Model of research of sociodemographic structures

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Abstract

A model of sociodemographic structures research is presented in the article – it is a multistage methodology, consistently analyzing in several hierarchy levels sociodemographic structures as one sociosystem. Customary in social and population researches cluster analysis are still very rare in this science, however, popular in physical sciences, typological analysis are used in it. It has been stated that in order to make a model more ideal, urbanistical physical structure component should be included in it in the future.

Keywords: demography, sociodemographic structures, population, typological analysis, census, sociosystem.

1 Introduction

GIS usage has already become irreplacable method of physical sciences research, however, in social and population researches, GIS usage, although it is more and more frequent, however, is still often superficial and satisfies with just simple spatial analysis or making of individual cartograms of main analyzed characteristics. Meanwhile, more complicated GIS models, applied by using more than one GIS analysis method, by analyzing together in complex all group of population of interest characteristics as a united sociosystem, are still rather rare.

The presented in this article model is a research methodology, enabling to know in complex sociodemographical population structures.

2 Case study: region and data

A case study has been performed for the demonstration of the suggested model. The spatial scope of its research is three largest cities of the Republic of Lithuania. The cities were chosen for methodology testing not by chance – namely they are main centers of attraction, where particularly many different social, public, cultural and ethical groups and communities live. They all live in a small territory – close to each other, often very mixed. All these groups make up highly various and often fragmented structure of cities population, where problems often occur – some groups separate, the inhabited by them territories start to degrade (Vaughan, 2018). Thus, it is very important to know in detail the structure of cities population and its spatial differentiation, to observe, if some territories do not gradually become social ghettos, and having noticed that – to prevent them in time.

Three largest Lithuanian cities – Vilnius, Kaunas and Klaipeda have been three the most important cities in current territory of Lithuania since old times, where the main political, economic and cultural potential of the country is concentrated. In case of our case study, it is particularly important that they are all very different, performing different administration and other functions. These three cities also had different history, which conditioned different their present sociodemographic state –in the interwar period three biggest cities of present Republic of Lithuania belonged to three different countries (Kaunas – to Lithuania, Vilnius – to Poland, Klaipeda – to Germany).

Sociodemographic data of census of population of Lithuania of 2011, which are provided in detailed grids – 250 m. x 250 m. (6.25 ha), were used for case study (Statistics Lithuania, 2019). Such data particularity enables not only to obtain particularly detailed knowledge about sociodemographic population structures, but also creates a larger take on of the analyzed territorial units (in this case – grids).

3 Methodology

The suggested model is a multistage methodology, consistently analyzing in several hierarchy levels sociodemographic structures as one sociosystem and relations inside the system itself. The essence of this model is rather simple: characteristics of one family (having analyzed them individually before) are joined by using cluster analysis, this way distinguishing demographic, socioeconomic and ethnic structures, and later they are joined in higher levels typologically already.

The suggested methodology may be divided into the following several stages:

0. Data preparation and re-classification. In case of Lithuanian data, its individual re-organization was necessary, since original data were provided in intervals of 10. Interval data is understood by GIS as text information, and analysis or calculations can not be made from it as such, thus, data had to be re-classified by making an average. Having done this, a minimal population was entered in a grid cell in order to avoid distortion (note that an average of 10 interval is taken, thus, an error of 5 is possible) – 50 residents, cells which did not reach

this threshold, were eliminated from analysis. The less is the population, the bigger error is possible, thus, a step of 50 has been chosen as the most optimal possible option.

I. Spatial analysis of individual sociodemographic (quantitative) characteristics. Analytical maps of individual structures are made.

