

New Prospects for Urban Planning Service Systems with Use of GIS Tools and New Data Sources Linked to Reference Databases

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1 ABSTRACT

Spatial management at present has the opportunities to obtain support by information in unusual scale. Such prospects are open by using the tools of urban spatial information system and possibility of linking the reference data with new sources of information emerging in the development of e-administration. As the examples of establishing such a link, and of the variety of analysis made available consequently, two cases of processing data from thematic databases based on Wrocław urban spatial information system are presented.

2 INTRODUCTION

Development of e-administration reveals chances, often unconsidered, of achievement of new dimension in analyses, planning and management of urban systems. They let us open ways of acquiring and processing of detailed information with spatial reference from the sources of data, which were inaccessible until now. If, as it often happens, the particular information concerns individuals (e.g. inhabitants, investors, clients, vehicles), their activities and registered events, but the database includes whole population or its significant representation, then it represents the ideal base for analyses and modelling of phenomena and processes, for construction of models of city or its subsystems. Research of human behavior can allow to adjust better for requirements of communities, but also it enable determination of spatial policy towards prevention of undesirable spontaneous processes.

One possible kind of the source of information are the existing formal registers (such as the records of inhabitants' accommodation, or records of economic activity), due to the mandatory recording of the different types of activity or of use of services of state or communal administration. These data include information of the registered events' addresses, which allow for allocation of its spatial reference, with proviso that the conformity with reference data is improved.

Furthermore, information may be acquired from electronic systems of services, emerging in process of development of e-administration, like the further presented system of recruitments to schools in Wrocław. The key factor is that data should be acquired by imposing the appropriate way of registering the information.

Efficiency of preparation of input data for analyses depends on conformity of address data model, on improvement of reference data, on making the addresses dictionaries available, and consistent adjustment of registers (or other thematic bases) to the created standards and dictionaries. In the context of the present state of address information incompatibility it is essential to apply the emergency mechanisms of adjustment of the incompatible data.

3 CREATION OF PREMISES FOR PLANNING OF SYSTEMS OF URBAN SERVICES ON EXAMPLES OF DEMOGRAPHIC ANALYSIS AND OF PROCESSING THE DATABASE OF SCHOOLS AND THEIR PUPILS IN WROCLAW

For the presented examples of analysis the reference data (address database) modernized in the process of extension of Wrocław urban spatial information system (SIS) has been used, along with reports from two bases in the form of table including address information, namely: registers of inhabitants accommodation, and database of electronic system of recruitment in schools via the Internet.

Moreover, the analysis referred to the division to the urban units, which are used in monitoring and planning the development of the city, as well as to other thematic layers of SIS (e.g. landuse - current status and projected development, model of transportation network, characteristics of the cost of displacement).

Reports from the registers of inhabitants accommodation allowed for examination of demographic and spatial structures and of internal migrations of inhabitants of Wrocław. The yearly examined data concerned the inhabitants of Wrocław, domiciled in permanent or temporary residence in the time-span of the last decade, taking into account the age and gender structure, as well as the migration of residents, with

recognition of the age and gender distinction as above. The data were aggregated to address point. Geocoding of information on place of residence and its change as well as examining the spatial relationships with other characteristics of the places (e.g. distance from the city center, type of residential area), provided new information on the demographic and spatial structure of population, trends and dynamics of migration processes within the city and beyond its borders.

Additional information was gained from the joint analysis of information about migrants person, which embraced the origin and destination place of migration characteristics, and migrations' length. Received information both provides characteristics of particular sites, and allow to define the quantitative indicators, which form the basis for the forecast elaboration.

The demographic analyses and forecasts are object of interest of the majority of the municipal authority's Departments, as a base for definition of needs for publics services (health, social care, education), and of requests for media (water, heating, gas, internet).

The size of the age groups population as forecast for the subsequent years, and the observed differences in their density in different areas, are essential for planning of the number, of the spatial distribution, and of the time-related changes of particular types of services.

Fig.1 and 2 illustrate the examples of such demographic analyses (Brzuchowska J. ,2009).

