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DEVELOPMENT OF DEMOGRAPHIC MAPPING METHOD BASED ON GIS TECHNOLOGIES

ABSTRACT

Nowadays we can clearly see the activeness of the methodological and technological aspects of the new geoinformation direction in the field of cartography. The development of modern mapping methods is closely related to the development of geoinformation systems and technologies. The importance of geoinformation cartography and geoinformation systems is significant in creating databases and digital maps based on GIS software instead of analog methods for creating maps. There are the most important tasks such as improvement of modern method in obtaining cartographic information, and development of ways to quickly transmit and distribute cartographic information about nature and society. The application of GIS technologies in the field of demographic cartography will lead to drastic changes in the scope of work, as well as improve product design and increase the accuracy as a result of the performed tasks. The study shows that there is a need to develop a new method for mapping a new generation based on GIS technology, reflecting demographic processes. This article will focus on creating a database for development of maps based on GIS technologies, rapid identification, monitoring spatial changes using data from aerospace and other sources, and development of demographic digital mapping methods based on GIS technologies. Mapping demographic processes based on GIS technologies aims at implementing a number of practical tasks and research related to population. Based on this, a systematic method has been developed to analyse the demographic situation in the southern region of the Republic of Uzbekistan, and a digital demographic map has been created by applying the developed method.

KEYWORDS: cartography, GIS technologies, regional analysis, demography mapping

INTRODUCTION

In the developing world, human consciousness grows as well as its needs. It is not surprising that the XXI c. is considered the age of information, and the age of technology. If we do not keep up with the times, if we fail to keep up with the news, learn and absorb the news, then it is very difficult to find our place in life. In recent years, tremendous research has been carried out in all areas of science and technology, and unprecedented results have been achieved.

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In particular, it is not secret that cartography and geoinformatics are developing as branches of science, technology and production. The introduction of geographic information systems (GIS) into science has made the industry more rapid.

Actually, the study of demographic processes in different regions of the country on the basis of modern geoinformation technologies and cartographic methods, collection, storage, database creation, digitization, analysis, processing, registration, evaluation, automatic forecasting, researches on modeling, integration, and visualization based on spatial data has not been sufficiently studied. Therefore, there is a need to study demographic processes based on geoinformation technologies and cartographic methods.

The reliability of cartographic research is to ensure that its task is solved correctly, in other words, if the result is closer to reality, the research will be more reliable.

It is very difficult to assess reliability because the result obtained is based on many reasons: theory of errors, cartometric calculations, mathematical statistics, and so on. It should also be noted that some results do not have clear evaluation criteria, they can be evaluated only on the basis of scientific experience and on the basis of the researcher's academic degree.

Therefore, a separate approach is required for each event in determining the level of reliability of scientific and practical tasks solved using cartographic research methods.

Moreover, the development of modern methods of mapping is directly related to the development of geographic information systems and technologies.

Modern mapping methods are online methods of data collection that ensure the reliability and modernity of databases on maps created on the basis of geographic information systems and technologies. The modernity of the data on the created maps is characterized by an integral connection to the database, which is collected quickly and reliably using special software tools.

MATERIALS AND METHODS OF RESEARCHES

Demographic maps are important for the study and explore of demographic processes. Also, based on the results obtained, it will play an important role in identifying and evaluating the structural parameters of the population infrastructure, natural conditions, and socioeconomic factors based on innovative approaches.

One of the main objectives of GIS technology is the development of thematic maps and plans, their processing, databases formation, integration and their visualization.

Today, there is the activeness of the methodological and technological aspects of the new geoinformation cartography in the field of cartography [*Abdurakhmonov, Inamov,* 2018].

The importance of geoinformation cartography and geoinformation systems is significant in creating databases and digital maps based on GIS software instead of the analog methods for creating maps [*Sabitova,* 2009].

It should be noted here that another great feature of GIS software is that a cartographic basis for the map being created will allow you to quickly and efficiently generate all-subject maps using statistics. This requires the creation of a large-scale cartographic basis from the map scale to be created.

