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THE STUDY OF LAND MANAGEMENT AND GEOGRAPHIC INFORMATION SUPPORT OF MUNICIPAL BUILDING IN UKRAINE

Розглянуті актуальні проблеми та методи земельного адміністрування і геоінформаційне забезпечення галузі міського будівництва для розвитку населених пунктів України відповідно до міст провідних країн світу. Розроблено методичку ведення та контролю міського будівельного кадастру в сучасних умовах на регіональному, державному та світовому рівнях.

Ключові слова: міський будівельний кадастр, земельне адміністрування, геоінформаційне забезпечення, управління міським будівництвом.

1. Introduction

The building cadastre is the one of most important information sources as to the indices, characterizing the city environment as an object for land management.

It is well known, that geoinformation system, degree of complication of the structure and volume of information must correspond to the degree of complication of the structure and scale of the managed object. Rather simplified understanding of municipal cadastre was considered till today, namely: a list (register) and map. But the modern city is a complicated object of management with multifunctional territorial structure, complicated multilevel complex of municipal economy branches. The structure of information model of Ukrainian big cities started to be formed only at the end of XX century. At the initial stage it consisted of hundred types of elements and dozens of parameters for their description. Geoinformation model of Ukrainian cities (Fig. 1) includes dozens thousands of attributes – elements, characterized by their parameters.

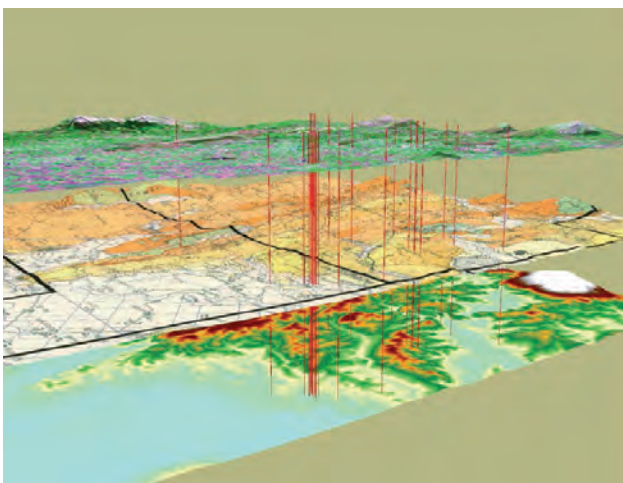


Fig. 1. Typical model of construction of city geoinformation system

It testifies to the extreme complexity of municipal information system, including the system of municipal cadastre of Ukraine. In the cities are numbers of informa-

tion and cadastre systems, which common feature is the orientation on the description of elements and phenomena of city environment, connected in one or another way to the city space, so they are in fact territory-oriented systems.

To make decisions that determine the processes of city development, it is necessary to have information about all created and existent on surface (soil, plants, buildings), under surface (geology, hydrogeology), and also over surface (microclimate, state of air basin and so on). The indices of population, economic base, type of city internal and external connections, bearing capacity of soils, engineer-technical conditions in preparation of grounds for building and so on [1].

2. The object of research and its technological audit

The work on creation of the system of municipal building cadastre includes creation of city planning data bank. Such work organization is caused by considerations of momentary advantage – by the fact, that the works on cadastre are described in the law about the bases of municipal building, are financed by local bodies, but the data bank is in fact needed.

It is the first problem, because organizational structure, program, technical and financial costs are calculated only for cadastre.

The management of process of city development is grounded on prospective models (Fig. 2), elaborated within the general city plan for remote prospect (for largest cities for 40–50 years). It is necessary for determination of principally possible standards and directions of social-demographic and territorial-planning development of the city, prospective development and placement of big objects of transport and engineer infrastructure of city and regional importance for the period of accounting term – 20 years and first term – 5 years.

The elaboration of such models is based on the data about state of city environment, demographic, social, economic, ecological, municipal building processes that take place in present time and also in previous period – 20–40 and more. At the same time the analysis of earlier forecasting and project works is needed.

