THE MAIN DIRECTIONS OF THE DYNAMICS OF LABOUR RESOURCE POTENTIAL OF THE REPUBLIC OF TATARSTAN

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Abstract:*The Republic of Tatarstan is one of the most economically developed regions of Russia. Large-scale projects implemented in the republic make high demands for labor resource security. Understanding of the status and trends of the dynamics of labor resource potential of the Republic of Tatarstan will allow the region to build a competent management of key factors for future economic development. The article describes the results of investigation of the dynamics of labor resource potential of the Republic of Tatarstan. It highlights an attempt to use cartographic research method in combination with the geostatistical methods of analysis of statistical data on the population based on the current capabilities of GIS.*

Keywords*:* the population, the labor resource potential, spatial analysis, geoinformation systems, the cartographic method, geostatistics.

Introduction

Effective decision-making process within the framework of integrated development programs in the region is in the best way carried out on the basis of rational use of resources, characterizing the potential of the territory.

The potential of the territory is considered by several researchers as the system of interconnected, interdependent and interacting factors for the effective and progressive development of the territory, as well as in the present conditions, and for the future.[1]

From the standpoint of sustainable development of the territory, which originated in the late 1980s and has become widespread since then, in the modern world successfully developing society simultaneously uses and multiplies three types of it's main assets: natural potential, economic potential and human potential. The development must ensure growth, or at least undiminishing of all those assets. Consequently, the sustainable development of the territory can not be based on the use of the natural potential only. Building social and economic potential of the region can provide its excretion in the forefront of science and

[1] Ryazantzev S.V., Aidrus I.A., Pismennaya E.V. Demographic potential as a basis of the development of higher education Studies. allowance. - Moscow: People's Friendship University, 2008. - 258 p.

technology. But this will require a significant increase in attention to the conservation, development and use of the human potential of the area.

The population is a rather complicated system – a number of people within a geographical area, united in the process of production and consumption.[2] The human potential is a qualitative characteristic of the population. Most researchers define the human potential factors such as the level of physical and mental health, life expectancy, level of education, work motivation, material and spiritual needs, people's social activity. However, the basis of the human potential is demographic potential, which is determined by quantitative indicators and their population dynamics.

The demographic potential of the country (region) is understood as number of people with certain qualities (characteristics) necessary for social-and-economic development of the area.[3]

In social-and-economic terms, the population is interconnected with the economy and social sphere and forms the main production force of the society and a consumer of generated material and spiritual values, goods and services [6]. It is the dynamics and structure of the demographic potential, that is formed under the existing geo-demographic situation in the region, have a decisive influence on the formation of size and structure of the labor resource potential of the area. In other words, the demographic potential determines the potential labor resource, and therefore, the economic functioning of the economy and social-and-economic development of the territory.

Results and Discussion

The Republic of Tatarstan is one of the most economically developed regions of Russia.

Favorable geographical position at the crossroads of major highways connecting east and west, north and south of the country, rich in natural resources, transportation infrastructure, a strong industrial and scientific complex are competitive advantages of Tatarstan. Large-scale projects implemented in the republic put forward high demands to the labor resource security.

The absolute value of the labor resources depends on two factors - natural and mechanical population growth. The above mentioned factors shape not only the quantitative characterization of the working

[2] Borisov V.A. Demography: Textbook. - Moscow, 2005. - 526 p.
[3] ARCGIS 9. Geostatistical Analyst. User Guide. ESRI, 2001. 285.

population, but also its qualitative characteristics in general. One of such indicators include the age and sex structure of the population. As seen from table 1, recently in the republic there has been some reduction in the working age population and an increase in the proportion of people with work-disability ages.

Table 1.Distribution of the population of the Republic of Tatarstan by age groupsfor years 2000-2012, beginning of the year, %

Data	2000 y.	2002 y. (census)	2007 y.	2008 y.	2009 y.	2010 y. (census)	2011 y.	2012 y.
The entire population	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Including: - under the working age	21,9	19,6	16,9	16,8	16,6	16,7	16,7	17,0
- working age	58,1	60,4	63,1	62,8	62,8	62,3	61,8	61,2
- above working age	20,0	20,0	20,0	20,4	20,6	21,0	21,5	21,8
Total of out-of-work age	41,9	39,6	36,9	37,2	37,2	37,7	38,2	38,8

After 2007, this is mainly due to the increase in population of above-work age. It is assumed that if current trends in population reproduction developing proportion of people of after-work age will exceed the similar indicator for the population of under-work age. Currently, 12.5% of the population of the republic are at the age of 65 and older. In accordance with international standards of the population is considered to be old when the proportion between 65-year-olds older people is more than 7% in the age structure of the population, there's a possibility to talk about aging process of the population in the republic.