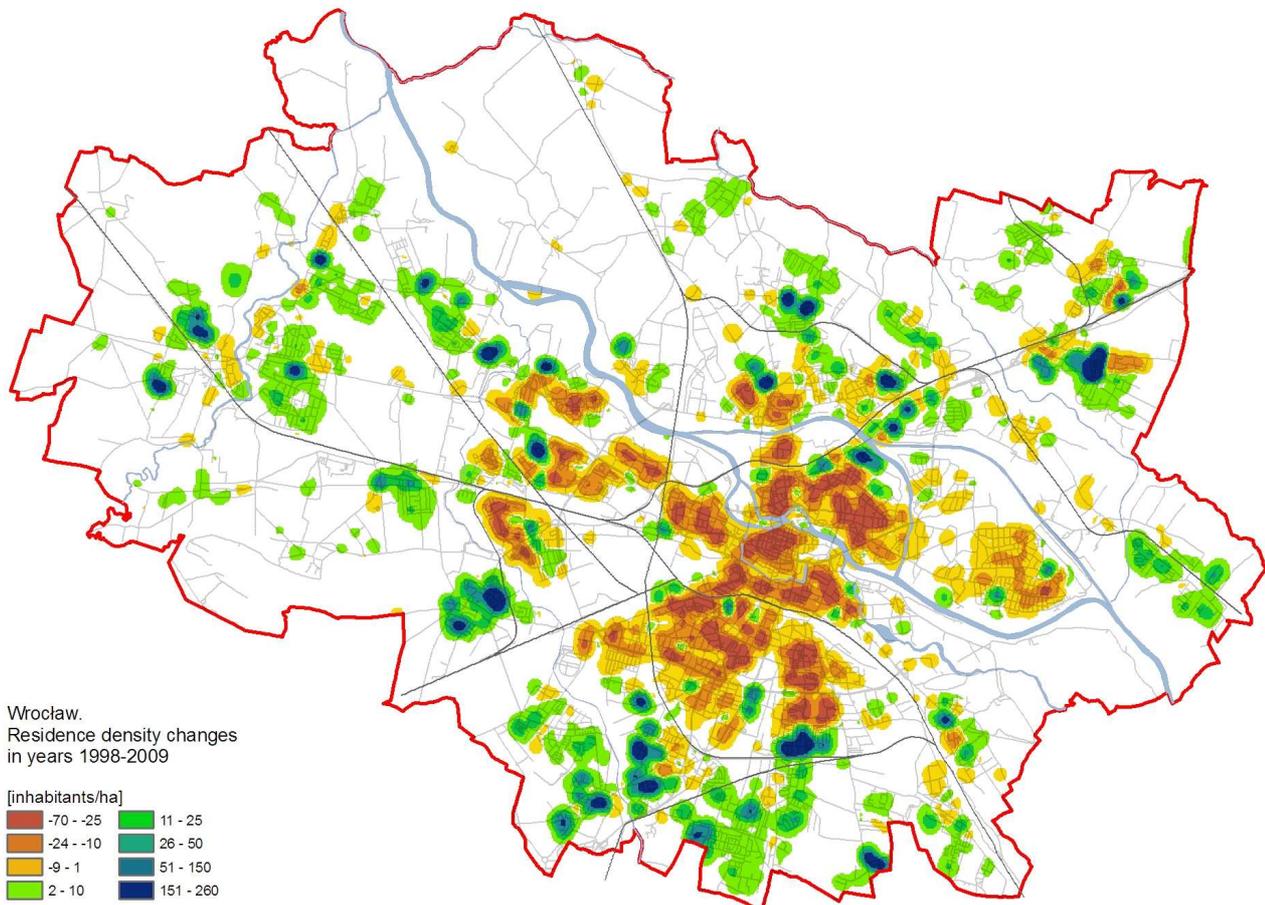


Fig. 1: Map of residence density changes in the area of Wrocław in the years 1998-2008, Elaborated on the basis of the permanent residence registers

