UDC 332.36

ECONOMIC ASPECTS OF LAND USE IN THE KYIV AND SUBURBAN AREAS

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Abstract. *In the article, the author has focused on analyzing the current state of land use by types of enterprises' economic activity, regional economic and financial data to propose a new robust model for cost-effective land use planning for commercial and non-commercial enterprises. The research results can serve as an important material for the decision-making process on how to develop the land and the city areas in the context of new global economic development. It provides extensive overview of existing land use trends for Kyiv city based on analytical data and scientific assumptions. The author believes that this research will be beneficial for government organizations, local government authorities, international organizations, private institutions, and researchers.*

The goal of the research paper is to build a solid scientific model based on a general understanding of underlying economic challenges of efficient land use considering past data, short-term and long-term planning. The paper has an overview of city planning documentation and city statistical data in the context of real estate, urban population, economic data, including research of real estate and currency exchange rate data to median salary in Kyiv starting from the 2000s. It is important not to put too much focus on the existing models and systems, as they rely too much on the assumptions and complicated calculations that are hard to make use of in real-world planning. Instead, we build our research on real-world data and developed a forecast for the size of investment in land use, average real estate prices for the next 5 years.

The paper noted an existing problem of inconsistency of the existing norms and regulations in Ukraine concerning rational and effective land use and planning, especially for local authorities and commercial organizations. The author substantiates why the economy in the context of urbanization needs a new look. The paper uses the planning of Kyiv city. It is a suitable example of a developing city, so the proposed model can be developed based on the city's economic and land use data. This research can help solve the existing problems of urbanization in Ukraine and have a positive impact on the economic development of the city and the region.

Keywords: *urbanization, economics, economic modeling, modern city problems, land management, zoning, spatial planning, strategic planning.*

Introduction. In present times large urban agglomerations serve as none of the major catalysts of economic trends. Urbanization, as a process, plays a key role in the transformation of the local, regional, and world economies. Urbanization should be considered an important factor in the development of the economy in both the city and the state. It dictates the path of micro- and macroeconomic development in regions, although not directly. And, in the context of long-term land use and spatial development, this process may play a significant role. The issues of suburban development, industrialization, post-industrialization, environmental problems, and the issues of further existence and development of agricultural regions bordering on urban centers (urban agglomerations) cannot be excluded from the field of view. Alongside new possibilities that arise from a large urban economy, a great number of challenges that need to be addressed appear. Besides the economic-related issues, irreversible ecology changes (rise of sea level, forest fires, etc.), global pandemics, and new technologies, a manufacturing process must be included in urbanization research. This requires a novel approach to how we view the city, build economic models, and make forecasts for future development. In this paper, we set the initial stage for the development of such a robust economic model, while using data and statistics of Kyiv city. This city can serve as a great test ground for a proposed model, as it is a relatively new urban center that is a part of the developing country's economy.

Analysis of recent researches and publications. According to the global real estate research agency research data, the main factors that will determine city growth in the next 15 years will be narrowly focused specializations in high technology, rapid movement of much qualified personnel to such regions, increasing regional turnover through major seaports, and national transport nodes. The center of economic development of the world will move to certain regions of Asia. Meanwhile, London, Paris, Tokyo, New York, Los Angeles, Singapore, Chicago, Shanghai, Guangzhou, Shenzhen, and others are centers of economic development. Unfortunate Ukraine and its

largest urban center Kyiv, fall behind in economic development with an average monthly wage of $ 560 and the main type of economic and labor activity are construction and trade. It is necessary to change the approach to the existing closed model of land use and stimulate the production of finished products with high added value in order to compete effectively in the world market, and thus ensure high employment of the population of Ukraine, following examples of neighboring cities of Warsaw, Bratislava, and Berlin.

According to the previous research data, the main challenges in the existing economic and land use planning are the lack of a holistic picture and general theoretical models that could be used in practice by the institutions, research individuals, and officials alike [1]. In this scientific work, the author proposes such a model. That is why we started working on the analysis of existing data and accepted models to have a clear idea of the situation. This will provide an opportunity to develop further steps towards creating a common model of urbanization, considering environmental, industrial, and other modern challenges.