The percentage of people of under-work age in the period between the two population censuses decreased by 2.9 percentage points in other words, by 110 thousand people.

The distribution of the population in three age groups is directly associated with coefficient of demographic load. Along the republic in the whole republic out of 1000 people of the working age there are 636 people aged 0-15 and the retired. The table 2 shows, that in general there have been declines in the total load on the working population over the last 10 years.

Table 2.Dynamics of the workload coefficient in the Republic of Tatarstan, ‰

	2000 y.	2002 y.	2007 y.	2008 y.	2009 y.	2010 y.	2011 y.	2012 y.
K_{0-15}	377	325	268	263	262	266	270	278

$K_{60(55)+}$	344	331	317	322	327	336	346	358
K_{total}	721	656	585	585	589	602	616	636

In particular, there have been noticeable changes in its composition. The calculations show, that if the society had worked on the content more children, now the economy of the republic should be redirected to the content and services mainly elderly (table 3).

Table 3.The structure of the coefficient of the total load in the Republic of Tatarstan, %

	2000 y.	2002 y.	2007 y.	2008 y.	2009 y.	2010 y.	2011 y.	2012 y.
total load	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Load of children	52,3	49,5	45,8	45	44,5	44,2	43,8	43,7
Load of elderly	47,7	50,5	54,2	55	55,5	55,8	56,2	56,3
CLS	37,7	32,5	26,8	26,3	26,2	26,6	27	27,8

The reason for these changes lies in the process of aging of the population, the deepening of the process due to changes in the natural population reproduction. Growth in population life expectancy will inevitably lead to an increase in the proportion of elderly people, and it leads to an increase of the work load indicator.

Of great importance is the value of turnover of generations of the working population. To do this, we calculated the coefficient of labor substitution (CLS), which describes the process of updating of the working population, its labor substitution. The overwhelming majority of employees - are people of the working age. Therefore, the coefficient of labor substitution has been calculated for this age. The CLS shows how much will every 100 people, coming out of working age, be replaced. In terms of demography, the coefficient of labor substitution characterises the degree of substitution of the working population. [4] So, at the beginning of 2012 the value of CLS was 27.8%, that is, for every 100 people of working age there are 27 people, that might become part of the working age population in the future, whereas in 2000 this coefficient was 37.7% (table 3).

Currently, the labor force of the Republic of Tatarstan is 2.4 million people. The labor resource potential of the Republic of Tatarstan

[4] Boyko A.I, Karmanov M.V. Economic Demography: Textbook / Moscow International Institute of Econometrics, information studies, finance and law. - Moscow, 2003. - 64.

is formed by the work-age population (94%), teenagers and above-work age population (5,2 %), foreign migrant workers (according to official statistics 19 thousand people are working in the republic). The total number of own labor resources of the republic is composed as follows (table 4).

Table 4.Structure of the dynamics of own labor resources of the Republic of Tatarstan, %

	2007 y.	2008 y.	2009 y.	2010 y.	2011 y.
Total labor resources	100,0	100,0	100,0	100,0	100,0
including: - able-bodied population of the working age	96,1	95,9	95,8	95,3	94,8
- people above working age and teenagers, employed in economics, total	3,9	4,1	4,2	4,7	5,2
one:					
- people of the above working age	3,8	4,0	4,1	4,6	5,1
- teenagers	0,1	0 ,1	0,1	0,1	0,1

The proportion of the working population in the total labor force declines despite an increase of the absolute value of the population of working age in the last ten years. This decline has given 1.3 percentage points. The number of this category of the economically active population, such as people of the above working age and teenagers increased by 1.3%. There is increase in the proportion of people of the above working age within the group from 3.8% in 2007 to 5.1% in 2011 and there are no obvious trends in the proportion of teenagers (0.1%). This can be explained by the fact that the size of pension received does not match the minimum subsistence level, which naturally leads to the fact that people of the above working age continue working. In their turn, the younger generation does not tend to choose working specialities, which by now have lost their prestige, resulting in the lack of labor force. This problem can be solved by increasing of additional workforce by bringing it from other regions, including the countries of near and far abroad, that can make a difference not only in the quantitative characteristics of the working population, but in the qualitative characteristics as well. Recently there has been discussed a question about the increase in the upper limit of the working age.

