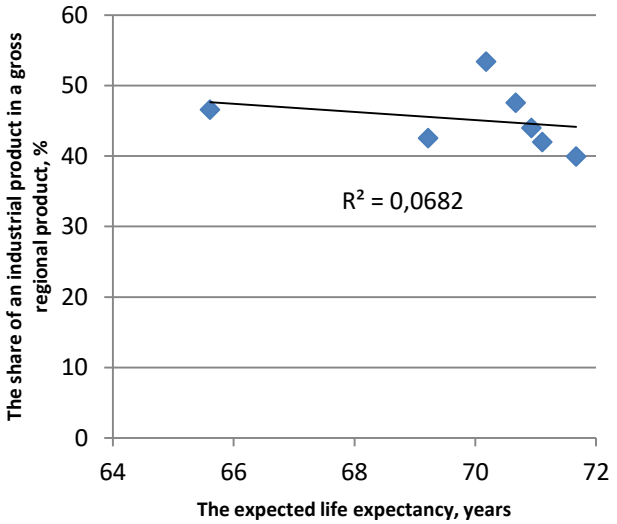
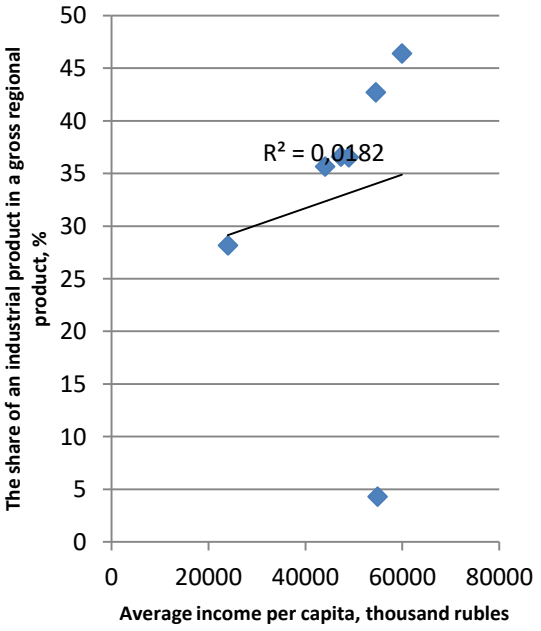
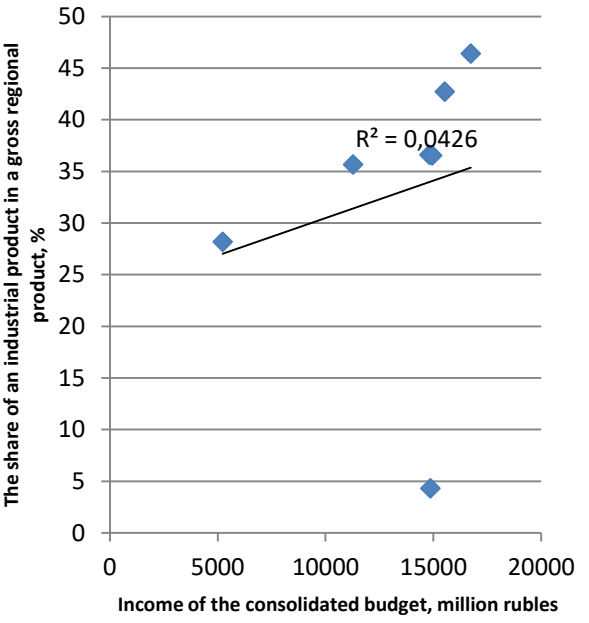



Fig. 2. Correlation between the mentioned indicators, Tambov region, 2015. Source: Calculated on the basis of indicators of the State committee of statistics (http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1138623506156)



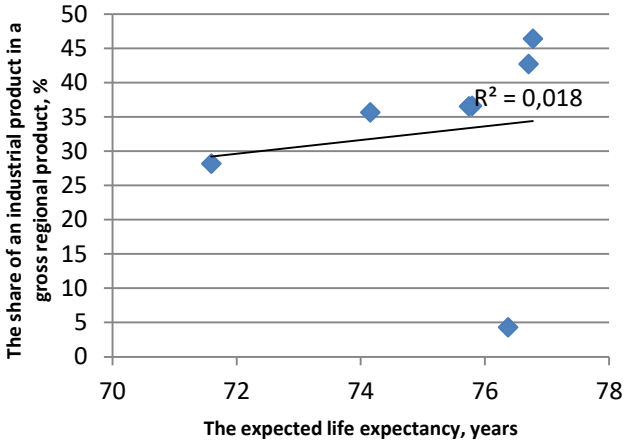



Fig. 3. Correlation between the mentioned indicators, Moscow, 2015. Source: Calculated on the basis of indicators of the State committee of statistics (http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1138623506156)

As for regions where the share of industrial output in a gross regional product exceeds 50%, there is no uniform tendency. In other words, the hypothesis formulated above is not confirmed.