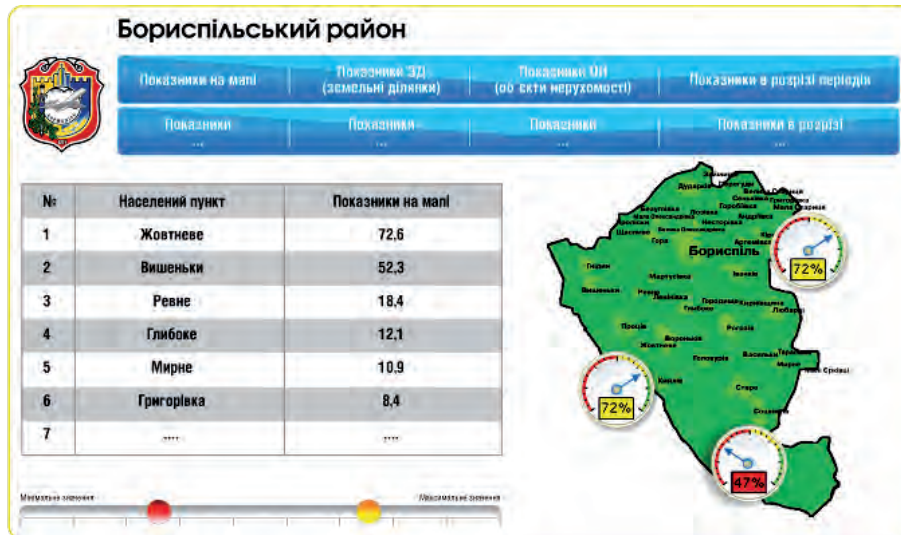


Fig. 2. Prospective model of management on example of Borispil district

The depth of forecasting period and retrospective analysis in time corresponds to the degree of complexity of buildings, time of building, capital capacity. For example, the project period for subway is determined as 50–70 years, tram lines – 10–12 years, trunk-roads – 7–10 years. It is clear, that these periods are connected with concrete experience. But it is well-known, to what extent conservative are the local municipal building traditions and to what extent limited are the material resources and financial possibilities of our cities.

3. The aim and objectives of research

Systematization and generalization of different approaches to creation of municipal building cadastre and main principles of the work in cadastre systems, used in Ukrainian cities; finding of possibility of solution of practical tasks as to the transport nets in general transport system of the municipal building cadastre.

To attain this aim it is necessary:

1. The introduction of land-managerial approaches in creation and realization of municipal building cadastre.
2. The elaboration of united geoinformation system of analysis of the structure of municipal building cadastre.
3. The generalization and structural approach to the system of space analysis and so on.

4. Research of existing solutions of the problem

It is known, that the data of municipal building cadastre, provided by the main normative bases [2], or SBN are not enough for making concrete decisions as to the planning and prognostication of development of a city [3] or its separate branches [4]. For that the information must be not in amount of cadastre but at least of municipal building data bank [5]. The municipal building cadastre is only the upper layer. The ratings about object are the type of object, its location, functional, metrical, technical, technical-economic characteristics and information about owner [6]. But the amount of information in cadastre [7] doesn't fully provide the managerial processes, especially,

in complicated municipal building situations with ambiguous decisions that need serious substantiations, search for optimal decision on the base of diverse method of municipal building projects processing [8].

5. Methods of research

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Under conditions of market relations formation in government economy, the leading specialists-city planners have doubts in expedience of centralized planning of city development, setting of certain temporal intervals in realization of municipal building programs that is accounting terms. Under today conditions the planned regulation of city development, centralized management of the development of city infrastructure objects, process of territorial-planning city development, regional municipal building system must be only improved. It is determined by the growth of the number of investors and also by the necessity of coordination, concentration of material and financial resources for creation of city infrastructure to realize the big municipal building programs.

The long-term building of big edifices (Fig. 3) influences not only the city budget but the state one in whole. As far as several or dozens of such programs are realized in the cities synchronously, with involvement of city costs, they all must be coordinated in time. The costs for building must be balanced in the general structure of costs for city development in years. Under conditions of limited resources (they are always limited), it is necessary to optimize the structure of their distribution in time – for 5, 10 years and sometimes more [9–11].