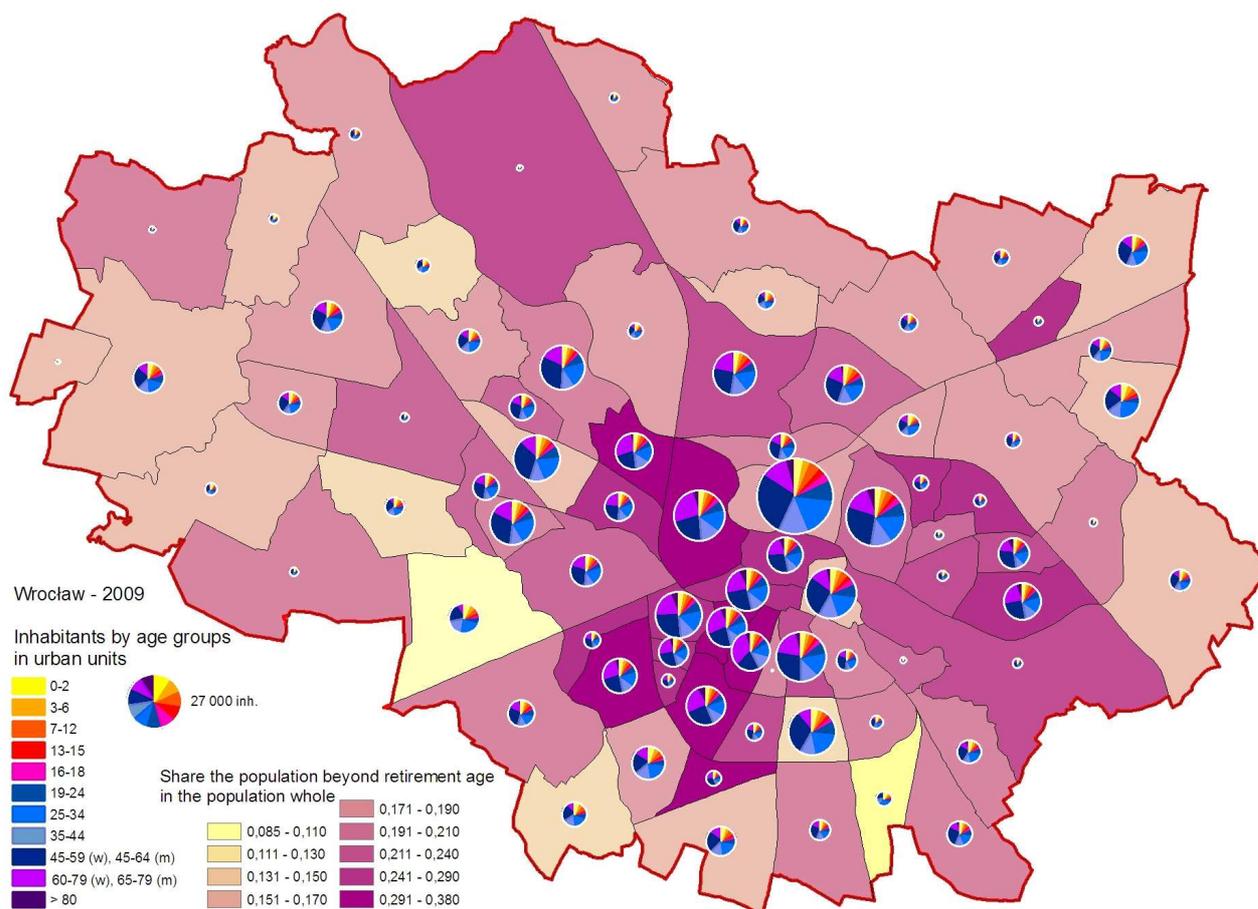


Fig. 2: Distribution of inhabitants of Wrocław by age groups ratio in urban units. As at 31 December 2009. Elaborated on the basis of the permanent residence registers

A detailed framework for examining the deployment of children in relation to the location of different levels and categories of schools has been provided by the database of system of recruitments to schools, which embraced the places of residence of each school's students, referenced to the address point or, in case of the suburbs of Wrocław, to a village.

The good cooperation of the recruitment system with the Wrocław urban SIS data sets and tools is the result of several years of experience of users of the both systems, including their extensive application, and active cooperation in the modernization of the reference databases. Year by year the increase of the amount of the collected and processed information is noted, as well as the range of the analyses conducted. The above examples relate to the school year 2008/09.

Geocoding of objects was the starting point for conducting a series of visual and quantitative analyses including - among others - various images of the deployment of objects and their spatial relationships, the flow rate and the intensity of these phenomena, the study of diversification of the service indicators (spatial accessibility, distribution of commuting distances to the schools of different kinds and levels, the number of schools' attendants). Distributions of travel distances examined along with the deployment of citizens counted in relation to the school location, allow for the determination of the parameters for the simulation of home-education contacts. In this way, characteristics of both schools and zones of different type of residential area and inhabitants' socio-economic profile, were built.

Juxtaposition of data has allowed also for investigation of the compliance of school districts' ranges with areas of the allocation defined with assistance of GIS tools, and with the real spatial distribution of living places of each school's students.

The analysis provided the rationale for both planning a network of schools and the arguments for specific decisions concerning the maintenance or elimination of particular schools, or finding their substitute localization. The results' output allows also to identify the under-served areas.

Geocoding was used not only for planning and analyzing: in the recruitment process the evaluation of the place of residence of the child, and of its distance from the school of their choice, was considered.

