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SOCIO-ECONOMIC AND ECOLOGICAL ASPECTS OF LAND MANAGEMENT IN CITIES

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ABSTRACT

Accelerated development of productive forces and population growth determines the more intensive use of land resources. Modern technologies progress contributes to more intense and complex technogenic load of the land. The active use of the land in a vertical dimension (not only ground, but also underground and aboveground space) often leads to consequences which are increasingly creating negative social pressures and necessitate the economic and environmental matching. Land relations have always been one of the determining factors of socio-economic development and tightly exist in a single system of socio-economic matters. Therefore, the development of cities, regions, countries is directly related to the effectiveness of land management. The aim of the study is to systematize objects that can be located in different vertical levels of the land plot with taking into account their origin and functional use. The study analysed objects both natural and anthropogenic ones. It was proved to separate a special subclass of natural-anthropogenic objects. Inter anthropogenic objects special attention is paid to the buildings and structures. Buildings are combined in subclasses – residential and non-residential buildings, and structures – in transport and engineering ones. The study also includes an analysis of the impact of various natural and anthropogenic objects on territories development in matching with land management methods ensuring harmonious combination the social, economic and environmental aspects. Object location in the vertical dimension was taken into account in research. Recommendations regarding eensuring a balance between the environmental, economic and social aspects of urban development were observed in the article.

Keywords: natural and anthropogenic objects, social, economic and environmental aspects, land management, land use

INTRODUCTION

The conventional intensifying of world urbanization clearly illustrates the increasing of urban population. According to the data of 2015, the proportion of urban population in Europe is 74%, Asia – 49%, Africa – 41%, Northern America – 81%, Latin America – 80%, Australia and Oceania – 69% (See: Fig. 1). Today, 54% of the world's population lives in urban areas and this proportion is expected to increase to 66% by 2050. The highest rates were achieved in Monaco, Singapore, Nauru, Qatar, Kuwait, Belgium, and Malta (see: Fig. 2). Countries that reached the lowest levels: Trinidad and Tobago, Burundi, Liechtenstein, Uganda (Fig. 2). Ukraine ranked 86th place (70%) among 226 countries by the level of urbanization. The nearest in meaning to Ukraine urbanization rates observed in European countries: Italy (69), Hungary (71), Czech Republic (73), Estonia (68), and Latvia (67).

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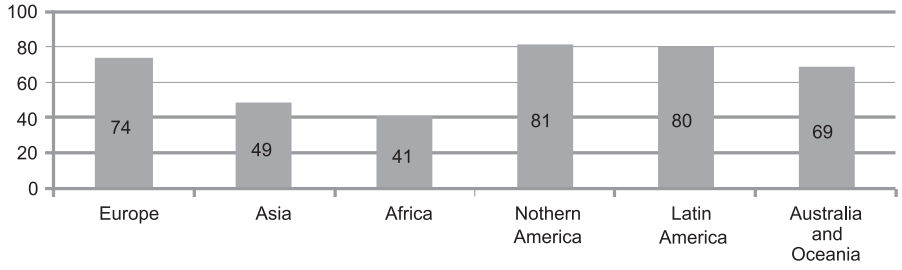

Fig. 1. The proportion of urban population, %

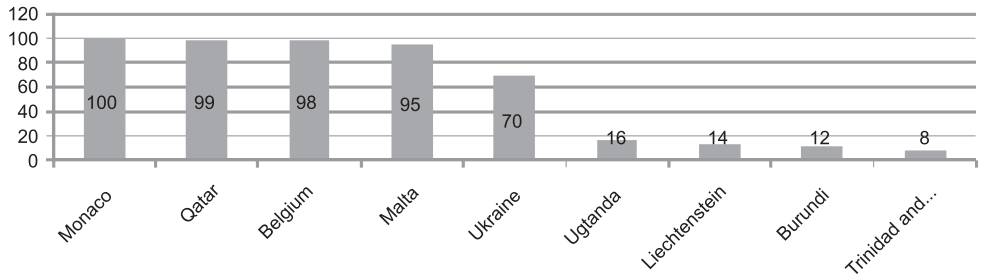

Fig. 2. Urbanization level, %

The level of urbanization in the country does not reflect the problems that arise as a result of the population providing with the necessary areas for housing, places of employment, public and cultural services and recreation. These problems are emerging and exacerbated in the cities. Usually, the consequences of urbanization are reflected in the relative index – population density. This index reflects the population per unit area, and not the availability of space necessary for the vital activity of the population. The authors conducted a comparative analysis of the areas provision of inhabitants in the country on average and residents of the capitals in order to illustrate the aggravation of the problems of land scarcity in the cities. The comparison was carried out for the countries that have the highest and lowest levels of urbanization.