GIS technologies are a key tool in demographic mapping. At the same time, each demographic data is represented in separate layer by the direction. All data presented on the basis of demographic digital mapping layers compiled in GIS software will be analysed and will automatically generate forecast maps in the future. Fig. 1 shows the examples of the advantages of GIS technologies in demographic mapping. It focuses on the advantages of GIS technology to ensure the readability, visibility, quality and other advantages of thematic mapping based on software systems and geosciences.

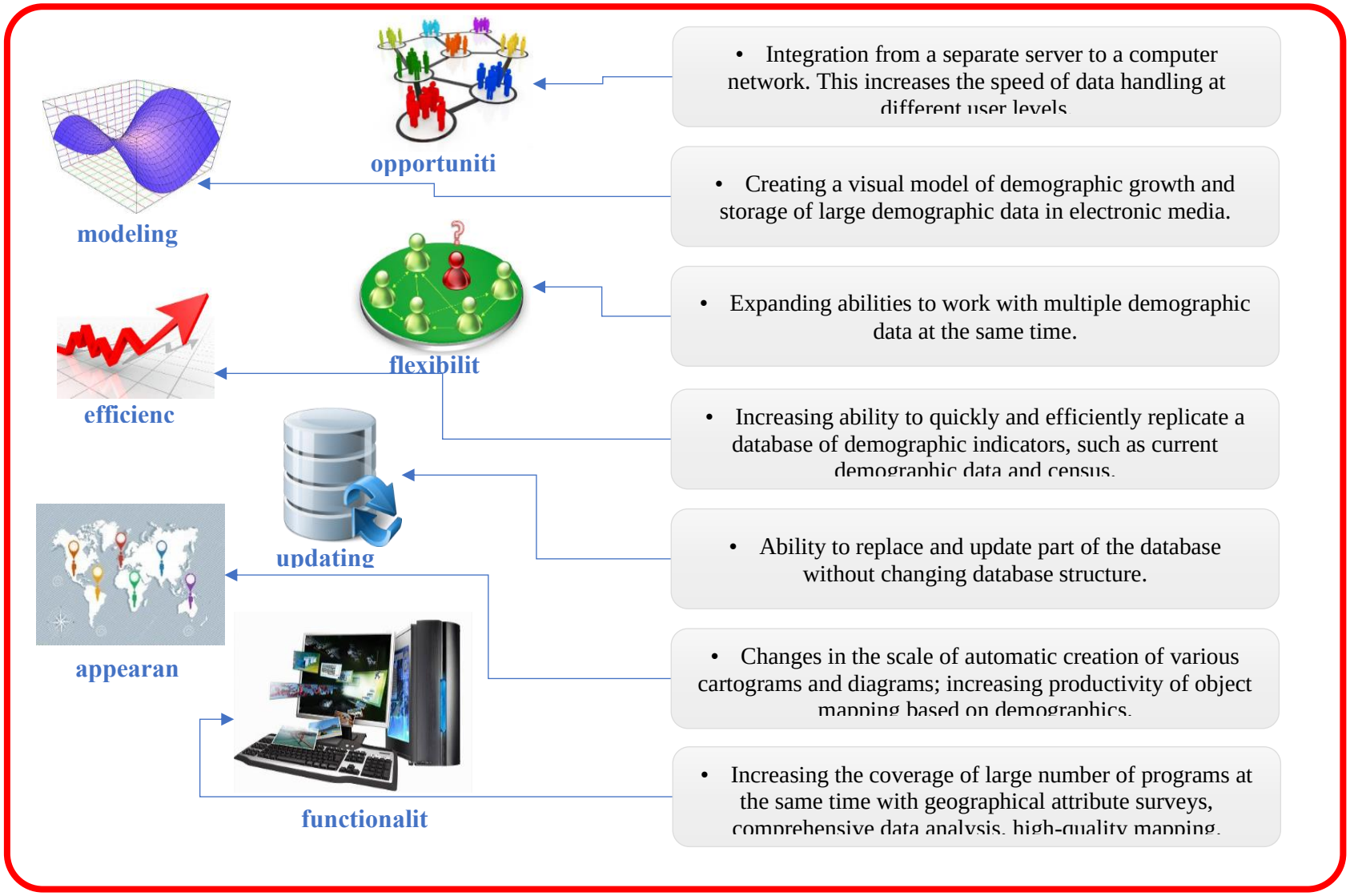

Fig. 1. Advantages of GIS technologies in demographic mapping

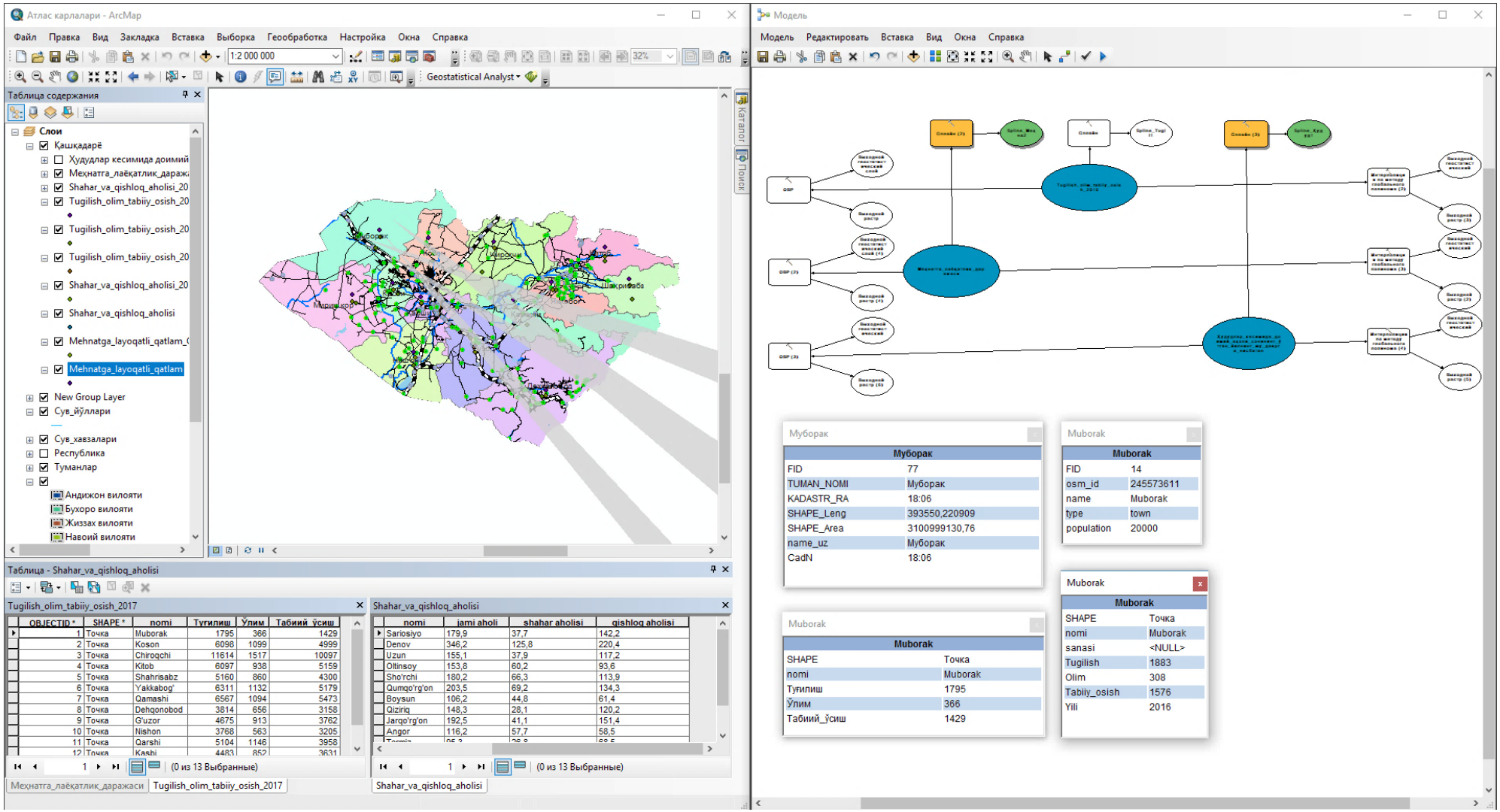

Fig. 2. Database management in ArcGIS software

Advantages of GIS technologies in mapping demographic processes include functionality, scalability, visibility, ease of updating, efficiency, flexibility, modelling, compactness, and other features of the maps. The benefits of GIS software also guarantee the completeness of maps being created.

It is desirable to use the materials of regional statistical departments based on the data of regional, district, and rural citizens' gatherings to obtain accurate data on the population of the southern region. In general, demographic mapping is more complex, it is important to pay close attention to the relief, hydrography, transport systems, and boundaries of the area in which the map is being created. Demographic maps made in Uzbekistan are mainly maps of complex and educational atlases, which are small-scale [*Tojieva*, 2010], cannot be sufficiently accurate.

In this research ArcGIS and MapInfo software have been widely used to create, edit, update, store and process cartographic data. In general, from the point of view of accepted GIS terminology, these programs also have a database management system (fig. 2).

Software with all the capabilities needed to create a map that describes the current state of demographic processes in the region is selected (fig. 3). Creating a high-precision map based on the selected software requires you to fill the database with accurate and reliable sources.

It is also important to use aerospace photos to indicate the location of the population and their characteristics on demographic maps, as it allows separating settlements and its functional characteristics are much easier [*Mirzaliev et al.*, 2009].

In recent years, automated methods for duplicating maps have been developed and implemented. In order to speed up the mapping processes and improve their quality, a method for printing map titles and various major inscriptions on adhesive paper was developed [*Musaev et al.*, 2015].