In the current conditions of rapid urbanization and future climate change, it is advisable to pursue a prudent policy in the context of sustainable urban development and rational use of land resources and make forecasts and plans for the next 20–25 years. When studying the process of urbanization, it is worth paying attention to the development of the real estate market, as urbanization is associated with population growth and relocation of people from the periphery to the urban center – cities and suburbs. In addition, new enterprises are being created and developed, around which the need for the organization of the service sector is increasing. All this attracts people from different regions of the country, as well as other countries and even continents [2].

This paper is a continuation of the author’s previous research on general economic patterns concerning urban development in Kyiv. In our previous work, we stated that the economic and environmental situation in Kyiv is uneven. Major factors that influence this were outlined, such as high rates of housing, transport, and civil development, as

well as the concentration of enterprises in certain city districts. While other districts are referred to as living districts, they require financial investment and attention from the city officials to boost their economic development and make them striving communities. In the microeconomic context, the author noted that costs of construction, land price and land rent for commercial use should be considered while working on the economic model for land use in the city of Kyiv and its suburbs [1].

The purpose of the research is to analyze current and past land use patterns, outline existing issues and economic inefficiencies in those patterns in a large urban city. In addition, we plan to look at land use from several viewpoints, that of the researcher, governmental institutions, commercial company, personal level. This will enable us to make correct assumptions and help build an economic model for future land use development.

Materials and methods. Research work is based on official statistics data, provided by State Statistics Service of Ukraine, the Kyiv city council, Municipal Enterprise "Kyivgenplan", private real estate companies, economists, and Public cadastral map of Ukraine [3]. We used statistical analytics, mathematical correlation, polynomial and linear approximations, Ratio analysis, utility curves, profit curves, and growth models. For predictions, modeling of key economic parameters was identified. This data was used to build linear dependency models of functions and plotted charts, diagrams based on calculations data.

Results of research and discussion. Ukraine does not stand aside from the global challenges of time related to globalization and urbanization. These are indicators such as significant labor migration, outdated land legislation, and inefficient use of land resources. Therefore, the author of the study analyzed the social, environmental, and economic factors influencing the development of the economy of individual united territorial communities of Ukraine with emphasis on Kyiv city. The main reason for focusing research work on this city is the general availability of statistical information and economic data from the 2000s.

The increase in population growth in large cities requires a proportionate amount of housing for people, as well as the development of new housing complexes and infrastructure around them for the future. In the early stages of urbanization, there may be a high demand for real estate and a small supply, as in the later ones. Therefore, prices for existing real estate are rising significantly. This is happening at a time when the rapidly developing urban region needs a new workforce and workers do not have the financial means to buy expensive housing. This leads either to the development of agglomerations adjacent to the center and the development of new transport routes or to the collapse of the real estate market. In addition, it is worth mentioning the process called “Soap Bubble in Real Estate”. It is characterized by an increase in real estate prices to an excessively high value, and then a sharp decline to a minimum. This phenomenon can lead to economic collapse. Investments are increasing but they are not covered.

In recent history, several events have happened that made dramatic effects on Ukraine and Kyiv’s land use economic situation. The global financial crisis of 2008 has affected real estate prices in Ukraine, in addition to Ukraine’s currency devaluation. In 2014, military conflict, war in the east part of Ukraine, and the Russian annexation of Crimea had its impact on the housing market, as well as further currency devaluation.

The current land area of Kyiv is 82.64 thousand hectares with a population of 2 967.4 million people [3]. As seen in Table 1, the land use is classified by the following types: Residential buildings; Public buildings; Industrial, research and production and utility territories; Transport infrastructure; Green areas; Water resources; Agricultural companies, and others. Analysis of the types of buildings in the capital shows that the largest share in the Residential housing has private houses – 3.76 thousand hectares and high-rise buildings – 8.4 thousand hectares. Non-residential real estate – buildings, premises that are not classified in accordance with the law to the housing stock, are divided into the following types: hotel buildings, office buildings, commercial buildings,

garages, industrial buildings and warehouses, buildings for public performances, outbuildings, and other buildings.

