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Production potential development and quality of life of the population indicators modelling

Abstract. In this research the methods which allow developing indicators, reflecting the level of production potential and quality of life are investigated. The statistics presenting the level of production potential and quality of life are selected and grouped. By means of the factorial analysis indicator variables are allocated by groups. Regression dependences between the group indicators and indicators reflecting the level of production potential and quality of life are received. Normative levels of production potential and quality of life development are formed. The research has been realized on the example of the Central Federal District of Russia (17 regions) for 2009-2014.
Keywords: Potential; Production Potential; Region; Factorial Analysis; Quality of Life; Indicators; Regression; Normative Levels
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Моделювання індикаторів розвитку виробничого потенціалу та якості життя населення
Анотація. У статті досліджено методи, що дозволяють розробити індикатори, які відбивають рівень виробничого потенціалу та якість життя населення. Відібрано й згруповано статистичні показники, що відображають рівень виробничого потенціалу, а також якість життя. За допомогою факторного аналізу виділено індикативні змінні по групах. Отримано регресійні залежності між груповими індикаторами й показниками, що відбивають рівень виробничого потенціалу і якість життя. Сформовано нормативні рівні розвитку виробничого потенціалу та якості життя.
Ключові слова: потенціал; виробничий потенціал; регіон; факторний аналіз; якість життя; індикатори; регресія; нормативні рівні показників.

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Моделирование индикаторов развития производственного потенциала и качества жизни населения
Аннотация. Авторами исследованы методы, позволяющие разработать индикаторы, отражающие уровень производственного потенциала и качество жизни. Отобраны и сгруппированы статистические показатели, отражающие уровень производственного потенциала, а также качество жизни. С помощью факторного анализа выделены индикаторные переменные по группам. Получены регрессионные зависимости между групповыми индикаторами и показателями, отражающими уровень производственного потенциала и качество жизни. Сформированы нормативные уровни развития производственного потенциала и качества жизни.
Ключевые слова: потенциал; производственный потенциал; регион; факторный анализ; качество жизни; индикаторы; регрессия; нормативные уровни показателей.

1. Introduction. In regional economy a large number of economic entities are engaged in a production activity. Set of production potentials of economic entities gives the production potential of regional economy which level assessment is an important task in synergetic sense. Such assessment will allow us to understand its components, define the factors having impact on it and create system of indicators which will form an information base for the regional governing bodies in order to develop proposals and directions on efficiency of economy's development increase.

We understand that the level of development of production potential creates bases for increase of level of social and economic development as well as influences the level and quality of life of the population. However, combination of quantitative and qualitative techniques for assessment of influence of production potential level on a standard of living of the population and on quality of life, has practically not been created. In this regard, an attempt to approach the solution of this task seems interesting. This article is a continuation of the study on the production capacity and quality of life, the results of which were included in the dissertation defended by E. V. Tinkova

2. Statement of a problem. Many researches of social and economic development level of regions in a varying degree rely on identification of primary indicators included in further processing (classification, grouping and economic-mathematical modelling) for definition of the general dynamics and orientation of this development.

Often the level of social and economic development is put into dependence from development of economic parameters of the region, in particular that are connected with the category of «production potential». However, such communications, as a rule, are based on the indicators reflected in official statistics, which are the obvious, visible indicators presented in dynamics by years. In reality, in the depth of economic processes rather implicit (latent) variables (factors, the reasons) which result in this or that value of statistics of the region lie. An attempt to find them is very interesting and lies in the sphere of the factorial analysis. These factors can serve as indicators of production potential development and provide search of standards of regions social and economic systems development. The factorial analysis will lead to formation of integrated indicators.

3. Short analysis of researches and publications. Many scientists-economists offered the ways of assessment of production potential, including connection between the economic growth and a standard of living (L. I. Abalkina (2001, 2002) [1, 2], N. D. Matrusova (1995) [3], M. B. Melnichuk (2008) [4]). However, methodically there is no accurate

correlation between the level of production potential and dynamics of indicators which reflect the social part of region's economy development. In this regard, synthesis of production potential, a standard of living and quality of life is interesting assessment. In our opinion, the purpose of production potential growth is ensuring high level and quality of life in the region. Creation of integrated indicators for production potential and quality of life assessment as well as a model of their interrelation is topical.