II. On the basis of cluster analysis, appointment of territories (in this case - grids) to certain classes, distinguishing by relatively homogeneous set of characteristics of one family (age groups, native language, source of living), this way distinguishing demographic, ethnic and socioeconomic structures. Due to rather large take on, a method of cluster analysis k – means was used (according to Euclid distance). It has one disadvantage – the future number of classes must be indicated in advance, thus, the structure may be advised artificially. In order to distinguish the classes as naturally as possible, cluster analysis was performed for each structure many times with different number of classes, then, a variation, which reveals best the differences of individual classes, is selected according to their standard deviation and classes averages. Thanks to cluster analysis, similarities and differences of structures are revealed in all three analyzed cities.

III. Typological joining of the distinguished demographic and socioeconomic structures, by distinguishing the types of already sociodemographic structure. Typological analysis is common in physical researches, especially in physical and landscape geography, however, it is still hardly used in social and population researches. Thanks to it, qualitative demographic and socioeconomic structures classes (made in stage II) can be joined and typical to both of them types, distinguishing by equal, already sociodemographic structure, may be created.

With the help of typological analysis, unlike cluster, classes, distinguishing not only by general features may be identified, but the least typical, extraordinary combinations, showing the scarcity of the phenomenon and certain deviation from norm, may be determined as well. These deflections are usually called in social sciences deviations (looking from GIS and statistics perspective, they are simply outliers). In most cases, distinguishing of deviations has certain logical meaning as well – if the territory is attributed according to the age of its population to a group of young people, and according to the main living source - to pensions (types E1 and E2) – this gives us a clear prompt that something is wrong with these territories.

IV. Typological joining of sociodemographic and ethnic structures, by distinguishing, so called, population structure. A ration of ethnic classes with sociodemographic structure is assessed at the same time.

All stages of the methodology are shown in figure 2.

4 Results

The suggested model distinguished the regions of three largest Lithuanian cities according to the age, socioeconomic status and ethnic composition of the population, determined main regularities of sociodemographic structure in them as well as evaluated, which territories may be problematic (deviations). Differences of sociodemographic structure in the regions, distinguishing by different ethnic composition were also determined with the help of a model, which clearly shows that sociodemographic state of the regions, distinguishing by non-Lithuanian ethnic composition, is poor. Many young and of average age population live in them (territories are attributed to young and aging classes), however, much larger part of population live from pensions than in the regions, where Lithuanians or population of mixed nationalities (several languages) of the same age live. Detailed results of analysis by different ethnic composition are shown in figure 1. Map of population structure of largerst Lithuanian cities is presented in figure 3.

5 Conclusions and future work

The study revealed that there are large sociodemographic differences between territories with different ethnic composition. One of the reasons, which might have conditioned the mentioned above differences of sociodemographic structure between the territories where Lithuanians, Russians and Polish live, is their urban structure. Since Russian-speaking population basically moved to Lithuania right after the Second World War, during mass industrialization of the country, most of them live in industrial territories, which experience a recession after the destruction of the USSR, since large part of the developed during soviet times industry did not withstand competition and collapsed. Meanwhile, most of Polish population live in old rural territories, which now became the outskirts of present Vilnius city. Thus, it is highly possible that poor sociodemographical state of the inhabited by Russians and Polish territories is first of all conditioned not by ethnic composition of the territory, but the poorest urban environment. Then, ethnic composition would be not the reason of the problem, but rather additional circumstance, which makes the situation even more complicated, since the territories, inhabited not by Lithuanians, possibly distinguish by poorer knowledge of official language, which may be an additional obstacle, for example, in retraining. This may be checked by supplementing a model of sociodemographic structure cognition with a component of urban structure. A component of urban structure is intended already in classical models of spatial population researches (or social segregation) (Murdie, 1969).

Evaluation on how that component should be added to a model is namely the main task to be done in the future. Most likely, data, enabling to distinguish particular urban structure, should be taken (it is not clear yet, which ones exactly – georeferential basics, territories planning or copernicus urban atlas data) and to agregate it to the grids, describing sociodemographical data. After to make qualitative urban structure classes with the help of cluster analysis and to join them typologically with the distinguished structure of population. This would state many questions – won‘t there be too many types of new structure? How should such amount of data be visualized (Kashnitsky, Schöley, 2018)? We will try to find the answers to these questions already in the future.