1. Land use in Kyiv by type and district

Land type	Land use, %	Land Area, thousand hectares
Residential buildings	1.56	12.97
Public buildings	4.75	3.93
Industrial, research and production, and utility territories	7.99	6.61
Transport infrastructure	7.45	6.16
Green areas	54.48	45.03
Water resources	7.33	6.06
Agricultural companies	0.21	0.18
Other	16.3	13.47
Total	**100 %**	**82.64**

Source: prepared on the basis of the Kyiv city data of the State Statistics Service of Ukraine.

To make better predictions and effectively analyze land use data, we will start with real estate data and general social information – such as monthly salary, an average number of employees per company, followed by the currency exchange rate, average office rent price, and average living apartment price in USD.

According to official data, the average salary for full-time employees in 2020 was UAH 16.186. As of 2018, the highest monthly wage was in the mining industry (UAH 44.405), and the lowest – in construction (UAH 8.311) and health care (UAH 8.406) [4]. The prices in Kyiv suburbs are much lower than in the city, with an average cost of sq. m being around UAH 13.500.

Based on the Kyiv city data of the State Statistics Service of Ukraine, the housing stock in Kyiv in 2019 had a total area of 59.1 million m^2 and an average of 20.2 m^2 per person [3]. The total number of apartments in Kyiv was 991.6 thousand. If we look at the state building codes as of 2019, the minimal area of a one-room apartment is 28 sq. m [5]. At the same time, according to the Kyiv city data of the State Statistics Service of Ukraine in 2019, the average available housing area per single person living in Kyiv was 20.2 sq. m. Let’s look at $ 26600 for 28 square meters apartment, with an average

monthly wage of UAH 16.186, which is $ 575, it will take 46 months on average to buy an apartment if there are no other expenses and the salary is tax-free. Median flat rent in Kyiv in 2020 was $ 9.4 per sq. m, which makes $ 263.2 for 28 square meters apartment per month or UAH 7401.

Afterwards, we conducted studying of enterprise operation statistics between 2018 and 2019. As a result, the following data was produced: the number of business entities was 294.458 companies, a number of full-time employees was 1,149,074 people, the volume of sold products produced by one (average) enterprise was 36,843.35 thousand UAH per year or 3070.2 thousand UAH per month, with the average number of employees in one company being 16 people [4]. Today, there are about 500,000 square meters of commercial real estate in Kyiv, and according to experts, by the end of 2020, this figure will increase by at least another 150,000 square meters.

Based on available data, we analyzed the average rent price that a company needs to pay for one month in Kyiv. If one office employee needs at least 6 sq. meters of office space, then the average company that consists of 16 employees will need to rent 96 sq. m of office space. Using 2020 data, on average the monthly rent is $ 2400per month, so the company will need to pay $ 28,800 per year. The study showed that the average cost of office space is as follows: $ 1200 per sq. m in 2020; $ 1500 per sq. m in 2019; $ 1300 per sq. m in 2018; $ 903 per sq. m in 2017.

2. Economic parameters of Kyiv real estate market from 1996 to 2020

Year	Currency exchange rate, UAH to USD	Average office rent, $ per sq. m	Average living apartment price, $ per sq. m
1996	1.8	-	-
2000	5.51	-	350
2005	5.07	-	1700
2007	5.09	56.6	1750
2008	7.62	25	2750
2010	7.96	16,3	2000
2015	23.79	19,3	1250
2018	27.69	45	1200
2019	25.14	40	1050
2020	28.12	25	950

Source: prepared on the basis of personal data.

Table 2 shows the economic parameters of the Kyiv real estate market from 1996 to 2020 [6]. The data provides a clear indication when major shifts occurred – the 1990s to 2000, 2007 to 2008 (global financial crisis), 2010 to 2015 (war in Ukraine), 2019 to 2020 (global pandemic). It is important to analyze the information about the housing stock in Kyiv in the context of our economic modeling.