The area per capita on average per country and in the capital: Belgium/Brussels – 2 680/135.11 m² /person, Ukraine/Kyiv – 12 870/285.73 m² /per., Monaco/ Monaco – 52/5.45 m² /per., Qatar/Doha – 4677/91.03 m² /per., Malta/Valletta – 724/133.02 m² /per., Trinidad and Tobago/Port-of-Spain – 3788/257.53 m² / per., Burundi/Bujumbura – 2539/174.02 m² /per., Liechtenstein/ Vaduz – 4238/3296.49 m² /per., Uganda/Kampala – 5386/114.48 m² /per., Malawi/ Lilongwe – 5589/39.44 m² /per. The results of the analysis demonstrate that the average area per 1 resident in the capital is hundreds times smaller than in the country. It should be noted that for more detailed analysis, it is necessary to exclude land that is not suitable for housing or construction, or not desirable to change the purpose of land use. For example, in Ukraine 70% of the land fund is agricultural land and 17% – forestry land. These lands are not desirable to use for expansion of built-up areas. In Poland, agricultural land covers 62.6% of the total territory of the country, 27.5% is covered with forests and shrubs. If to calculate the indicators of the areas provision for the construction of facilities providing labour, public, cultural, etc. needs, taking into account the features of the land fund of the country, then the indicators will be significantly lower.

The authors analysed the ratio of urban areas to population in large cities of Ukraine. The results of the analysis make it possible to conclude that the level of land scarcity in the city depends on:

- the size;
- administrative status;
- economic profile;
- indicator of economic development;
- natural and climatic conditions;

- land fund distribution by purpose land;
- structure of the land use system.

One of the first bursts of urban population growth, as a consequence of industrial development, is observed at the end of the nineteenth century. Cities are facing complex problems due to the limited urban land resources and increasing population density in the 20–30 years of the XX century (Le Corbusier, 1933; Merlen, 1977). The first response to the need to increase area for the population was urban sprawl, which was promoted by intensive development of different transport modes, characteristic for the twentieth century. American researcher, real estate economist Richard Melancthon Hurd noted a special role of urban transport in expanding urban areas in the early twentieth century (Hurd, 1903). However, in the middle of the 20th century it becomes obvious that the expansion of areas by urban development, known as "urban sprawl", has its own disadvantages. The development of science and technology in the 40's–50's, has provided new opportunities for land exploration and development and promoted to beginning of intensive "vertical" urban growth (Pleshkanovska, 2011). In the early 60's, problems of rapid urban sprawl are exacerbated leading to an imbalance in the environment of the population vital activity, mainly in the environmental and social aspects. This situation is reflected in the origin of the ideology of sustainable development of society, in particular settlements.

MATERIALS AND METHODS

Limited land resources and urban development

The issues of the limited land resources during population growth at different times were solved by different methods. In the history of development, from the twentieth century to the present, the problems of limited land resources with increasing population density in cities were exacerbated. Two main directions of solving the problems can be singled out: *spatial and economic*. The spatial aspect of the solution of this problem can be considered in two dimensions – *horizontal and vertical.*

Urban sprawl occurs in the two ways:

– during uncontrolled or controlled absorption by large cities of small cities (mergers of cities);
– due to the absorption of agricultural land, forests etc.

In the first case, there are social, economic and environmental changes in the development of settlements primarily involved in the development of large cities. The control of these processes should be carried out through spatial planning at the regional and local levels and the regulation of changes in the boundaries of administrative divisions. During merging of cities there are many issues related to changes in the social sphere, environmental pollution of small cities, different land rights of local communities (municipalities), land value, tax burden, etc (Petrakovska; Mykhalova, 2017).

In the second case, the most acute environmental problems are arising as a result of the destruction of such natural resources as arable land and forests, which are the constituent elements of the ecological network (On ecological network of Ukraine, 2011). Economic problems are manifested through the destruction of arable land and forests as the main mean of production from economic circulation. It should be noted that the need for increasing the land area required for the population living conditions, comes up not only proportional to urban population growth, but also as the result of changes in requirements for quality of life and services.