Understanding of the status and trends of the dynamics of the labor resource potential of the Republic of Tatarstan will allow the region to build a competent management of the key factors for future economic development and take a worthy position in the competition for attracting of all kinds of economic resources the territory of the republic.

The acceleration of the social life rhythm, the growth of the needs to using the resources of diverse statistical information on the social-and-economic status of the territory, have put forward high requirements to its treatment in order to ensure making sound management decisions.

For geographical research in the study and analysis of the labor resource potential of economic methods, the most significant ones are: analytical, forecast, balance, group, cluster. Along with the above mentioned methods, an important method widely used in studies of the socio-economic dimension is the cartographic method. This is due to the attachment of people to a particular territory. In particular, about 80% of the information of the modern society have a geographic component - coordinate attachment to a particular territory, the volume of such information is increasing yearly. Population mapping has geo-demographic character because the map allows you to set the spatial patterns of development structure, layout, and territorial organization of the population.

The development of cartography, including social-and-economic, is due to the background and development of common civilization: social production, science, technology, and public relations. The XXI century is called the age of computerisation (informatisation) due to the widespread introduction of information technology to many fields of human activity.

The appearance of new opportunities associated with the development of geographic information systems (GIS), has led to new methods and technologies for spatial analysis processes and phenomena, including the social-and-economic. One area of the kind is the analysis of spatial data geostatistics, which is growing rapidly at the moment. The possibility of using a geostatistical approach in evaluating social development and the environment are reflected in the works by S.A Burtzeva.[5]

Geostatistics - science and technology for analysis, processing and presentation of spatially distributed (or space-time) data by means of

[5] Burtzeva S.A. Geostatistical approach to space-time development of the society / / Questions of Statistics. 1998. Number 5. Pp. 51-55.

statistical methods . Geostatistics models the distribution of phenomena and processes in geographic space.

Thus, use of cartographic method of research in combination with geostatistical methods of statistical data analysis based on advanced GIS capabilities will reveal geostatistical patterns and significantly improve the analysis of spatially distributed processes and phenomena in the study area.[6] «In the study of the system «society-nature» it is important to highlight the key-factor of its development. Such factor is economic relations, which include geographical basis, where these relationships develop… Statistics, which task is the study of social phenomena in their development (in space and time), should put qualitative-quantitative characterictics of geographical space into the object of its study".[7]

As an analytical tool GIS software package ArcGIS Desktop 10.0 has been selected. The main and priority possibilities of this program in relation to the study of socio-economic direction include the possibility of spatially attributive data conversion the combination of vector layers with spreadsheets containing the date of previous and current population censuses, the ability to import / export data in many other formats supported. The tools allow ArcGIS to make inputting and processing indicators of the population automatic thanks to a wide set of functions, a variety of mathematical operations, which allows to calculate values based on other fields.

Moreover, an extension to ArcGIS was used for geostatistical analysis – the module called Geostatistical Analyst, which expands the capabilities of ArcGIS due to the appearance of additional tools intented for visualization, analysis and understanding of spatial phenomena.

As the initial territorial unit were taken all administrative districts of the republic (at the time of the study, there were 43 districts). The source of statistical data were values of the labor resources in the Republic of Tatarstan in 2011.

At the beginning of the geostatistical analysis has been conducted the study of the data on the basis of ESDA tools (exploratory spatial data analysis) of exploratory spatial data analysis was conducted , which enables research workers to explore the data from different perspectives. Thus, the histogram tool in ESDA shows the density distribution of the test data set, while calculating summary statistics (Pic. 1).

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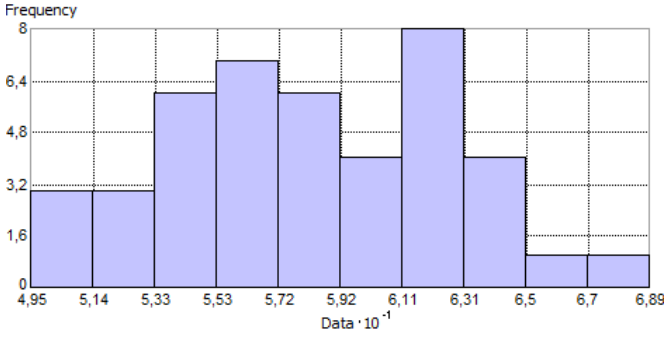
[6] Medkov V.M. Demography. Textbook. - Moscow: INFRA-M, 2008. - 638.

[7] Spatial analysis / Under the editorship of A. Trofimov, EM Pudovik. - Kazan: New Knowledge, 2000. - 116.