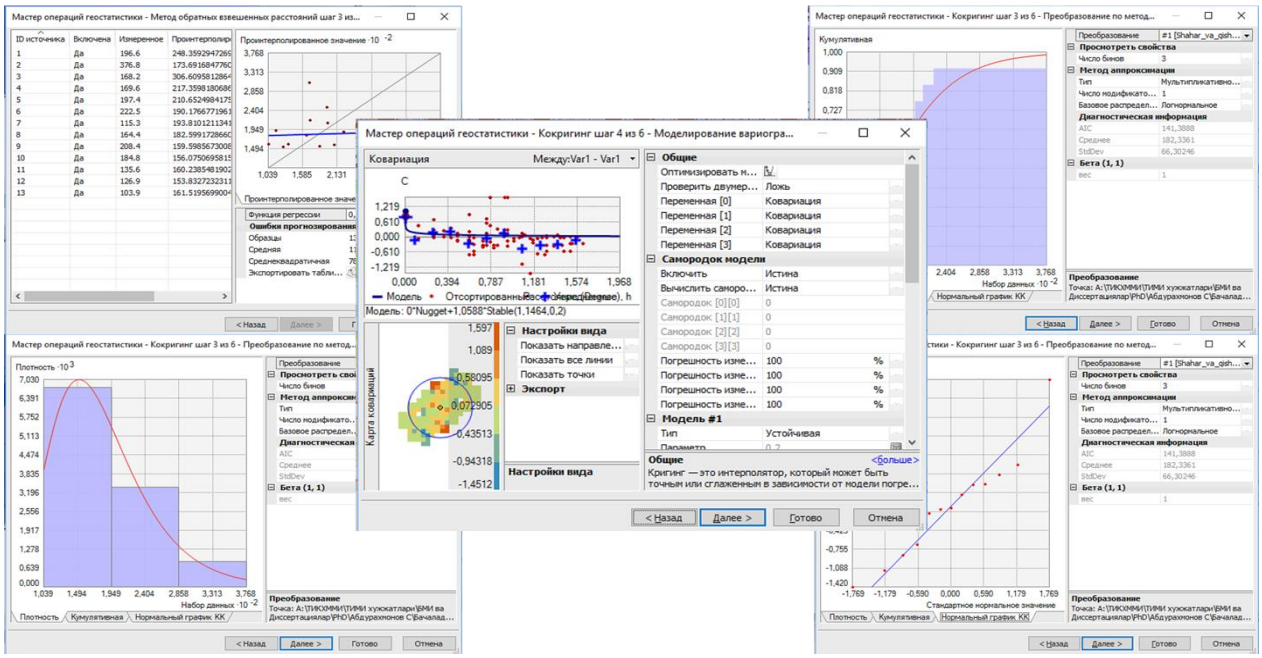

Fig. 3. Analysis of demographic processes in ArcGIS software

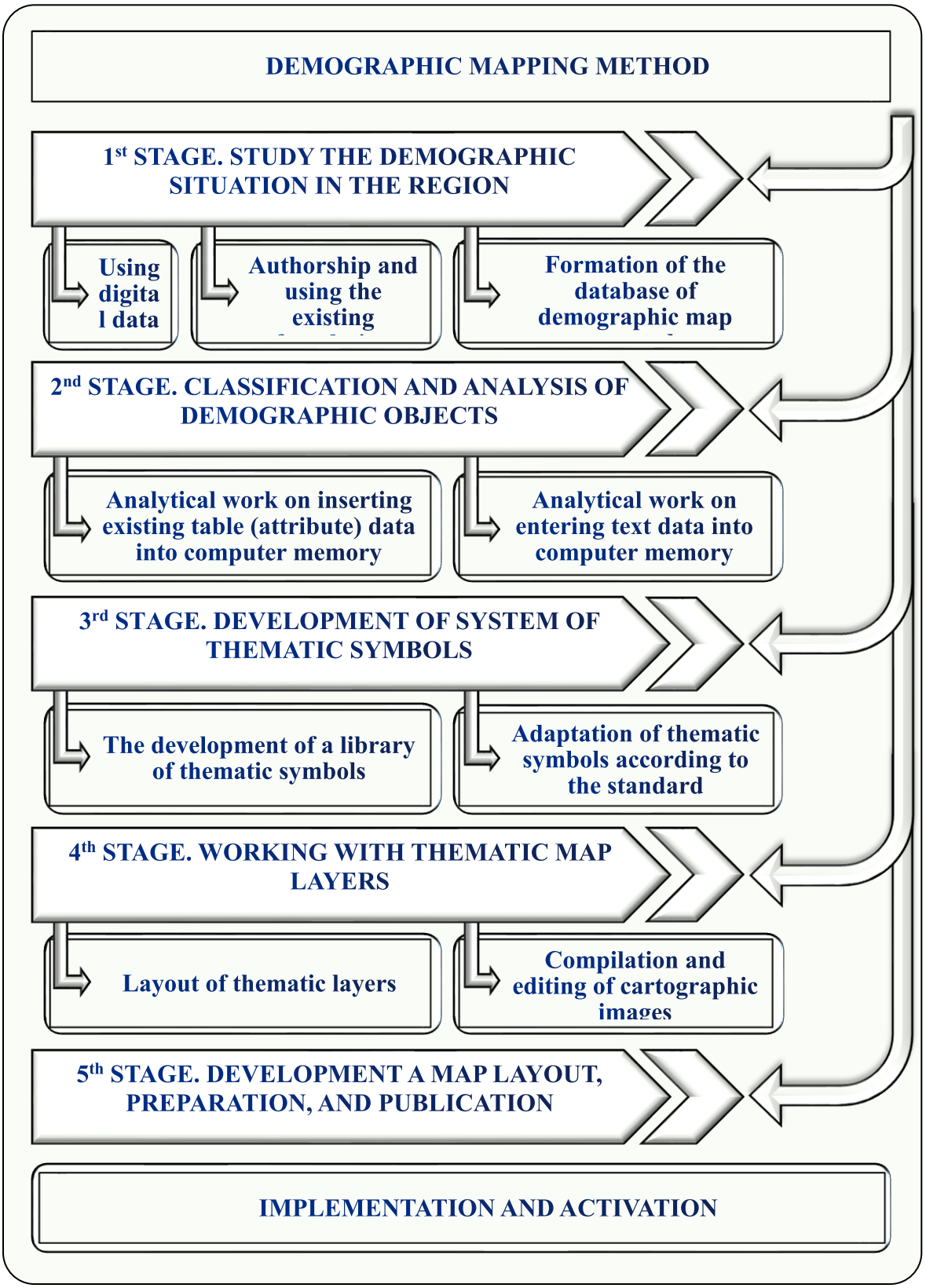

Fig. 4. Demographic mapping method

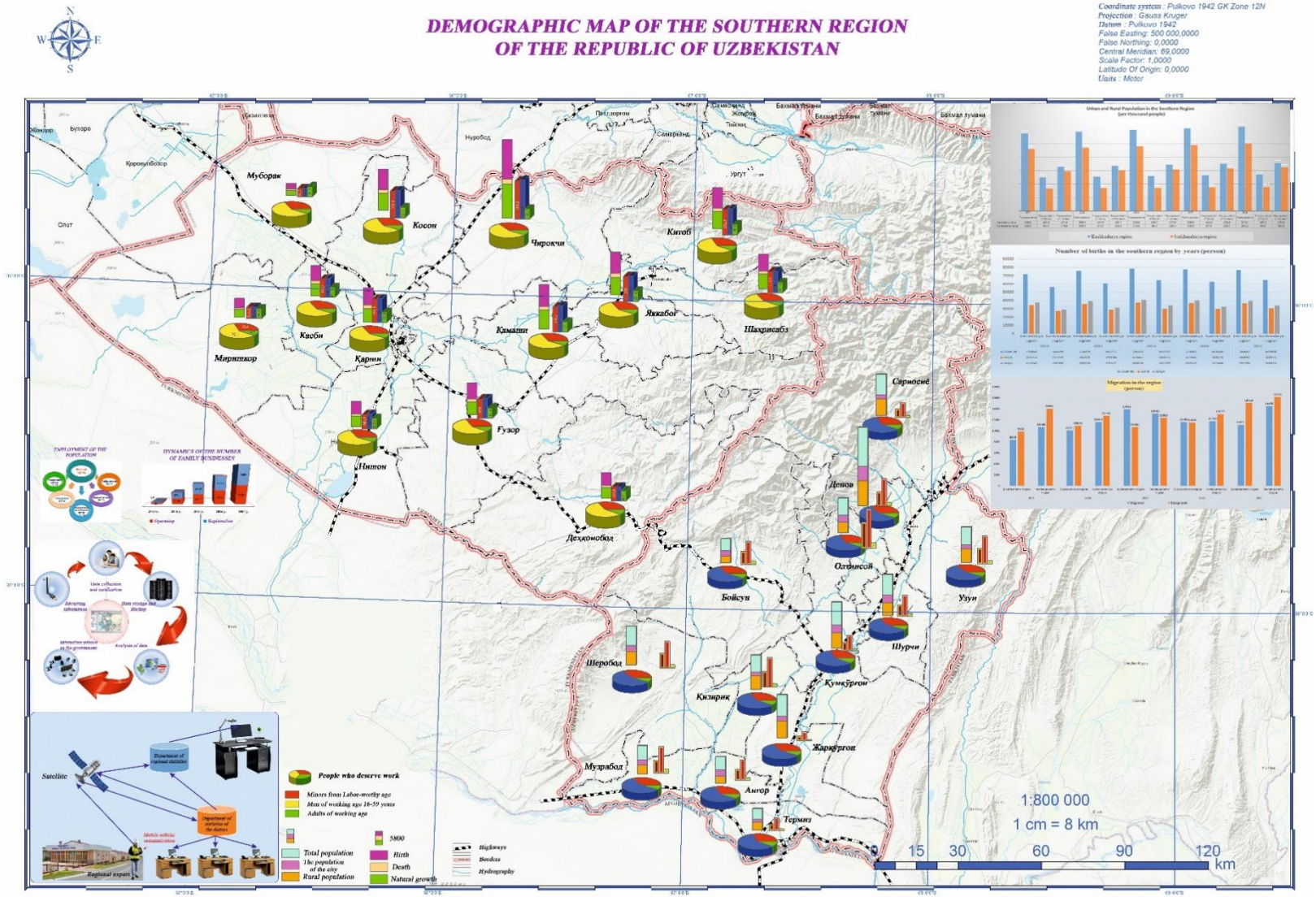

Fig. 5. Digital demographic map of the Southern region of the Republic of Uzbekistan

Mapping of demographic processes on the basis of GIS software is aimed at a number of practical tasks and research related to the population. In the periodic demographic mapping process based on the developed demographic mapping technology, the increase in the accuracy of data in the creation of databases and the speed of data collection is proved.

It will also improve the classification and analysis of objects, the development of a system of symbols of the created maps, the accuracy of working with thematic layers of the map, the development of the map layout, its preparation for publication and printing.

When creating population maps, the work is based on one system. Based on this, the developed demographic digital mapping technology will improve the quality of electronic digital population maps. The structure of population maps using special GIS software and cartographic research methods allows to improve the speed of analysis, processing and forecasting of information on maps.