Fig. 3. Scheme of high-cost long-term municipal building

The calculations, realized in general city plan for remote prospect, must determine the directions and standards and also the general volumes of investments, necessary for balanced city development. For the period of accounting term – conventionally 20 years – general plan must determine the need in resources for realization of concrete programs: preparation to the developing of new territories, building of big elements of city infrastructure – bridges, detours, sources of power supply; objects of external transport – airports, railway detours, train stations and so on [12].

So, for the nearest 5–7 the program of development and capital construction must be grounded; it must be supplied with the real resources that must be planned too [13].

The municipal cadastre must supply the upper echelons of city authorities with information about the state of city environment, planning elements – housing, production zones, public centers, open spaces – natural complexes; systems of engineer equipment, transport, municipal economy. It must be organically connected with municipal information systems, including the general data base (GDB), bodies (services) of statistics, planning, projecting.

It is well-known, that creation of modern information systems in the cities started from organization of information support of AMS of different branches of municipal economy. In Kyiv and Kharkiv – PMWSE, HME, TT management, subway, Kyivproject, KharMetroproject and other. They all are not connected with each other till today and are oriented on the solution of bureaucratic tasks [14].

Creation of municipal building cadastre is aimed at providing integration of separated and isolated systems

on the base of introduction of united municipal standards of description of the subject fields of the management of city development, integral principles and standards of address connection of the objects of city environment that is «information infrastructure» (Fig. 4).

According to the regulatory documents, the data structure of municipal building cadastre includes information about the plots of land use (landowning). It is an address (location), functional use, name of owner (user), area, price (estimated cost) [15].

Cadastre includes the data about buildings and edifices as the objects of municipal building analysis at the different stages of projecting and planning works (general plan, planning schemes and so on), information about special scientific works and also real estate objects. It is connected with factual absence of private property for land and with fact that is edifice that is an object of economic relations till now [16].

In backward countries and in the modern ones with market relations the real estate object is a land plot with all edifices, located on it.

The structure of the data of municipal building cadastre (Fig. 5) includes also information about engineer nets and edifices. There is street-road net, water supplying, sewerage, heat, gas, electric and other nets.

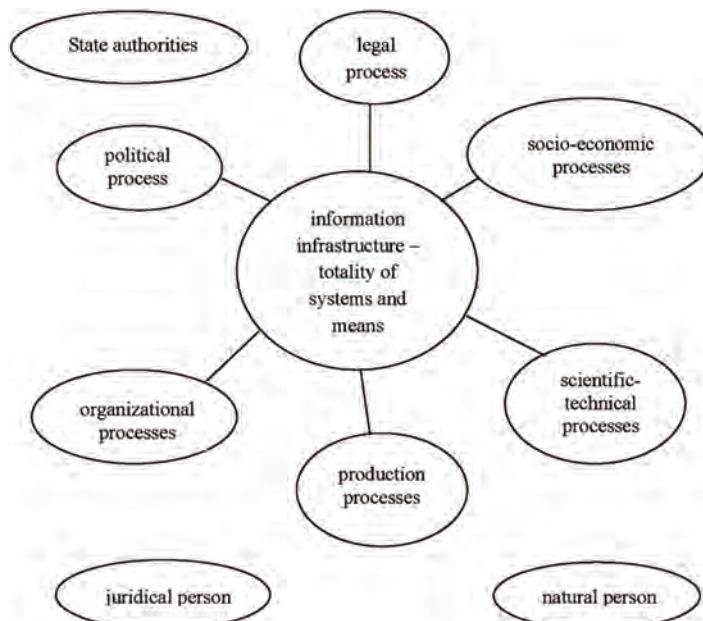


Fig. 4. Information infrastructure of city environment

Taking into account the fact that information about the state of engineer nets and edifices is contained in municipal branch organizations and services with one or another amount of necessary data, the elaboration of municipal building cadastres practically in all Ukrainian cities started from the description of the least studied elements of city structure, especially, cadastre of land plots and in separate cases – buildings and edifices, mainly the housing and public ones. It corresponds to the general world tendencies, testified especially by the well-known

example of German, Sweden, USA and other cities. The land resources, real estate objects are considered as the main source of the municipal treasury filing [17].

