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SOCIO-DEMOGRAPHICAL INDICATORS OF AN ELECTRONIC ATLAS OF SOCIO-DEMOGRAPHIC DEVELOPMENT OF THE REGIONS OF THE REPUBLIC OF KAZAKHSTAN

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ABSTRACT

The research is based on the materials of the scientific project, whose goal is to develop and create an electronic atlas of socio-demographic development of the Republic of Kazakhstan using GIS technologies. Atlas maps was created based on spatial geodatabase of social and demographical indicators of the Republic of Kazakhstan. Currently, an electronic atlas of the socio-demographic development of the regions of the Republic of Kazakhstan consists of two blocks of indicators: social and demographic. The social block of indicators consists of the following sub-blocks: health care, education and science, living standards, culture, housing, labor and social security, tourism, offense, totally about 300 primary and estimated indicators. The demographic block of indicators consists of sub-blocks: population size, population structure, marriages and divorces, population natural movement, infant and maternal mortality, life expectancy, migration, population settlement and urbanization, totally 200 primary and estimated indicators.

The aim is to study the problems and prospects of socio-demographical development of the quality of life of the Republic of Kazakhstan. The main content of project is to develop an atlas information system of the socio-demographic development based on the created spatial database of demographic and social indicators of human development in the Kazakhstan using GIS technologies.

Data source and Methods: comparative geographical, cartographic, dynamics statistic methods, GIS.

Results: Geodata base of the socio-demographical indicators of the quality of life of population will allow to monitor, manage and forecast of socio-demographic development of the Republic of Kazakhstan. The Atlas was created for 14 regions of the Republic of Kazakhstan and 2 cities – Astana and Almaty for 1991-2016 years in Kazakh, Russian and English languages.

Conclusions: All thematic and integral socio-demographic maps of the atlas are presented in the dynamics for 1991-2016. In addition the atlas contains statistical and analytical materials on socio-demographic issues. The electronic atlas is addressed to researchers, managers, teachers and students, as well as to all who are interested in the socio-demographic problems of the Republic of Kazakhstan and its regions.

Keywords: socio-demographical indicator, socio-demographic development, geodata base, atlas, GIS.

INTRODUCTION

Improving the quality of life of the population is the most important task of the social and economic policy of the Republic of Kazakhstan. The state has developed and implemented a number of state development programs to achieve these objectives that are aimed at improving the socio-economic development and digitization of the economy of the republic, improving the quality of life of the population [1-3].

There are not enough comprehensive spatial geographical studies of socio-demographic processes in Kazakhstan. This determines the urgency and necessity of developing and creating an electronic atlas of the socio-demographic development of the regions of the Republic. There are traditional and electronic atlases in different thematic areas in Kazakhstan [4-6], but there was no electronic atlas of socio-demographic processes in Kazakhstan. The authors of this article participated in the project on the creation of an electronic atlas of the socio-demographic development of the regions of the Republic of Kazakhstan in the period 2015-2017 [7].

The presentation of socio-demographic indicators in the web portal defines the electronic atlas as a convenient tool for analyzing, monitoring and managing indicators of the socio-demographic development of the regions of the republic.

Materials and methodology of researches

The source of the data was the official statistical data of the Committee on Statistics of the Republic of Kazakhstan in 1991-2016, demographic yearbooks, monographs, scientific reports and articles. The scientific research methods were used: comparative geographical, cartographic, dynamics statistical, GIS-technologies, methods of expert and rating evaluations. The software were used: GeoServer 2.11.1, GeoJSON, Open Layers, PostgreSQL, QGIS, ArcGIS 10.2.

Results and discussion

Spatial database on demographic and social indicators of the Republic of Kazakhstan was created in the context of 14 oblasts and Almaty and Astana cities in the dynamics for 1991-2016 to create an atlas of the socio-demographic development of the regions of Kazakhstan.

All socio-demographic indicators were grouped into two major thematic blocks in the geodatabase: demographic and social. The demographic block of indicators consists of 109 primary and 88 calculated indicators, and the social block of 174 primary and 40 estimated indicators in dynamics.

The demographic block of the spatial geodatabase contains statistical data on eight groups of demographic indicators: Population; Population structure; Marriages and divorces; Natural movement of the population; Infant and maternal mortality; Average life expectancy; Migration; Population resettlement and urbanization.