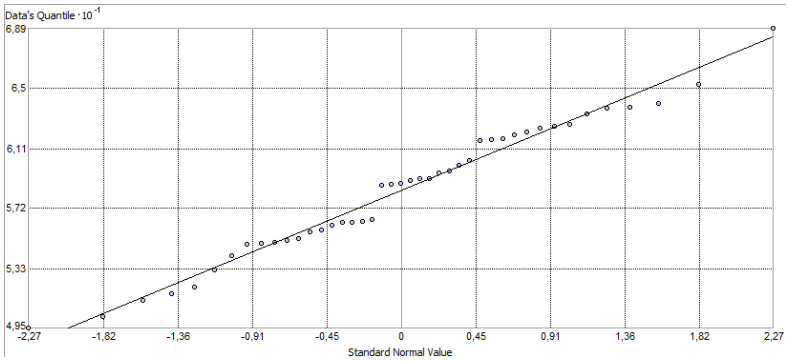
Statistical indicators:	
Count of district	43
Min amount of labor resources in district (%)	49,45
Max amount of labor resources in district (%)	68,92
Mean amount of labor resources in district (%)	58,4
Std.Dev. (%)	4,4
Skewness	-0,0124
Kurtosis	2,491
1-st Quartile (%)	55,185
Median (%)	58,8
3- rd Quartile	61,949

Picture. 1. Statistical indicators and histogram distribution of labor resources of the Republic of Tatarstan in 2011

All the values of the number of labor resources in the general population in municipal districts of the Republic of Tatarstan have been merged into 10 classes. The height of histogram columns is proportional to the number of municipalities of the republic, in which the number of labor resources in the general population falls into a separate class. The most essential characteristics of this distribution are the mean, median, and skewness. As long as the mean and the median of the distribution labor resources in the region are similar in magnitude (58.4 and 58.8 pers.), we can say that the distribution is close to normal. However, the mean value of a little less than the median, and this suggests that the data are not fully subject to the law of normal distribution. In particular, the distribution has a negative skewness. This is confirmed by the histogram

- the data are asymmetric – the graph of distribution has a long left tail of small values. The value of the skewness (-0.0124) is also evidence of the negative skewness of distribution. The right tail of the distribution indicates the presence of a relatively small amount of municipal districts with relatively high values of labor resources (65 to 68%), and the left one - the predominance of municipalities with relatively low values of labor resources from 53 to 49% in Republic of Tatarstan. The kurtosis of the distribution density curve depends on the size of the histogram tails and gives a measure of how likely the distribution of outliers in the labor resources in the districts will be encountered. As long as the kurtosis of the normal distribution is 3, in our case the value of kurtosis (2.491) indicates a slight "peaked" of the distribution being researched.

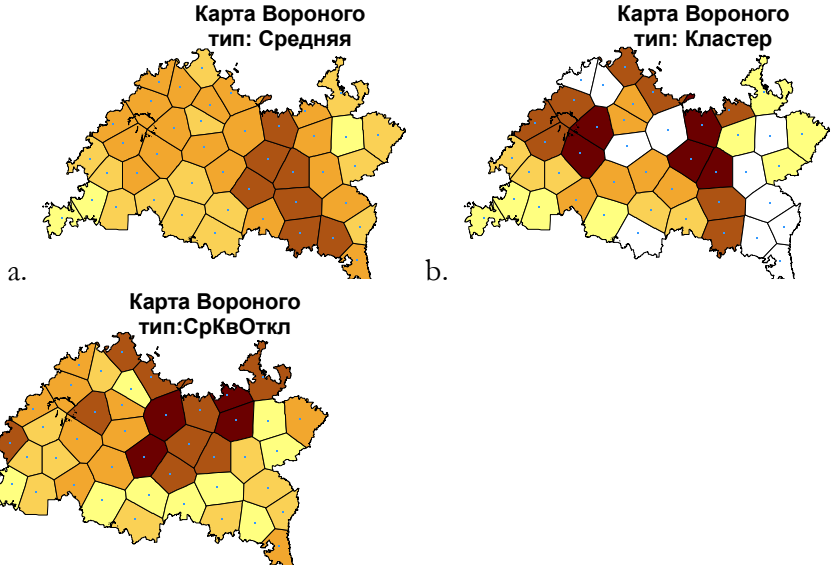
To check the normality of the geostatistical data distribution a normal QQ graph has been constructed by applying the appropriate coordinate axis values from the data set and the values obtained for the normal distribution curve corresponding to the same value of the cumulative distribution. The QQ graph allows you to compare the distribution of the data to with the standard normal. The more accurately we can construct points on a straight line, the closer the distribution is to the normal. The QQ graph shows (Pic. 2), that the graph is relatively close to a straight line. The largest deviation from this line falls on the high value of the amount of labor resources in some districts of the Republic of Tatarstan.