Increasing building heights, increasing built-up density, activation and deepening use of underground and aboveground space are actively used from the middle of the 20th century in order to restrain rapid spatial sprawl. These decisions sometimes lead to new ecological problems connected with the removal of inhabitants from the natural environment, more concentrated anthropogenic influence of the built-up area on all components of the natural environment, air pollution, water objects, soils, deterioration of the noise regime and so on. For example, in urban parks in Krakow, the average noise level throughout the day is higher than the standards ordered by the World Health Organization (Malek, 2017).

Vertical urban growth is characterized by complex multifunctional land use, the consequences of which are observed in the social, economic and environmental spheres. Modern technologies development contributes to a more intensive and complex man-made load on the ground, above ground and underground

space. Increasing anthropogenic pressure often leads to consequences that create more negative social pressure. This explains the importance of accounting different types of land use when harmonize the economic effect and environmental impact on the environment. Moreover, when the land is used for various purposes, its features as a basic mean of production, a spatial basis and a natural resource have got special significance. This in turn leads to complications of the tasks of management and administration of land resources. Land relations have always been one of the most influential components in a single system of socio-economic relations. Relations between the entities and land and building authorities, the use of underground and aboveground space requires improvement of regulatory mechanisms taking into account types of land use.

Economic methods of preventing population density increasing and development are aimed at "pushing out" certain types of land use from densely populated areas of the city through financial pressure: differentiated taxation, utility costs, prices for energy, water and heat supply, etc. However, it is important to understand that financial mechanisms using leads to a redistribution of concentration of built-up areas and population. As a result, we observe a spatial urban sprawl, displacement and dispersal of urban load and tension.

TYPES OF LAND USE AND LOCATION CONSEQUENCES

In order to maintain the dynamism of development, the cities are faced with complex problems, arising, on the one hand, population increasing and its economic and social activity, and, on the other hand, the limited land resources. Due to innovations and modern technologies used, the mixed and multifunctional land use of vertical space is increasingly used in cities.

The article analyses vertical land use taking into account the origin and functional use of objects that can be located in different vertical dimensions as well as their social significance and environmental impact. The analysis was carried out according to the following vertical levels: ground, underground and aboveground space. It is necessary to avoid misunderstandings in terms of "ground" and "aboveground" location. In the meaning of "ground" refers to the location in which the object is located on the surface of the earth and between the object foundation and the earth surface has no free space. In the sense of "aboveground", on the contrary, the surface under the object is free and the object is constructed on different types of pillar at a certain distance from the ground.

By origin, the groups of natural, anthropogenic and natural-anthropogenic objects were investigated in the article. Natural objects are analysed in terms of their belonging to mineral, water, forest, recreational resources etc. A group of anthropogenic objects includes two main subgroups: buildings and structures. Buildings are combined in subclasses – residential and non-residential buildings, and structures – in transport and engineering ones (State Classification of Buildings and Structures, 2000).

Residential buildings include all types of buildings that are designed for permanent (house, condominium) and temporary residence of people (hotels, hostels, guest's houses, dormitories etc.).

The totality of non-residential buildings is divided into *public, industrial and special buildings*. *Public buildings* are office buildings of different purpose, trade and catering enterprises, cultural, entertainment and sports facilities (cinemas, theatres, museums, gyms), educational buildings (higher educational establishments, schools, kindergarten, etc.), buildings of consumer utilities and communications (mail, laundry, etc.), medical buildings (hospitals, clinics) and transport and communication buildings (airports, railway and bus terminals, etc.).

Industrial buildings are buildings of enterprises of various types of industry (agricultural, food, energy, etc.) and warehouse buildings.

Special buildings are government, defence, military and religious objects. Political factors are dominant when making decisions about abovementioned objects' location. These factors do not influence the location of residential, public and other buildings that's why they are not analysed in this article.

In the group of structures there are mainly analysed: transport infrastructure objects (railways, roads, bridges, tunnels, etc.) and engineering infrastructure objects (heating networks, gas pipelines, sewage systems etc.).

According to the authors, from point of view environmental aspect, it is important to separate a special

subclass of natural-anthropogenic objects. They can be artificially created, but have the attributes of natural objects, or natural objects, that have undergone anthropogenic changes. There are zoo-, hydrological and other parks, botanical gardens, squares, reserves, reservoirs, ponds and so on.