In general, it took almost 8 months to develop this demographic mapping technology based on completing the tasks mentioned in the results of research and their discussion part of the paper.

RESULTS OF RESEARCHES AND THEIR DISCUSSION

The study shows that there is a need to develop a new method for mapping a new generation based on GIS technology, reflecting demographic processes. Based on this, the following demographic digital mapping method has been developed (fig. 4).

The sequence of tasks on the implementation of demographic mapping method is as follows:

1. Study the demographic situation in the region. At the same time, digital data is collected and databases are formed with the accumulation of copyright authorities, stock maps, and remote sensing (RS) materials. The scope of work at this stage also includes the process of geographical study of the demographic situation in the selected region.

2. Classification and analysis of demographic objects. In this stage, existing tables (attributes) and text data collected are entered into the computer's memory.

3. Development of a system of thematic symbols. In this case a bibliography of thematic symbols describing demographic processes as well as a legend based on the standard bibliography of thematic symbols describing events and phenomena in the area is created.

4. Working with thematic map layers. In this case, the thematic layers are correctly arranged in the selected sequence, and mapping and editing of cartographic images is performed.

5. Once the above steps have been successfully completed, the map layout (boundary of the image area, its placement relative to the map frames, map title, scale, legend, various digital and text data, tables, graphs, additional cross-maps etc.) will be developed, and publication will be done.

Based on the abovementioned stages, a systematic method has been developed to analyse the demographic situation in the southern region and its digital demographic map has been created (fig. 5).

CONCLUSIONS

It is possible to create digital maps of population in different directions based on the techniques of demographic digital mapping method developed above. When mapping demographic processes in GIS software, the data is digitized and displayed on a computer screen, which involves complex editorial preparation. Maps numbering is performed by scanning cartographic materials using custom objects and at the end by converting raster data into vectors.

In the periodic demographic mapping process based on the developed demographic mapping technology, the increase in the accuracy of data in the creation of databases and the speed of data collection is proved.

It will also improve the classification and analysis of objects, the development of a system of symbols of the created maps, the accuracy of working with thematic layers of the map, the development of the map layout, its preparation for publication and printing.

When creating population maps, the work is based on one system. Based on this, the developed demographic digital mapping technology will improve the quality of electronic digital population maps. The structure of population maps using special GIS software and cartographic research methods allows to improve the speed of analysis, processing and forecasting of information on maps.

GIS technology allows us to work with databases and maps in an integrated way, and an infinitive number of other tools. We can see this in the creation of maps and plans, their processing and data integration. Mapping demographic processes based on GIS technologies aims at implementing a number of practical tasks and research related to population.

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