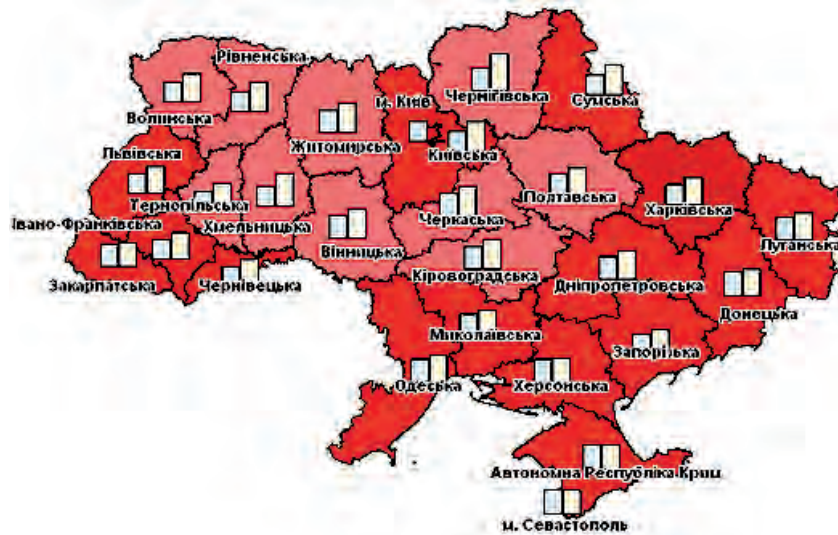


Fig. 5. Example of the data structure of municipal building cadastre of Ukrainian cities.

Note: Demographic burden on population per 1,000 resident aged 16–59 years:

■ – 600–650 (10); ■ – 550–600 (15); ■ – 500–550 (2); □ – city; □ – countryside

6. Research results

There are different approaches to the systems organization. In Germany after 1990 was created and used the cadastre system of dwelling houses accounting, based on the principle of transfer of all data, contained in house books, kept there since XVIII century, on automatic carriers. This work has been carried out by the institute Facility management (city Berlin) according to its own methodology and on the base of own software. In many cities of the USA by the municipal task the group of professional municipal workers in the middle 80-ies have elaborated and introduced the automated system of land-owning accounting. The activity of group, consisted of several persons, was supported by budgetary financing. The participants of system were landowners, responsible for the timely renewal of data and their reliability. There is information about owners, cost and sizes of plots. At the same time it was only a register that is annually edited and distributed without graphic support [18, 19].

The elaborations of cadastre systems in Ukraine are realized mainly at the expense of extrabudgetary costs of state administration. The works are carried out taking into account the existent regulations and state recommendations. Today the first trials to fill the initial data bases are made in the cities. The main question is the creation of full value services, order and ways of data actualization. It testifies to the fact that we have also in fact started to create the systems of municipal cadastre, because the idea of concentration of all amount of information in cadastre service existed for a long time. The volumes of necessary information, its diversity and difficultness of collection and processing of initial information testify to the expedience of the work with separated data base. At that the initial data are collected and concentrated in branch services. The task of the services of municipal building cadastre is to organize the interaction with numerous municipal data

bases. At that the complications appear because of the absence of regulatory base and organizational principles that regulate the relations between the municipal cadastre service and services – owners of data bases and also elaborated technologies of data transmission. This fact along with the absence of united rules and standards of address referencing of data is the one of most urgent problems in the sphere of creation and keeping the municipal building cadastre.