The authors propose to discuss possible options for the various objects location in the vertical space and the consequences of this location. First of all, it should be noted that in modern conditions of the achievements of scientific and technological progress and the ingenuity of human and architectural intention, makes it possible to use underground and aboveground space to large extent. Construction of any objects is possible, both in underground and aboveground space. Examples of this situation may be: luxury housing in a former missile shaft in the event of any apocalypse in Kansas and underground gardens in California. We can continue the list of examples, but it is important that these objects are usually exclusive ones and designed to meet a very limited social category of the population or attract tourists. In addition, underground or aboveground construction may be due to natural conditions. Residents of the small city of Coober Pedy in Southern Australia have been saved from a hot climate thanks to the construction of underground housing. There are many examples of the underground space using during the Middle Ages for the location of religious and military structures. This article studied modern objects aimed at the viability of the urban population as a whole, taking into account international experience.

The conducted study illustrates the following statements. Transport facilities – overpasses, bridges etc. are mainly located in the aboveground space in the world. At the same time, the intensity of aboveground space using depends on the land scarcity, and the height of the structures corresponds to the height of built-up. The aboveground space using for the transport facilities location will negatively affect not only the ecological state of the air, soils, reservoirs, increase of noise and vibration, etc., as well as the sanitary conditions of the rooms located in buildings under or along to these structures. In Chongqing, China, the world's largest city in terms of population – the overpasses can go directly between houses. It has been proved today that the mass emissions of pollutants to the environment are caused mainly by dynamic sources. The location of transport facilities over the surface of the earth leads to deterioration of all components of the city's ecosystem. Chongqing and six other Chinese cities are among the ten most environmentally polluted cities in the world. Environmentalists consider this is a reckoning for a very powerful technological breakthrough at the expense natural resources and unbridled consumption.

All residential and non-residential buildings and various structures which are the spatial basis of society life are located in the ground space. Most often the counteraction to the environmental and economic feasibility of this or that land use occurs when choosing a place for commercial real estate. For commercial real estate the very important factor is the concentration of people as potential consumers of goods and services. In addition very important factors are well-developed transport and engineering infrastructure that also increases the desire to develop these areas. Development of urban area aims to improve the living conditions of the population from one side and to achieve economic results from other side (Petrakovska, Tatsii, 2014). At the same time, cheapening of construction due to availability for consumers and the development of engineering and transport infrastructure, often leads to measures required to overcome the environmental and social consequences, become more expensive. Different types of land use in cities are regulated by spatial planning and zoning. However, classification of land use, which is regulated by zoning, does not itemize functions of objects that can be located in the underground space.

Increasing level of urbanization is a recognized phenomenon which has no retroactive effect. The three-dimensional space using, which will progress in parallel with the development of modern science and technology, has its advantages, disadvantages and cannot be stopped.

Nowadays, the environmental aspect of land management is extremely important and requires increased attention from public authorities. The question is that modelling the development of urban area, which in fact is spatial planning, should be done not only taking into account modern requirements and existing restrictions, provided by zoning and other regulations, as well as an assessment of the consequences of this land

use in the future. Then, the application of legal, administrative and economic methods of land management for the implementation of the spatial planning strategy will have a reasonable foundation.

In some countries, it is allowed to design underground residential buildings in accordance with modern construction norms and rules with new energy-efficient technologies and the concept of "ecological building" appearing. But if human habitation goes into the underground space, what remains on the ground. This is unnatural itself. Modern technologies using is often aimed at solving urgent problems of the present without modelling and forecasting of future consequences.

Special objects which should be restricted or forbidden for access are usually located in the underground space. Modern problems of large cities are solved by creating multi-level and multifunctional objects with integrated underground space using. As for the buildings, which are aimed at the needs of the population provision, the most common location in underground space is commercial real estate and parking, especially in city centres. Thus, it can be detached object or part of a multifunctional building complex.

The spread of multi-level and multifunctional objects solves the problems of the population accessibility to services, which are especially important to take into account when synergizing the effect of united services (housing, restaurant, parking, and household services). The placement of multi-level and multifunctional objects in the underground space should be considered from the point of view of compliance with sanitary and hygiene norms. However, it should be noted that during underground location of objects, sanitary norms for different buildings or their parts are different. For example, cinemas, restaurants, supermarkets, etc., where a person is present for several hours, requires a more complex system of forced ventilation, in contrast to parking lots, where a person is short term. The consequences of such ventilation are felt on the surrounding lands and buildings.