Analysis of the dynamics of the demographic indicators of the republic for 1991-2016 revealed regional changes in the structure of the population. The population of the Republic of Kazakhstan in 2016 amounted to 17 670.6 thsd. people, including 10 066.5 thsd. people (57.3%) in urban area, 7 604.1 thsd. people (43.7%) in rural area. In comparison with 1991 the population increased by 7.8% in 2016 the most populated regions are South Kazakhstan (2 859.7 thsd. people), Almaty regions (1 965.5

thsd. people), Almaty city (1 727.7 thsd. people), less populated - North-Kazakhstan oblast (569.4 thsd. people).

There is a significant population growth in the capital, Astana, where the population increased from 326.9 thsd. people to 922.6 thsd. people in 2016. At the beginning of 2018 the population of Astana exceeded 1 mln. people. Almaty with a population of 1727.0 thsd. people in 2016 has a constant tendency to increase and in 2018 it has already reached 1806.8 thsd. people (Figure 1).

POPULATION GROWTH OF THE REPUBLIC KAZAKHSTAN IN 1991-2016.
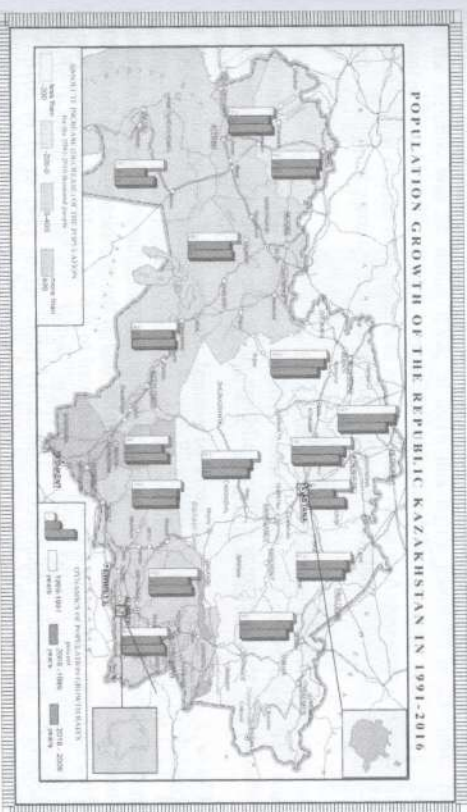
Figure 1 - Map of population growth dynamics in the regions of the Republic of Kazakhstan, 1991-2016.

In 1991 in Kazakhstan the sex structure of the population was formed with a slight preponderance of the proportion of the female over the male population (51.6% and 48.4%, respectively). In 2016 the male population was 8605.1 thsd. people (48.7%) and the female — 9128.1 thsd. people (51.3%).

In 1991 the share of the population in the non-working age of 0-14 years in the republic was 31.5% of the total population, and in 2016 this figure declined to 27.1%, respectively. A high proportion of children in 2016 was in the southern regions (more than 30%), a low proportion in the structure of the population of the population in the northern regions (21%).

In 1991-2016 years the share of the working-age population in the structure of the population of Kazakhstan increased from 65.7% to 67.1%. In 2016 the largest working-age population was in Astana (69.6%).

In 1991 the proportion of the population older than the working age in the republic was 5.9%, in 2016 – 6.9%. In 2016 the max indicator at the age of 65 and older years prevails in the East Kazakhstan region – 9.4%.

The natural movement of the population of the Republic of Kazakhstan for 1991-2016 has undergone significant changes. Fertility rates declined from 21.5 ‰ in 1991 to 14.6 ‰ in 1999. Then this indicator grew to 22.6 ‰ in 2016. In 2016 the high birth rate was

observed in Mangistau oblast – 31.8 ‰ and in Astana - 30.1 ‰. The low birth rate was in the northern regions – 13.5 ‰.

In the republic the death rate in 1991-2016 tended to decrease, so it decreased from 7.9 % to 7.5 ‰. A high mortality rate in 2016 was recorded in the northern regions (10-12 ‰), low mortality - in Mangistau region (4.6 ‰) and Astana (4.5 ‰) (Figure 2).

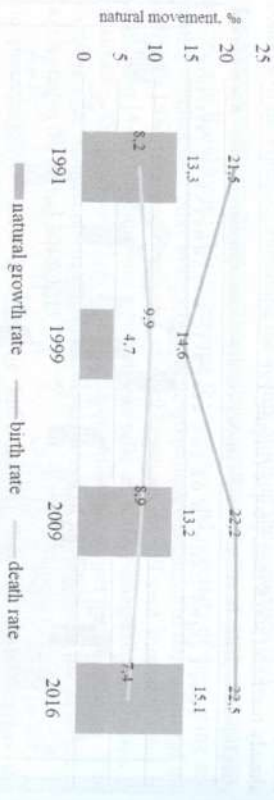Figure 2 - Dynamics of indicators of natural movement of the population of the Republic of Kazakhstan, 1991-2016.