6 References

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Figure 1: Results of analysis.

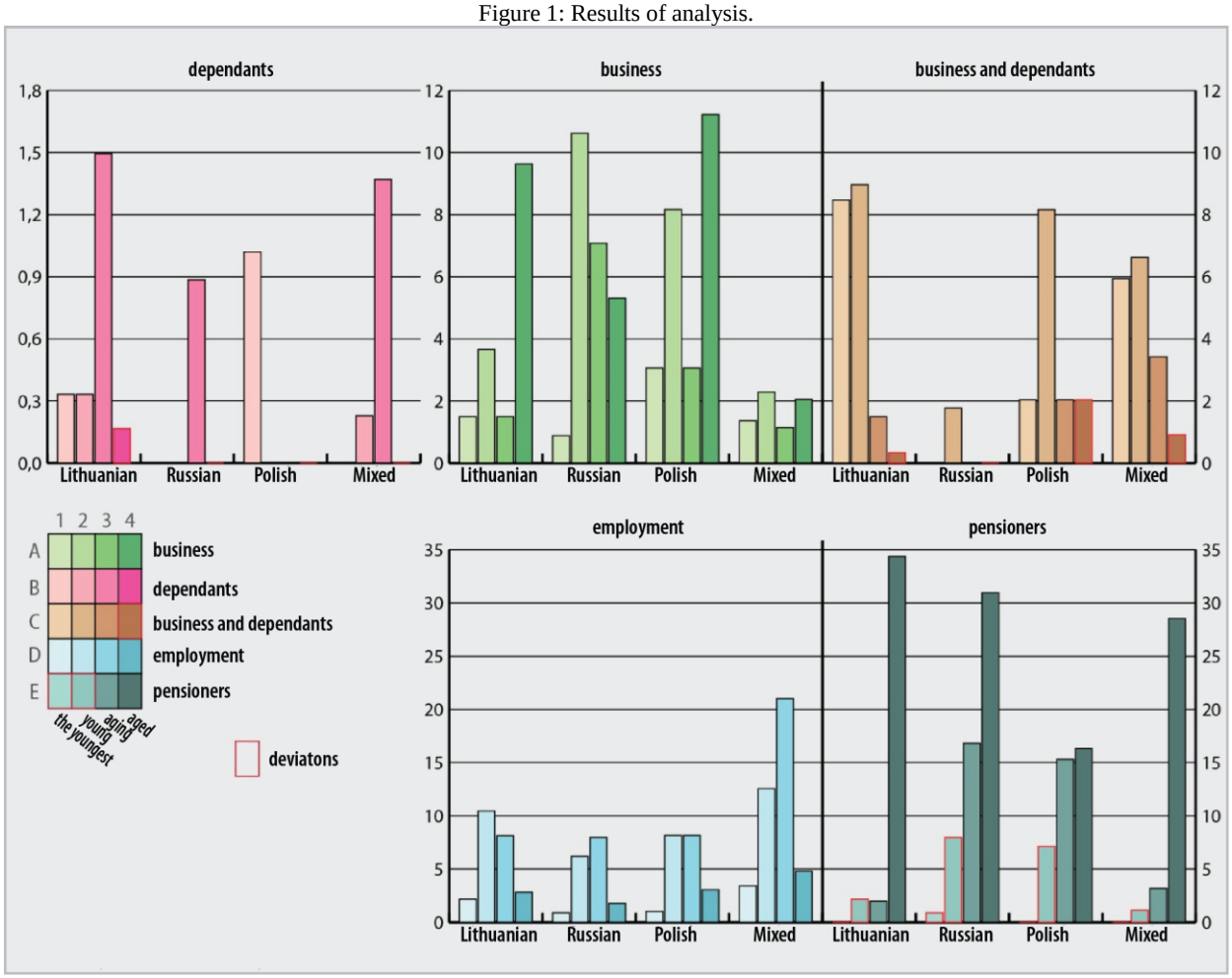