Regarding the impact of urban pressure on natural resources, particularly in cities, in addition to air pollution, water pollution acquired significance, both ground and underground. And sometimes, the state of underground resources, the quality of which is much more complicated to determine, plays more important role as a potential source of water supply to the population.

CONCLUSIONS

The deviation in the ecological state in different cities is directly related to the anthropogenic load of these cities. In large cities of Ukraine, the land scarcity largely depends on economic profile, indicator of economic development and structure of the land use system. The dynamics of urban development illustrates the intensification of three-dimensional land using. Therefore, the most important tasks of the present are to reduce the negative consequences of it in cities.

When horizontal solution method the issues of the limited land resources, the most negative environmental consequences arise from changing of land use (the absorption of agricultural land, forests etc., changing of landscapes). And when vertical solution method the most negative environmental consequences arise from increasing population density and their activities, increasing built-up density. The question is open and controversial. Which method is better under the same conditions?

Mainly transport facilities are located in the aboveground space. They are the most powerful source of environmental pollution. Such location of transport facilities is beneficial from the economic point of view. In this case, priority is given to this component of sustainable development. In countries focused on economic development, placement of transport facilities in the aboveground space solves social and economic tasks at the expense of the ecologic component.

Ensuring a balance between the environmental, economic and social aspects of urban development is a complex interdisciplinary task. Specialists of various fields are involved in solving it. Sustainable land management should be based on a systematic approach that combines interconnected and interactive scientific and practical spheres and includes modelling of future long-term environmental impacts. Such modelling should take place in a three-dimensional form as a reflection of essential conditions in cities with developed use of vertical space. In order to make informed decisions should be considered not only the spatial characteristics of the territory as a whole, but influence on individual land plots, in particular. A model of land use accounting in

a vertical section should be developed and should include both quantitative and qualitative characteristics of land use.

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SPOŁECZNO-EKONOMICZNE I EKOLOGICZNE ASPEKTY GOSPODAROWANIA GRUNTAMI W MIASTACH

ABSTRAKT

Przyspieszony rozwój zasobów produkcyjnych i wzrost liczby ludności determinują coraz bardziej intensywne wykorzystanie zasobów ziemi. Postęp nowoczesnych technologii przyczynia się do bardziej intensywnego i złożonego technogenicznego obciążenia gruntu. Aktywne wykorzystanie terenu, również w wymiarze wertykalnym (nie tylko gruntowym, ale podziemnym i nadziemnym) często prowadzi do konsekwencji, które w coraz większym stopniu powodują negatywne presje – a więc wymagają dopasowania – w aspekcie społecznym, ekonomicznym i środowiskowym (ekologicznym). Struktura zagospodarowania terenu zawsze była jednym z najważniejszych czynników determinujących rozwój społeczno-gospodarczy i jest ściśle powiązana z całym złożonym systemem zagadnień społeczno-gospodarczych. Dlatego rozwój miast, regionów, a także krajów jest bezpośrednio związany ze skutecznością gospodarowania gruntami. Celem badania jest usystematyzowanie obiektów, które mogą być zlokalizowane na różnych wertykalnych poziomach dział-

ki, z uwzględnieniem ich pochodzenia i funkcji (sposobu zagospodarowania). W badaniu przeanalizowano obiekty zarówno naturalne (przyrodnicze), jak i antropogeniczne. Wydzielono specjalną podklasę obiektów przyrodniczo-antropogenicznych. Wśród obiektów antropogenicznych zwrócono szczególną uwagę na budynki i budowle. Budynki łączy się w podklasy – budynki mieszkalne i niemieszkalne, a także obiekty inżynierii lądowej i wodnej, w tym infrastrukturę transportu. Badaniami objęto również analizę wpływu różnego rodzaju obiektów przyrodniczych i antropogenicznych na rozwój obszarów, w połączeniu z metodami zarządzania i zagospodarowania terenu, zapewniającymi harmonijne połączenie względów społecznych, ekonomicznych i środowiskowych. W badaniu uwzględniono lokalizację obiektu w wymiarze wertykalnym. W artykule odnotowano zalecenia dotyczące zapewnienia równowagi między ekologicznymi, gospodarczymi i społecznymi aspektami rozwoju miast.

Słowa kluczowe: obiekty przyrodnicze i antropogeniczne, aspekty społeczne, ekonomiczne i środowiskowe, gospodarka gruntami, użytkowanie terenu