For today all necessary preconditions of legislative base for municipal building cadastre are created in Ukraine. There is the law on the bases of municipal building, that recommends create the cadastre systems in the cities at the expanse of municipal budget. The main regulatory base is elaborated, the main organization – State research institute of the theory and history of architecture and municipal building with the center of municipal cadastre – is chosen. Then only the practical realization is needed. The sufficient number of the different software means is elaborated; they are permanently renewed and allow work with municipal cadastre data in full. The expedience of their use in our conditions, taking into account the volumes of information, existent technical means, staff qualification, ways of giving and actualization of data, is not verified yet [20].

7. SWOT-analysis of research results

Strengths. The modern multilevel structure of land management for timely acceptance of important decisions is constructed; the basic accumulative mechanisms of the management of cadastre system information using geoinformation support are established.

Weaknesses. The dependence of perfect system on human factor; the problem of introduction of system in the aspect of material supply and complication of its understanding for common executor.

Opportunities. To plan the methodology of approach to introduction of the level system of the land resources management, to separate the zones of territorial control influence.

Threats. The support of continuity of municipal cadastre services activity, monitoring system, preparation of analytic data.

8. Conclusions

1. The approaches to the land management and creation of municipal cadastre and main principles of the work in cadastre systems of Ukrainian cities were systematized and generalized; the united geoinformation system of analysis of the municipal building cadastre structure was elaborated.

2. The possibilities of solution of practical tasks as to information systems in general geoinformation system of municipal building cadastre were established; the approaches to the systems of space analysis of modern cities were generalized.

3. It was established, that the specificity of information system that supports municipal building decisions is not only in data structure, but also in the necessity of involvement of retrospective and forecasting data together with actualized ones that is a function of municipal building data bank.