The author analyzed the dynamics of increasing the number of living apartments by year. In 1995, their number (in thousands) was – 889.4; 2000 – 926.9; 2005 – 984.4; 2010 – 1037.9; 2015 –1112.1; 2018 – 1081.7; 2019 – 991.6. It should be noted that since 2001 the total area is determined considering the summer premises with the established reduction factors. Since 2004, the total area of the housing stock and the number of apartments has included data on bankrupt enterprises and those that have completely ceased operations (stat data). The population of Kyiv, according to official statistics, is as following (by year): 1995 – 2643.8 thousand people; 2000 – 2615.3 thousand people; 2005 – 2666.4 thousand people; 2010 – 2785.1 thousand people; 2015 – 2888.0 thousand people; 2018 – 2934.5 thousand people; 2019 – 2950.8 thousand people; 2020 – 2967.4 thousand people. Total income per all officially employed in the Kyiv city: 2010 – UAH 5286.46; 2015 – UAH 6255.92; 2018 – UAH 13243.96; 2019 – UAH 17546.89. The total share of income from business and self-employment as compared to total income in Kyiv per year: 2010 – 8°%; 2015 – 4.5 °%; 2018 – 6.3°%; 2019 – 6.2°%.

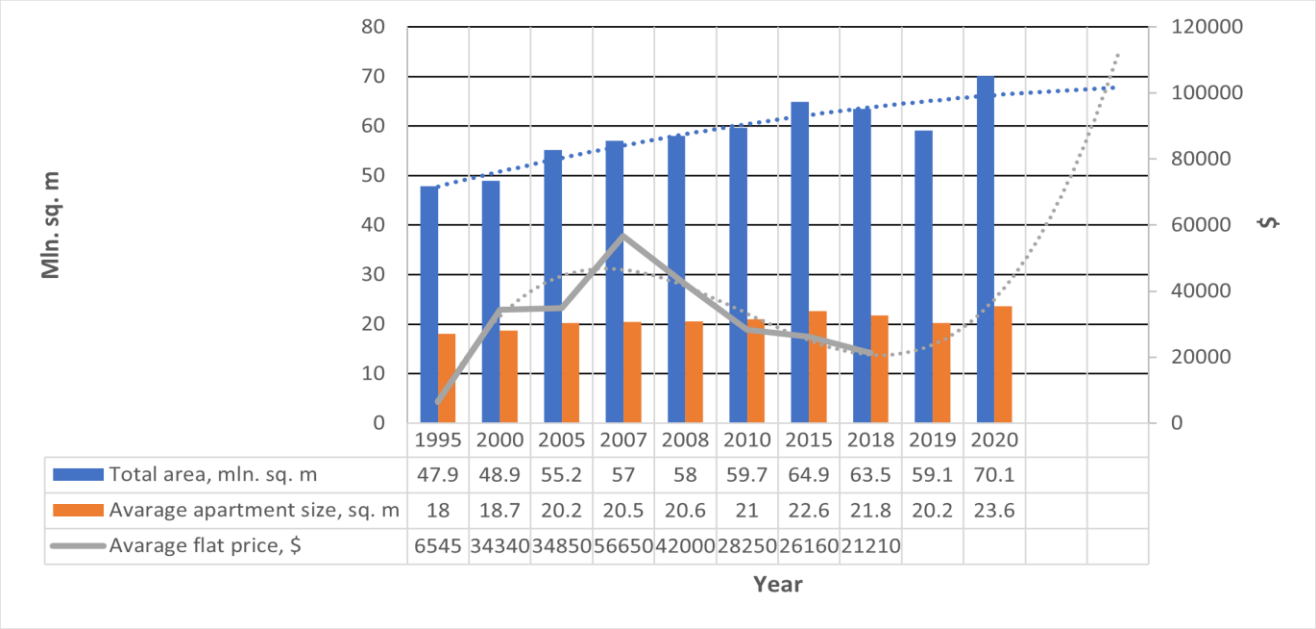

Fig. 1. Diagram of economic parameter dynamics based on Kyiv real estate data from 1996 to 2020

Figure 1 describes the dynamics of economic parameters based on Kyiv real estate data from 1996 to 2020. We made a short-term prediction based on this dynamic that states that the total area of real estate spaces will remain relatively unchanged, while the price for flats will increase.