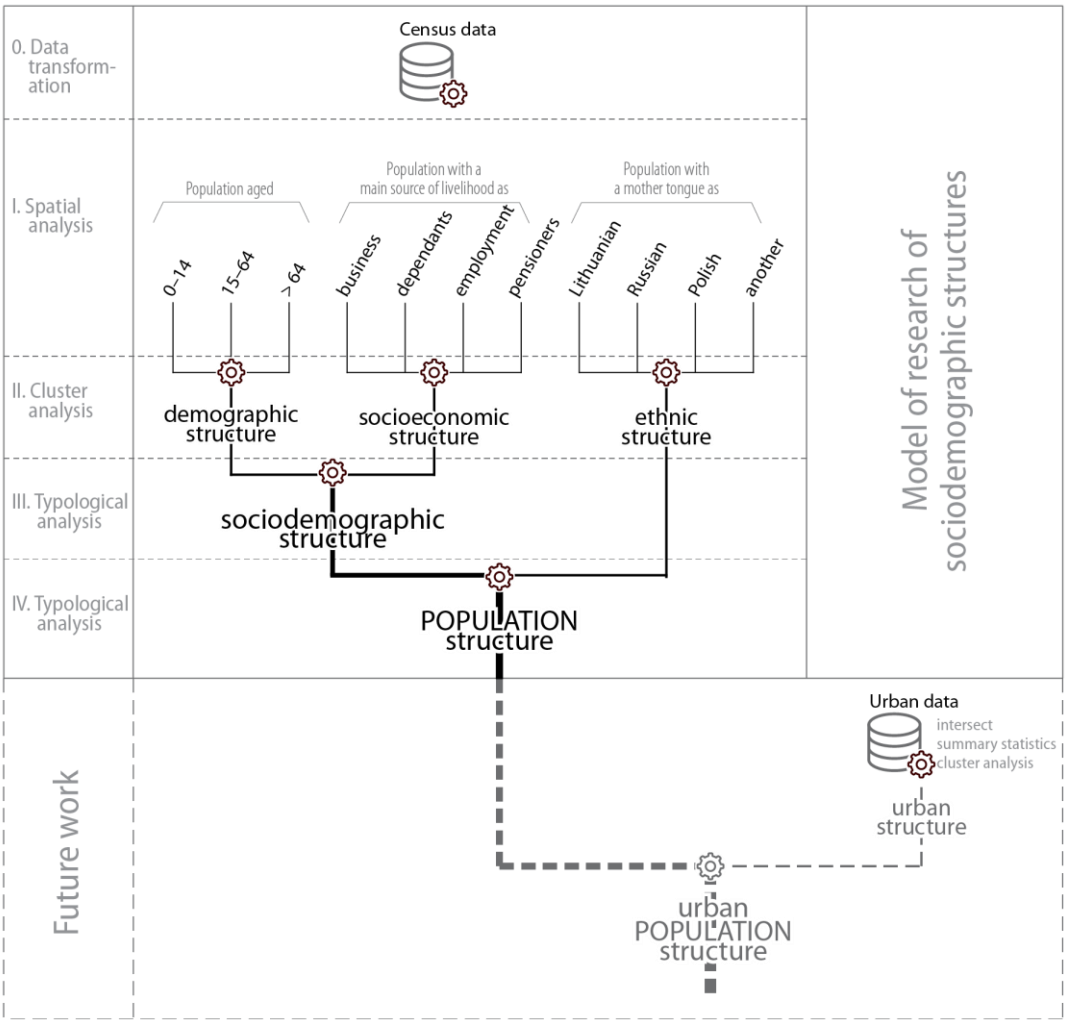


Figure 2: Model of research of sociodemographic structures.