The minuteness of the acquired information implies the search for new techniques of analysis and of the phenomena presentation. The examples of such attempts are to be found among the illustrations enclosed.

Figures 3 A and 3 C show, in various forms, where students of III LO (High School) school are recruited from. Figure 3 A and B present graphs of young people who commute to two high schools with different social profile. Fig 3 C and D, in the form of traditional cartograms, based on quantitative assessments, show areas with a population of greater degree of educational aspirations.

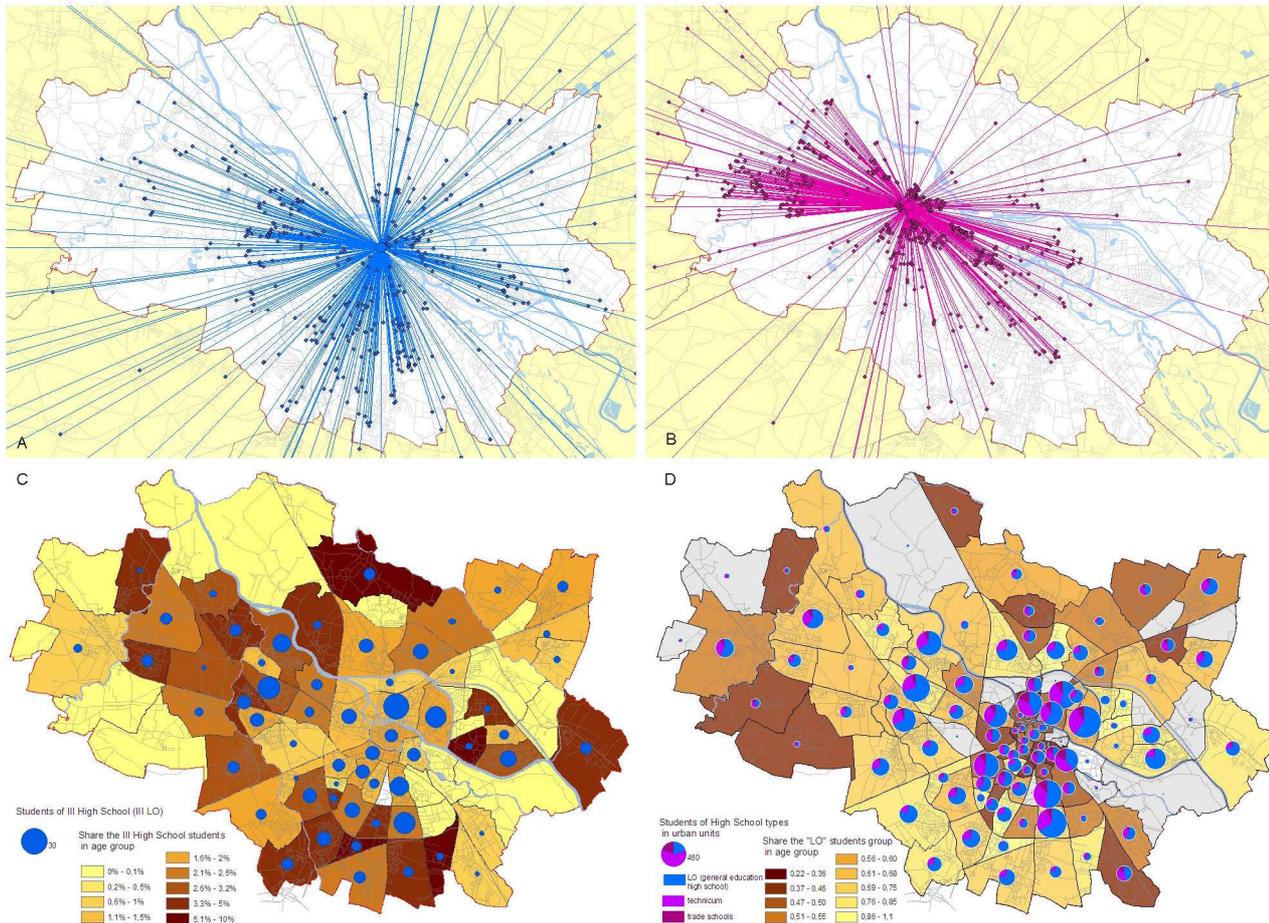


Fig. 3: Examples of analysis of the distribution of students: A) Graph of III High School students commuting to school B) Graph of VI High School students commuting to school C) Participation of III High School students in the age group (in the urban units) D) Participation of all high schools students in the age group