There is a wide range of office spaces available in Kyiv (Fig. 2). They are classified by the following categories – A, B, C, D, and E. The size of average office space ranges from 40 sq. m to the big open space offices with more than 1000 sq. m. The most common office categories in Kyiv are A (mostly located downtown), B (historical center), and C (in sleeping areas and on the site of old research institutes).

Class “A” offices are the most prestigious premises located in new office complexes and business centers in the city center. These buildings have the highest level of service. Class “B” offices are premises with almost the same characteristics as class “A” offices. They can be in new or newly renovated buildings that have the necessary utilities, Class “C” offices – a room, usually rented from a research institute or manufacturing plant. Sometimes they are called “Soviet”. The last repair in them can be made more than 10 years ago using those materials that were at that time. In such a room

there is usually no modern communication, central air conditioning, a ventilation system – normal, and a toilet in the hallway.

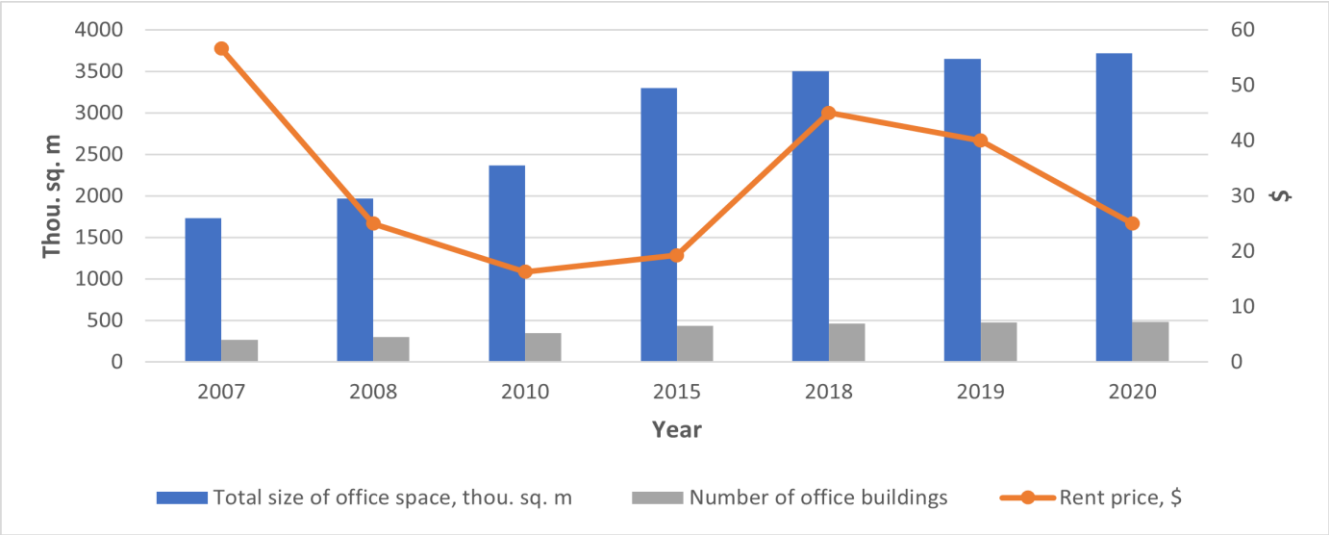

Fig. 2. Diagram of economic parameter dynamics based on Kyiv real estate data from 1996 to 2020

Another trend is the rapid reduction of vacancies in the Kyiv office centers. During the first half of 2019, the growth of demand and the small amount of new supply of office space led to a decrease in the average vacancy rate from 6.5 to 6°%, these data were taken from reports of international real estate agencies. In some office buildings, the vacancy was in the range of 4–5°%. For comparison: in 2016, on average, 16°% of the spaces were vacant in Kyiv business centers, and in 2015 – more than 20°% of spaces were vacant. We analyzed which types of industries have formed the highest demand for real estate office rent in Kyiv in recent years to form this trend. The highest percentage is 52°% in IT companies; professional services in various fields – 35°%; FMCG – 7°%; pharmaceutical companies – 3°%, energy companies – 2°%, and agricultural companies – 1°%.