Many works were devoted to quality of life and development of integrated indicators for its assessment, namely, those of E. V. Fakhrutdinova and Sh. M. Valitov (2010) [5], M. A. Simakina (2012) [6], S. A. Ayvazyan (2012) [7], R. Veenkhoven (1993) [8], A. Sen (1999) [9, 10], J. Cobb (1994) [12]. For example, E. V. Fakhrutdinova and Sh. M. Valitov (2010) compared contents of the main concepts of quality of life and allocated the approaches uniting them [5]. M. A. Simakina (2012) argued about existence of communication between the economic growth and quality of life of the population [6]. S. A. Ayvazyan (2012) used integrated indicator of quality of life of the population [7]. The Dutch sociologist R. Veenkhoven (1993) investigated the concept of «happy life» and offered an integrated indicator of the expected happy life [8]. A. Sen (1999; 2002) developed an indicator (index) of human development (Human Development Index, HDI) [9-11]. The group of the American scientists under the leadership of John Cobb in 1995 defined the indicator of true development (Genuine Progress Indicator, GPI) [12].

4. The purpose of the article is to form a technique of level of production potential influence quantitative assessment on indicators of quality of life and to develop indicator standard parameters of its development.

5. Results. One of traditional approaches to assessment of quality of life is the approach concentrated on meeting of requirements, or achievement of certain qualitative and quantitative indices (indicators) for certain people. The majority of resources for an assessment of indicators are presented by cost indices of income or consumption. Non-monetary indicators can be included, such as access to certain public benefits, (health care, education, water supply, electricity and transport availability). In some approaches, resources can be expanded to include consumption of the main goods. Several new indices of quality of life (QOL) were gradually created by E. Diener (1995; 1997; 2000) [13-15].

The measured parameters in foreign practice are often based at a universal set of the human values from S. H. Shvartts's works (1994; 2005) [16-17]. Hence, the main index of quality of life intended first of all to carry out differentiations between developing countries, included seven variables: purchasing power, crime rate, satisfaction of the basic physiological needs, level of suicides, literacy level, gross violations of human rights, and deforestation level. The expanded index of quality of life intended generally to assess a level of quality of life in industrialized countries, included seven other variables, namely: number of doctors per capita, percent (level) of savings, level of income per capita, subjective wellbeing, percent of population trained in colleges, inequality of income, quality of ecological situation and level of the legislation development in this area. Schwartz considered that a combination and mutual use of these two indices makes it possible to perform reliable measurement of a level of quality of life of the population [16].

Attractive is a thought of creation of the mathematical model reflecting not only quality of life and production potential, but also their interrelation and interference. For this purpose, not to do without integrated indicators.

Integrated indicators in essence are mathematical combinations of a set of various individual indicators. Their wide use led to strong debate concerning conceptual and methodological pros and cons of this research approach. However, we consider them justified. All approaches supplement each other and, therefore, have to be used in principle for achievement of a research objective.

In the context of the international (interregional) comparisons, a multidimensional (multiple-factor) method, the main component of which is the cornerstone of the factorial analysis, is offered for calculation of difficult (compound) indices of economic development, such as income per capita, degree of basic needs satisfaction and other possible indicators of wellbeing of the population. K. Iberla (1980) [18] and I. Okun (1974) [19] considered that the method is conceptually attractive, easily used, and, apparently, perspective in several directions of production and social spheres' interrelations research.

Formation of indicators of classification groups of indicators of production potential development and the quality of life of the population of regions of Central Federal District of Russia (Central federal district) caused by it, definition of quantitative characteristics of these indicators by methods of the factorial analysis allow us to calculate and coordinate evidence-based perspective standard values of indicators of level of production potential and the qualities of life of the population entering the qualifier of federal statistics. These indicators are grouped in blocks: one is connected with the level of production potential, three blocks - with quality of life. In the block of production potential, there are 17 variables (X41-X72); in the blocks of quality of life («demography and employment», «standard of living» and «health care, training and criminalization»), there are 22 variables (X16-X40).

For achievement of a goal, the production functions (PF) of these indicators from the general indicators of classification groups of indicators of level of production potential and quality of life of the population as regression models of statistical dependence of the corresponding indicators on numerical characteristics of indicators are developed for the areas of the Central federal district. Study period is 2009-2014.

When modelling influence of indicators on the indicators characterizing production potential, statistically correct regression dependences were developed. We called them production functions as at each of them there is an indicator I1 variable and indicators of production potential reflecting ability of economy to make production (works, services). The following dependences were calculated based at our previous research [20]:

X41=187008+28670,6*I1,D=91,6%;
X42=115121+2300,9*I1,D=41,7%;
X44=37729,1+4777,1*I1,D=89,5%;
X47=1241,5+16,7*I1,D=87,6%;
X53=346,1+40,7*I1,D=90,6%;
X54=214,3+12,1*I1,D=72,9%;
X55=10+0,44*I1,D=48,7%;
X61=786,8+181*I1,D=92%;
X72=64961,8+9859,7*I1,D=91,8%.