In the Figure 4 the spatial distribution of children commuting to different types of school is illustrated with use of a new version of trip-directional plans, matrix of displacements visualization method (Brzuchowska J., 2010)

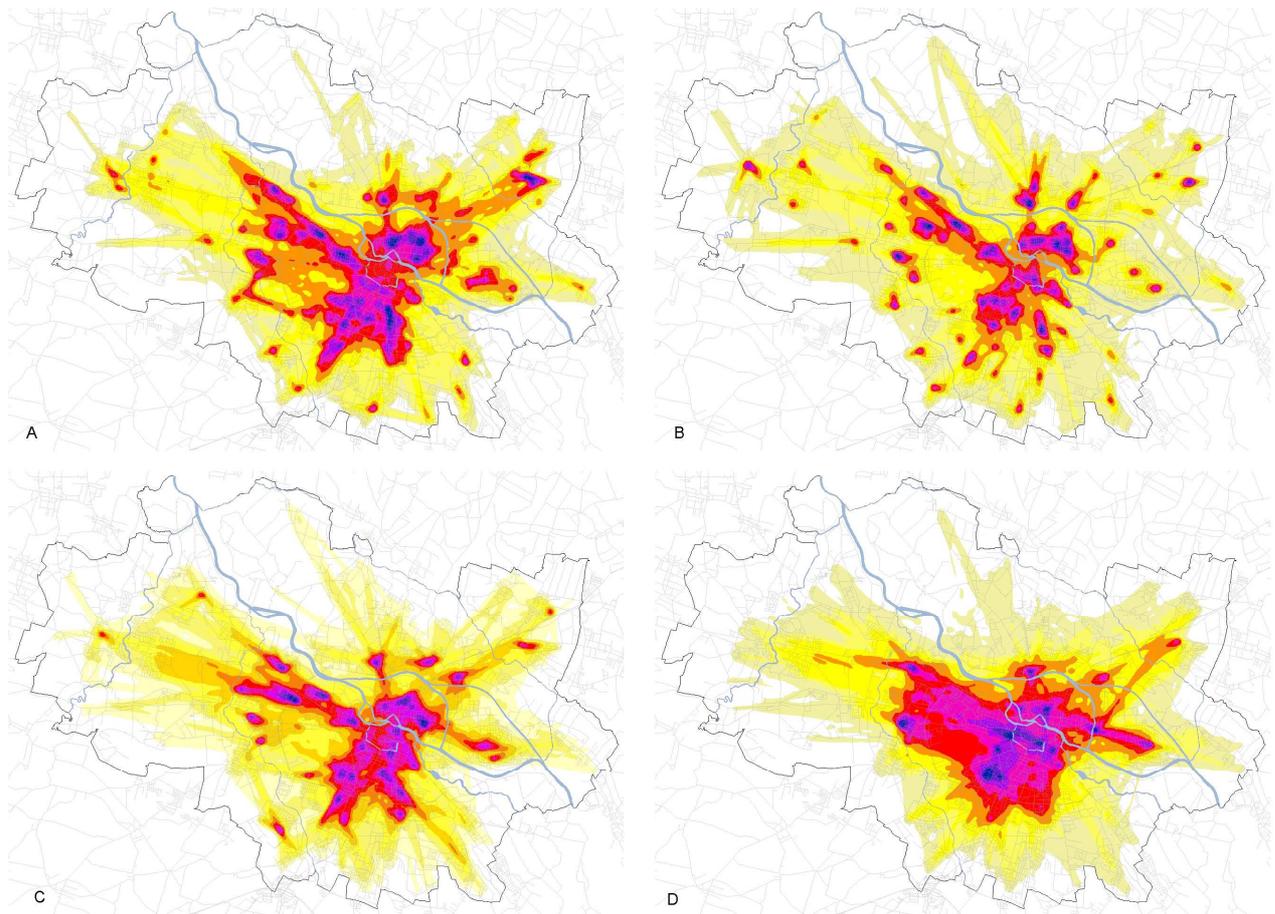


Fig. 4: Displacement density of children commuting to school of various level A) kindergarten B) primary school C) secondary school D) high school

4 CONCLUSION

Urban geoinformation systems are often used to record rather than for analysis of the information and for planning support. The new opportunities are a challenge for developers and users of geoinformation systems. They require imagination and expertise in the design and implementation of monitoring mechanisms and analytical tools. The efficiency of operation depends on the investment in quality of the reference databases, and on extortion of their compatibility with the other data. It requires a major effort, but it can give synergistic effects of unusually rich source of information supporting planning, spatial management, decision-making, and research.

5 REFERENCES

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