References

- Mistobudivnyi kadastr [Electronic resource] // Official Website of the Department of City Planning and Architecture. Kharkiv. – Available at: \www/URL: <http://www.dma.kh.gov.ua/planning/kadastr>
- DBN B.1.1-16:2013. Sklad ta zmist mistobudivnoho kadastru [Electronic resource] // State Construction Norms of Ukraine. – Available at: \www/URL: <http://dbn.at.ua/load/normativy/dbn/1-1-0-1035>
- Pro rehlivannia mistobudivnoi diialnosti [Electronic resource]: Law of Ukraine from 17.02.2011 № 3038-VI. – Available at: \www/URL: <http://zakon2.rada.gov.ua/laws/show/3038-17>
- Enemark, S. Updating Digital Cadastral Maps: the Danish Experience [Text] / S. Enemark // Proceedings of the FIG XXI International Congress, Commission 7: Cadastre and Land Management, July 19-25, 1998, Brighton. – Jessica Kingsley Publishers, 1998. – P. 426-437.
- Williamson, I. The justification of cadastral systems in developing countries [Electronic resource] / I. Williamson // *Geomatica*. – 1997. – Vol. 51, № 1. – P. 21–36. – Available at: \www/URL: <http://www.csdila.unimelb.edu.au/publication/misc/anthology/article/artic9.htm>
- Inventory of Land Administration Systems in Europe and North America [Electronic resource] / UNECE Working Party on Land Administration. – Ed. 4. – London: HM Land Registry, 2005. – 250 p. – Available at: \www/URL: <http://www.unece.org/index.php?id=10952>
- Lykhohrud, M. H. Struktura y osoblyvosti formuvannia kadastruvoho nomera zemelnoi dilianky ta inshoi nerukhomosti [Text] / M. H. Lykhohrud // *Zemlevporiadnyi visnyk*. – 2000. – № 4. – P. 64–68.
- Ho, S. Legal barriers to 3D cadastre implementation: What is the issue? [Text] / S. Ho, A. Rajabifard, J. Stoter, M. Kalantari // *Land Use Policy*. – 2013. – Vol. 35. – P. 379–387. doi:10.1016/j.landusepol.2013.06.010
- Van Oosterom, P. Research and development in 3D cadastres [Text] / P. van Oosterom // *Computers, Environment and Urban Systems*. – 2013. – Vol. 40. – P. 1–6. doi:10.1016/j.compenvurbsys.2013.01.002
- Danylyshyn, B. M. Ekolohichna skladova polityky staloho rozvytku [Text]: Monograph / B. M. Danylyshyn. – Donetsk: Yuho-Vostok, Ltd., 2008. – 256 p.
- Shypulin, V. D. Osnovni pryntsyipy heoinformatsiynykh system [Text]: Tutorial / V. D. Shypulin. – Kharkiv: KhNAMH, 2010. – 313 p.
- Dumanski, J. International workshop on sustainable land management for the 21st Century [Text] / J. Dumanski // *Land Use Policy*. – 1994. – Vol. 11, № 2. – P. 142–145. doi:10.1016/0264-8377(94)90008-6
- Pieri, C. Land Quality Indicators [Text] / C. Pieri, J. Dumanski, A. Hamblin, A. Young, UNEP UNDP // *World Bank Discussion Papers*. – Washington: The World Bank, 1996. – № 315. – 51 p. doi:10.1596/0-8213-3511-1
- Smyth, A. J. FESLM: An International Framework for Evaluating Sustainable Land Management [Text]: a discussion paper / A. J. Smyth, J. Dumanski, G. Spendjian, Food and Agriculture Organization of the United Nations. – Rome: Land and Water Development Division, Food and Agriculture Organization of the United Nations, 1993. – 74 p.
- McCalla, A. F. Rural development [Text] / A. F. McCalla, W. S. Ayres. – Washington: The World Bank, 1997. – 157 p. doi:10.1596/0-8213-3966-4
- Shaver, T. M. Surface Soil Physical Properties After Twelve Years of Dryland No-Till Management [Text] / T. M. Shaver, G. A. Peterson, L. R. Ahuja, D. G. Westfall, L. A. Sherrod, G. Dunn // *Soil Science Society of America Journal*. – 2002. – Vol. 66, № 4. – P. 1296–1303. doi:10.2136/sssaj2002.1296
- Rockstrom, J. Managing water in rainfed agriculture – The need for a paradigm shift [Text] / J. Rockström, L. Karlberg, S. P. Wani, J. Barron, N. Hatibu, T. Oweis, A. Bruggeman, J. Farahani, Z. Qiang // *Agricultural Water Management*. – 2010. – Vol. 97, № 4. – P. 543–550. doi:10.1016/j.agwat.2009.09.009
- Sakala, W. D. The Potential of Green Manures to Increase Soil Fertility and Maize Yields in Malawi [Text] / W. D. Sakala, J. D. T. Kumwenda, A. R. Saka // *Biological Agriculture & Horticulture*. – 2003. – Vol. 21, № 2. – P. 121–130. doi:10.1080/01448765.2003.9755257
- Scialabba, N. E.-H. Organic agriculture, environment and food security [Electronic resource] / ed. by N. E.-H. Scialabba, C. Hattam. – Rome: Food and Agriculture Organization of the United Nations, 2002. – Available at: \www/URL: <http://www.fao.org/docrep/005/Y4137E/y4137e00.htm#TopOfPage>
- Scopel, E. Impact of direct sowing mulch-based cropping systems on soil carbon, soil erosion and maize yield [Text] / E. Scopel, A. Findeling, E. Chavez Guerra, M. Corbeels // *Agronomy for Sustainable Development*. – 2005. – Vol. 25, № 4. – P. 425–432. doi:10.1051/agro:2005041

ИССЛЕДОВАНИЯ ЗЕМЕЛЬНОГО АДМИНИСТРИРОВАНИЯ И ГЕОИНФОРМАЦИОННОГО ОБЕСПЕЧЕНИЯ ГОРОДСКОГО СТРОИТЕЛЬСТВА УКРАИНЫ

Рассмотрены актуальные проблемы и методы земельного администрирования и геоинформационное обеспечение отрасли городского строительства для развития населенных пунктов Украины согласно городов ведущих стран мира. Разработана методика ведения и контроля городского строительного кадастра в современных условиях на региональном, государственном и мировом уровнях.

Ключевые слова: городской строительный кадастр, земельное администрирование, геоинформационное обеспечение, управление городским строительством.

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