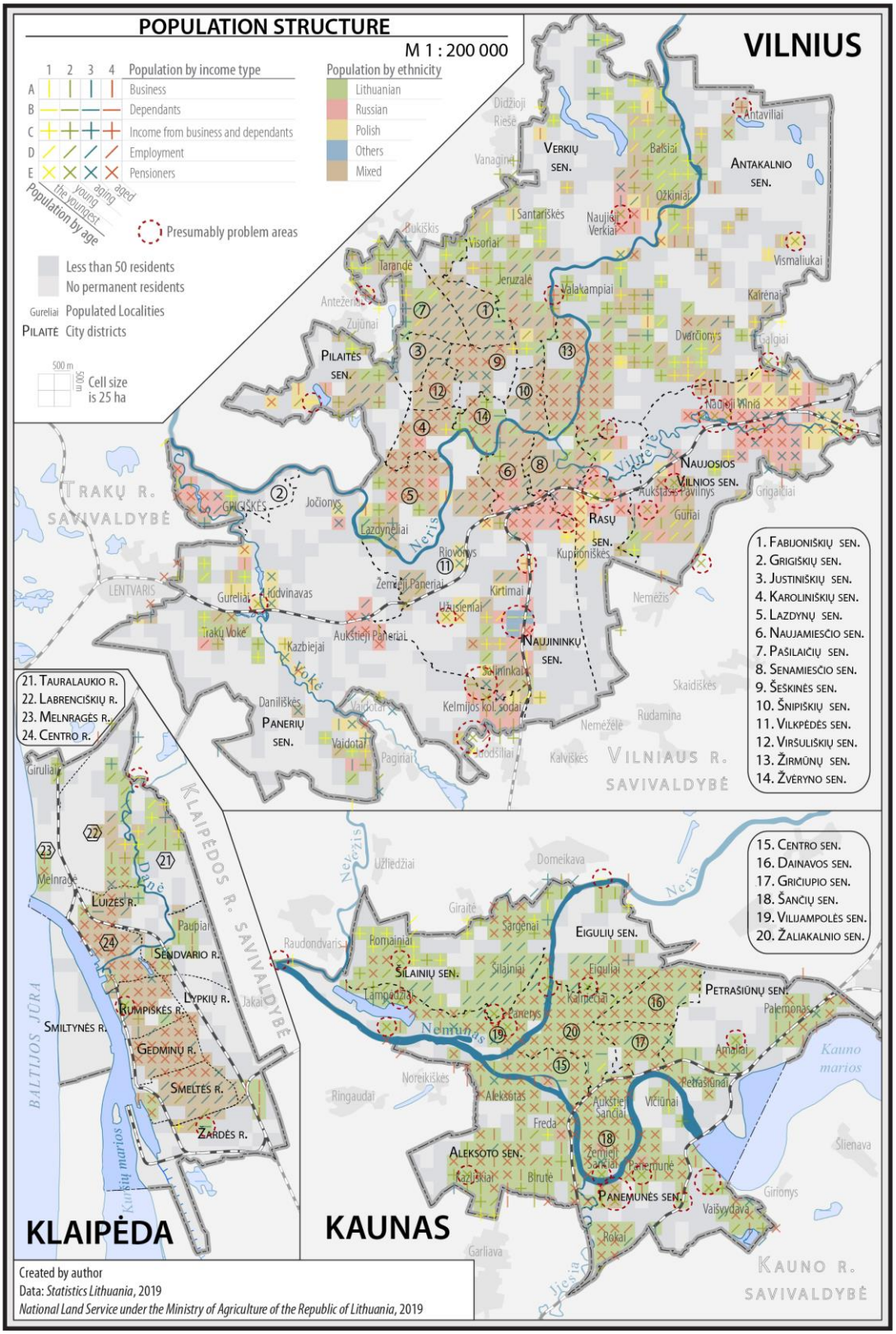


Figure 3: Population structure of largerst Lithuanian cities.