So, X41-X72 indicators were exposed previously to the factorial analysis. From all set of 17 indicators for inclusion in models, the most significant were selected. Among them X41 - the level of a gross regional product, X42 - the VRP level per person, X44 - number of the industrial organizations, X47 - output of milk, X53 - output of ferro-concrete designs, X54 - output of a brick, X55 - output of electric power, X61 - the volume of input of houses in operation, X72 - the volume of investment into fixed capital, D - value of coefficient of determination. Coefficients at the indicator I1 variable define positive proportions in change of this indicator and the corresponding X41-X72 values. The indicator I1 variable is received as a result of stages of the factorial analysis.

At first stage of analysis, variables were grouped by influence of factors: factorial loads of variables which form a group of indicators of a level of regions' production capacity development in the Central federal district. We should note that degree of importance of impact of factors on the level of production capacity of regions in this group (as well as in all classification groups) of indicators decreases in ascending order of their numbers: at F1 the highest significance value turned out; impact on the production potential of a factor F2 follows further, the factor of F3 has the smallest impact [20].

At the second stage, we receive the indicator I1 variable for the regions of the Central federal district. The most important achievement of the factorial analysis is possibility of quantitative expression of indicators of the studied economic phenomenon what the level of development of production potential of subjects of the Central federal district is. It is reached by means

of corresponding individual for separate factors and integrating numerical characteristics generalized for all significant factors which form individual and general indicators of the relevant classification group of socio-economic indices (table 1).

The results of the factorial analysis which allowed us to establish the size of the general I1 indicator, and developed by PF of the indicators expressing a level of development of production potential of the Central federal district regions are the basis for constructed by us regression models which was used further for obtaining target standard levels of the indicators reflecting development of production potential and indicators of blocks of quality of life in Kursk region.

Based at these models, we can tell rather precisely what level of the studied target standard indicators on the «production potential» block and the «quality of life» blocks will be. Indicators on the «production potential» block are given below (see tab. 2).

Thus, we determined the level of deviations of standard sizes from actually reached in production potential of Kursk region. Deviations in the big party of the indicators are regarded as achievement for this period of time of target values. However, standards can change and become different for future period of time. Therefore, monitoring by such technique has to be carried out regularly.

Indicator variables on indicators of quality of life (I2, I3, I4) and their standard values are received in the same way.

6. Conclusions. Thus, as a result of modelling with the use of the factorial analysis and regression models, we managed to reveal indicator variables which allowed receiving standard reference points of indicators of production potential, on the one hand, and indicators of the «quality of life» block, on the other hand. The deviation of the actual levels of indicators from standard is target reference points for achievement. The system of regional government can use these values and include them in indicative planning and programs of development.

Tab. 1: **General and individual indicators of level of production potential of the Central Federal District regions, 2009-2014 (according to the factorial analysis)**

Serial number of the region	Name of Region	Private indicators, express by factors:			General indicator I1
		F1	F2	F3	
1	Belgorod region	2,00	-0,97	0,74	1,77
2	Bryansk region	-3,50	-1,40	0,70	-4,20
3	Vladimir region	-0,23	-0,79	0,31	-0,70
4	Voronezh region	2,40	1,09	0,09	3,58
5	Ivanovo region	-4,49	-1,01	-0,50	-6,00
6	Kaluga region	-1,53	-1,86	3,09	-0,30
7	Kostroma region	-4,51	-0,44	-0,48	-5,43
8	Kursk region	-2,77	0,72	-0,50	-2,55
9	Lipetsk region	0,95	-1,00	-0,57	-0,62
10	Moscow region	25,90	7,08	0,00	35,98
11	Oryol region	-3,63	-1,16	-0,53	5,32
12	Ryazan region	-1,76	0,08	-0,62	-2,30
13	Smolensk region	-1,82	1,12	-0,92	-1,62
14	Tambov region	-4,31	-1,4	-0,39	-6,10
15	Tver region	-0,59	1,65	-0,60	0,46
16	Tula region	-1,48	-0,89	1,80	-0,57
17	Yaroslavl region	-0,60	-0,80	-0,72	-2,12

Source: Authors' elaboration

Tab. 2: **Rationing of indicators of production capacity components for Kursk region, Russia**

Variable equations	Level meaning		
	Actual level	Standard level	Relation of the actual level to the standard, %
Level of gross regional product	124201	122326	98,49
Level of global regional product per person	108237	111302	102,83
Number of industrial bases	24936	25132	100,79
Output of milk	40,7	41,6	102,21
Output of ferro-concrete frames	275,4	268,8	97,60
Output of bricks	120,0	122,9	102,42
Output of electric power	25,2	23,7	94,05
The volume of input of houses in operation	408,3	396,6	97,13
The volume of fixed asset formation	44095	43518	98,69

Source: Authors' elaboration

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