In Kazakhstan the level of infant and maternal mortality has significantly decreased during this period. In 1991 the infant mortality rate in the republic was 27.3 ‰, in 2016 this figure was reduced in 3 times and amounted to 8.6 ‰. In 2016 the highest rate of infant mortality was in the South-Kazakhstan region 9.9 ‰. The number of dead mothers in the republic decreased significantly from 141 in 1991 to 51 in 2016. The causes of mortality and morbidity in Kazakhstan were also examined, and the medical and demographic features of the regions are revealed.

In 1991-2016 years there was an increase in natural population growth from 13.3 ‰ in 1991 to 15.1 ‰ in 2016 in Kazakhstan.

The average life expectancy of the population of the Republic of Kazakhstan was 63.2 years, in 1999 – 67.6 years, in 2009 – 68.4 years, in 2016 – 72.3 years. Average life expectancy of the urban population of the republic is higher than the rural population. There is a large difference in the average life expectancy of women and men, so in 2016 the difference was 8.7 years (women's average life expectancy – 76.8, male average life expectancy – 68.1). In 1991 this difference was 10 years.

Migration processes in the republic were characterized by a large outflow of population after the collapse of the USSR, so in the period 1991-2003 there was a negative balance of migration in Kazakhstan, which peaked in 1994 (-406.7 thsd. people) as a result of the outflow of representatives of Slavic nationalities who left for their historical homeland. And only since 2003 to the present time there is a positive balance of migration in the republic. The number of ethnic Kazakhs who arrived in Kazakhstan during the period of independence amounted to 957.7 thsd. people, mostly repatriates (oralmans) from Mongolia, China, Uzbekistan and other countries.

All demographic primary indicators of the Republic of Kazakhstan for 1991-2016 were uploaded to the site and estimated indicators were obtained based on them. Also, using the primary and calculated demographic indicators, the thematic maps of the atlas of the socio-demographic development of the republic were created [7].

The second major thematic block of the atlas is the social block of the spatial geodatabase. This block presents statistical data on eight groups of social indicators: The standard of living; Culture; Tourism; Offenses.; Labor and social security; Education and science; Health care; the housing stock; Culture; Tourism; Offenses.

The authors analyzed the dynamics of social indicators for 1999-2016. It was revealed that there is a tendency to increase the level of average per capita nominal monetary incomes of the population in the Republic of Kazakhstan. In 1999 the average indicator for the republic was 26 dollar USA, in 2016 this figure increased in 23 times and amounted to 244 dollar USA. A regional analysis of the monetary incomes of the population was carried out and it was revealed that Almaty, Astana cities, Atyrau and Mangistau regions were the leaders in this indicator, with indicators from 357 to 420 dollar USA.

The value of the subsistence min in the Republic of Kazakhstan on average by regions for 1999 was 25 dollar USA, and in 2016 subsistence – 62 dollar USA. The max indicators of the subsistence min in the republic for 2016 were in Astana and Almaty - more than 70 dollar USA.

In 1999 the average monthly salary of one employee was 84.5 dollar USA in the republic; in 2016 this figure increased in 5 times and amounted to 415 dollar USA. In the regional context the highest wage in 2016 was in the cities of Almaty and Astana, and in Atyrau, Mangistau regions (from 588 to 794 dollar USA).

The share of the economically active population of Kazakhstan in 1991 was 56.5%, in 2016 - 72.1% of the total population. In 1991-2016, a high level of economically active population was observed in Akmola, Kostanay regions and Almaty city (from 56.5% to 77.9%).
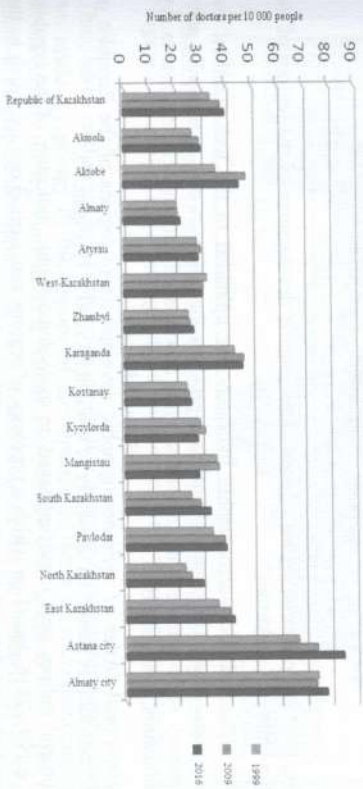
Figure 3 - Provision with doctors by regions of the Republic of Kazakhstan, 1999-2016.