For deeper analysis we calculate correlation coefficient on spatial selection. Now 18 regions will act as observations. Results of the correlation analysis on spatial selection are given in Table 4.

Table 4. Results of the correlation analysis

| № | The Period | Coefficient of Correlation | | |
|---|---|---|---|---|
| | | Y, $X_1$ | Y, $X_2$ | Y, $X_3$ |
| 1 | 2010 | -0.34 | -0.44 | -0.41 |
| 2 | 2011 | -0.33 | -0.42 | -0.37 |
| 3 | 2012 | -0.31 | -0.41 | -0.43 |
| 4 | 2013 | -0.46 | -0.55 | -0.54 |
| 5 | 2014 | -0.29 | -0.35 | -0.38 |
| 6 | 2015 | -0.29 | -0.34 | 0.88 |

Source: Calculated on the basis of indicators of the State committee of statistics (http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1138623506156)

Thus, we can see a slightly greater correlation between indicators of Y,$X_2$ and Y, $X_3$. Though the level of correlation can be called into question.

## 4. Conclusion

As a result of the research, we can declare the following. Firstly, there is a set of approaches to understanding the term “industrial region”. All of them have a distinctive character. Let’s consider that in order to be considered an industrial region, the share of industrial production in a gross regional product exceeds 50%. In this case the Central Federal District absolute majority of areas are industrial. Only the Tambov region and Moscow aren't industrial ones at the end of 2015.

Secondly, we called three effects from industrial production: financial, fiscal, and social (ecological) ones. The first one is expressed in change of the population’s income. The second one is expressed in replenishment of the local budget income. And the social (ecological) effect is expressed in change of life expectancy.

The analysis show that on the one hand, in a majority of regions, correlation between a share of industrial production in a gross regional product and the average income per capita, the income of the budget and life

expectancy is observed. Nevertheless, we cannot make a definite conclusion. The temporary selection indicates more close connection, than spatial selection. Our further studies will be devoted to the analysis of other Russian federal districts. After that we will be able to draw more definite conclusions regarding these observations and trends.

## References

Birch, K., MacKinnon, D., Cumbers, A., (2010). Old industrial regions in Europe: a comparative assessment of economic performance. Regional Studies, 44, 35–53.

Coenen, L., Moodysson, J., & Martin, H. (2015). Path, Renewal in Old Industrial Regions: Possibilities and limitations for Regional Innovation Policy. Regional studies. 49. Issue 5: Evolutionary Economic Geography: Theoretical and Empirical Progress.

Fowler, C. S., & Kleit, R. G. (2014). The effects of industrial clusters on the poverty rate. Economic Geography. 90(2). 129-154.

Gilmanova R. I. (2011). Republic Tatrstan as an industrial region. Management of economic systems: digital scientific journal. 32. P.9.

Grigoriev, L.M., Urogaeva, U.V., & Ivanov, D. S. (2016). Synthetic regional classification: a basis of regional policy. URL: http://pandia.ru/text/78/153/24957.php. Accessed 05.05.2017.

Hassink, R., 2005. The restructuring of old industrial areas in Europe and Asia. Environamental Planning A, 37, 571–580.

Henderson, S. R., 2015. Transforming old industrial regions: Constructing collaboration within the Black Country, England. Geoforum, 60, 95–106.

Kumaneeva, M. K. (2014). To question of assessment of sustainable development of industrial regions. Topical issues of modern society development. 2. 440-443.

Nijikamp, P. (2016). The «resourceful region» a new conceptualization of regional development strategies. Investigaciones Regionales. 36. 191-214.

Regions of Russia. Main indicators of subjects of Russian Federation. Statistic report. M.:Rosstat, 2016. 671 c.

Tatarkin, A. I., & Doroshenko S.V. (2011). Region as self-developing system: a transition through crisis. Economy of region. 1. 15-23.

Tatarkin, A. I., & Gershanok G.A. (2006). Methodology of assessment local territories sustainable development on basis of measuring its social-economic and ecological capacity. Bulletin of Novosibirsk state university. Social and economic sciences. 6 (1). 40-48.

Tatarkin, A. I., & Tatarkin, D. A. (2009). Self-developing territorial economic systems. Dialectics of forming and functioning. Economics. Taxes. Law. 5. 3-13.

Wolman, H., & Hincapie, D. (2015) Clusters and Cluster-based Development Policy. Economic development Quarterly. 29 (2). 135-149.