Picture 2. Normal QQ plot of distribution of labor resources of the Republic of Tatarstan in municipal districts in 2011

The Voronoi Map tool allows to carry out the analysis of stationarity and spatial variability of a set of geostatistical data. To construct these maps reference points, which are built around a series of polygons, have been used (Pic. 3).

On the Voronoi maps can be estimated on the subject of investigated geostatistical indicators on the level of local smoothing (Mean, Mode, Median), local deviations (standard deviation, interquartile range (IQR), entropy), local outliers (cluster), local influences (simple). Each map describes the spatial variability of the indicator on municipal districts in the region and allows you to select homogeneous groups of regions .[8]



Picture 3. Voronoi maps in terms of labor resources in the municipal districts of the Republic of Tatarstan in 2011. Types of maps: mean (a), cluster (b), StDev (c)

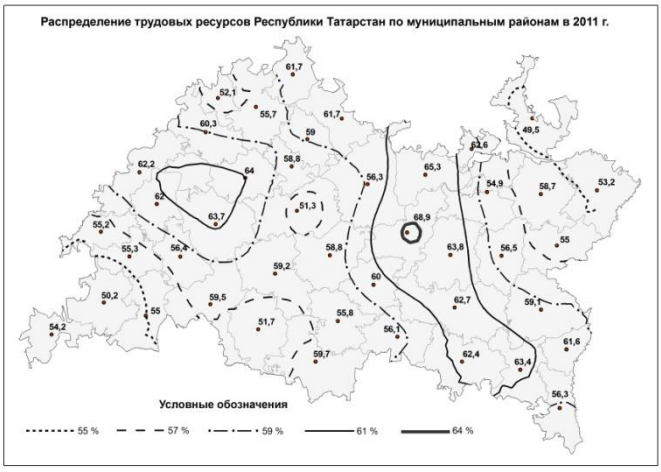
The most crucial stages of geostatistical research in GIS is determination of global trends in a set of geostatistical data, and the study of the variogram (covariance), allowing to make an analysis of spatial dependencies.

The latter is especially important because in the absence of spatial correlation between the data obtaining an estimation in geostatistical center by weighing the neighboring centers and using geostatistical interpolation techniques (kriging) have no meaning.[9]

[8] Dem'yanov V. Saveliev E. Geostatistics. Theory and practice. Moscow: Nauka, 2010. 327.

[9] Dem'yanov V. Saveliev E. Geostatistics. Theory and practice. Moscow: Nauka, 2010. 327.

In Geostatistical Analyst of geographic information system ARCGIS it is possible to use ordinary, simple, universal, probability, indicator and disjunctive kriging, along with the supplementary Cokriging. These methods of the Kriging can not only build interpolated surface of values and errors, but can also be used in creation of maps of probability and quantile (Pic. 4). Highlighting the fact that kriging method does not advance requirements of normality to the source data. However, submission of the data of the normal distribution necessarily to create maps of probability for ordinary, simple and universal kriging .



Picture 4. Map of values interpolated by the method of ordinary kriging of the distribution of labor resources for to municipal districts in the Republic of Tatarstan in 2011. The initial values of labor resources (%) assigned to geo-centres of municipal districts

Therefore, on the basis of construction of maps interpolated by ordinary kriging values of the labor resources in the municipal districts of the Republic of Tatarstan (Fig. 4) we can dwell on additional opportunities of imaging hidden features of spatial distribution of labor resources in the investigated territory. On the map stands out the zone of municipal districts in the central and south-eastern parts of the Republic of Tatarstan with relatively high indicators of labor resources: the basic core of a high concentration of labor resources is observed in Nizhnekamsk region of the Republic of Tatarstan; and the zone of municipal districts which is located to the south-west and north-east and characterized by low values of the labor activity of the population.

Conclusion

The given experience demonstrates the promising use of cartographic and geostatistical methods based on the current capabilities of geographic information systems in the field of socio-economic research, including the study of labor resource potential of the area.

A combined us age of methods has revealed spatial heterogeneity in the distribution of labor resources within the study area, which greatly complements the existing understanding of the basic directions of the dynamics of labor resource potential of the Republic of Tatarstan.

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