The high number of employed among the regions for 2016 remains in the South Kazakhstan and Almaty regions (1163.2 thsd. people and 602.3 thsd. people respectively), a low number of employees in the Mangistau region (277.8 thsd. people). The unemployment rate in the republic decreased more than 2.5 times for 1999-2016 years (from 13.5% to 4.9%) [8].

With the improvement of the social and economic situation, an effective healthcare system has been created in the Republic of Kazakhstan in recent years, aimed at improving the health of the population. 1999-2016 the provision of the population with medical staff is increasing (33 and 41.6 per 10 thsd. people respectively) (Figure 3).

The average provision of housing stock in the Republic of Kazakhstan in 1991 was 27731.3 thsd. sq. m, in 2016 – 39641.9 thsd. sq. m. According to the data of 2009 and 2016 the largest area of the housing stock of the republic is in the territory of the South-Kazakhstan region – 43505.7 thsd. sq. m. (Its 14.26% of the total area of the housing stock of the Republic of Kazakhstan). Regions with a relatively small area of housing stock are Mangistau, Atyrau, West Kazakhstan and Kyzylorda regions (3.09% – 3.52% of the total housing area).

The authors made a regional analysis of the indicators of the educational system of the Republic of Kazakhstan, including higher education institutions, secondary schools, preschool institutions and their provision with personnel, as well as the provision of educational organizations with a material and technical base. Cultural indicators were also considered [9].

Figure 4 - Web-portal "Atlas of socio-demographic development of the regions of the Republic of Kazakhstan"

All submitted socio-demographic indicators are uploaded to the web-portal of the electronic atlas. The open web interface provides the ability to edit or manually enter primary socio-demographic indicators, view downloaded data by selected criteria (by indicators, years, regions).

Web-portal "Atlas of socio-demographic development of regions of the Republic of Kazakhstan" is placed on the server of al-Farabi KazNU [7] (Figure 4).

Integral indices were identified based on socio-demographic indicators of the republic for 1991-2016, based on which a typology of regions was carried out according to the level of socio-demographic development of the regions.

Trends of socio-demographic development in the regions of Kazakhstan allowed determining territorial disparities and identifying groups of regions with different levels of socio-demographic development. In this research, the method of linear scaling was applied for an integrated assessment of the socio-demographic development of regions, which is the most complete and reliable, the data were systematize and unified, i.e. are reduced to one dimension. The calculation took into account the reference points, while a large number of indicators were included in the calculation.

The formula for definitions the index of integral socio-demographic development of regions:

$$ISDD=(D+E+P+Q+R+S+T+F+U+V+H+W+B+C+X+Y+Z+AA)/18$$

18 indicators were used to assess the socio-demographic development of the regions, with the "weight" of all indicators being the same and equal to 1: life expectancy (D), infant mortality rate (E), maternal mortality per 10 thsd. live births (P), natural growth rate (Q), the provision with doctors per 10 thsd. people (R), the number of hospital beds per 10 thsd. people (S), the level of crime per 10 thsd. people (T), the number of students of all kinds educational institutions per 10 thsd. people (F), number of visits to theaters per 10 thsd. people (U), number of museum visits per 10 thsd. people (V), average housing provision per person (H), nominal cash income (W), share of population with incomes below the subsistence level (B), unemployment rate (C), provision of the population with cars in personal ownership for 100 people (X), number of received benefits (Y), provision of children with permanent preschool institutions for children per 100 places (Z), morbidity of the whole population per 100 thsd. people (AA), ISDD - the index of socio-demographic development.
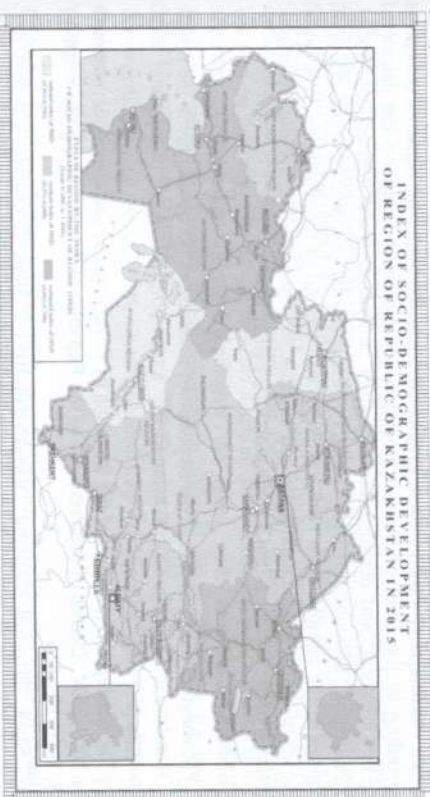

Figure – 8. Level of socio-demographic development of the regions of the Republic of Kazakhstan, 2015.

Thus, based on the calculated data on the evaluation of socio-demographic development, we made a typology of the regions of the republic in terms of socio-demographic development. All regions including Astana and Almaty were assigned to 6 types of socio-demographic development level. It should be noted that the presented typology of regions by the level of socio-demographic development of the regions of the Republic of Kazakhstan is conditional.

Analysis of the socio-demographic development of the regions is presented on the map "Level of socio-demographic development of the region in the Republic of Kazakhstan" (Figure 8). All spatial data indicators are presented in the electronic atlas in tabular, graphical, cartographic forms. In addition, a mechanism of interactive mapping in a web environment on statistical, derived indicators and indices of socio-demographic

development was developed in the electronic atlas, and shared access to users for spatial-temporal visualization and analysis of socio-demographic development data of the regions of the republic.

With the help of the GIS module, users are given the opportunity to perform an interactive formation of thematic maps of the atlas by selecting indicators to display the values in a different cartographic form. The module also implements the ability to select a set of indicators to display data in the form of diagrams, tables.

CONCLUSION

As a result of scientific research an electronic atlas of the socio-demographic development of the republic was developed and created by authors in 2015-2017 on the basis of the created spatial database for 14 regions and 2 cities of Almaty and Astana of Kazakhstan in dynamics, 1991-2016 using GIS technologies. A spatial geodatabase based on socio-demographic indicators was composed of 2 blocks: demographic and social. Information support of the electronic socio-demographic atlas along with the database management system is accompanied by the actual digital basis of the maps, which consists of an ordered set of graphic layers of the map. The typology of regions according to the level of socio-demographic development based on the calculated indices of social and demographic indicators in dynamics was carried out. Social, demographic, thematic and integral maps of the socio-demographic development of all regions of the republic have been developed and created in the dynamics. Web-portal allows users to get a quantitative and qualitative description of socio-demographic portraits of the regions of the Republic of Kazakhstan.

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SPATIAL ANALYSE OF CADASTRAL MAPS

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ABSTRACT

Cadastral maps are essential component of cadastral documentation. They are heterogeneous from many points of view and have several dissimilarities and imperfections. Only one half of them has been created in actual mapping campaign, thus with quality criteria which are sufficient for current requirement of modern society. The fact, that maps are in vector form, does not guarantee their accuracy and quality. The user must be extremely cautious when a digital image of the map is interpreted.

The advances in technology and the availability of GIS tools open wide range of spatial data analysis. Vector cadastral maps represent a structured spatial database that also includes information about positional accuracy of each detailed survey point. The quality of detailed survey point information is a key element that can be utilized. The quality of detailed survey point determines the quality of the boundary and the quality of position of the particular location on the map. The article presents a spatial analysis of the vector cadastral map accuracy. Visualization quickly highlights the areas with specific reliability of positional accuracy. Results of spatial analysis focused on accuracy are for vector cadastral maps users significant.

Keywords: detailed survey point, vector cadastral map, positional accuracy, spatial analyse

INTRODUCTION

Cadastral maps are heterogeneous from several perspectives. Quality code of detailed point "T" (Table 1.), which represents the spatial accuracy m_{xy} is assigned to every detailed point on the map [1]. The quality code of detailed point determines the process of map updating [2]. [6].

In practice, vector cadastral maps represent an administration of 4,149 files. Only 1,796 files are numerical cadastral maps where the quality code for all detailed points takes the value from "T" = 1 to "T" = 3. Every point has its own numerical identifier and coordinates in horizontal datum of unified trigonometric cadastral network S-JTSK (S-JTSK). Non-numerical are divided into two groups:

- 459 files of non-numerical cadastral maps – implemented (with implemented numerical results) contains non-numerical detailed points without any identifier (the quality code takes the value of "T" = 5) and numerically defined detailed points with their own numerical identifier (the quality code takes the value of "T" = 1 to "T" = 3) and coordinates in S-JTSK.