To have a better understanding of how real estate prices were formed we need to study the land rent price through the city. Unfortunately, this information is not publicly available in the format and the existing data is very scarce to make economic models and take it into account while modeling land use. The data that we found from online

sources is from 2016. The statistical data in the field of land relations shows that the monetary value of land is very different in the districts of Kyiv – the closer to the city center, the higher its value, the further – the lower. The average level of normative monetary valuation of commercial land plots in remote areas of the capital is UAH 250,000 per 100 sq. m. We can calculate that the rent for a small plot of land, such as 400 sq. m that can be used by the small commercial facility, will be a minimum of UAH 1,000,000 per year. In the city center, the amount of rent was much higher, about 10°% of the regulatory monetary value.

An important part of the research on land use is real estate investment [7]. The data is based on the official statistics of capital investments in Kyiv's real estate and is the following: 53,725,841 thousand UAH in 2010 (14.9°% of total investments), 213,247,802 thousand UAH in 2019 (6.7°% of the total), 52,090,467 in 2020 (8.6°% of the total). The calculation of the share of housing, non-housing, engineering structures, land from the total investment by type of assets by years amounted to (in thousands UAH): 2010 – 53,725,841; 2015 – 88,138,606; 2018 – 200,308,295; 2019 – 213,247,802; 2020– 52,090,467. The above listed data was used to build the Real estate investments ratio index for Kyiv from 2010 to 2025 (Fig. 3).

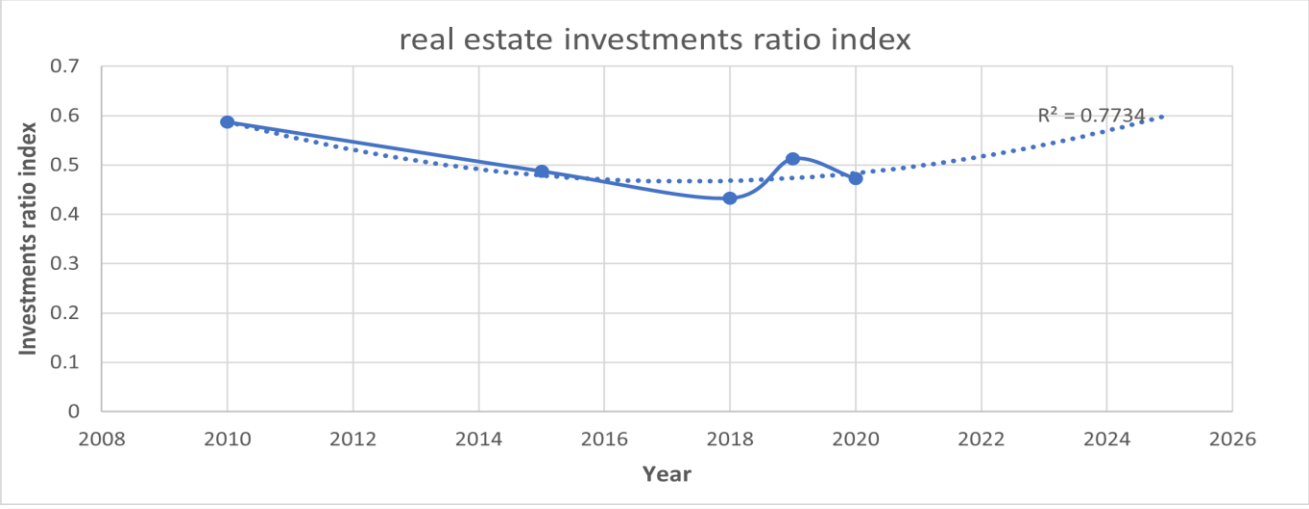

Fig. 3. Real estate investments ratio index for Kyiv from 2010 to 2025

An important factor influencing the pricing policy in real estate is the saturation level of European capitals with quality retail space. This figure is calculated in square meters per 1,000 inhabitants of the capital. We analyzed data from neighboring European capitals. The highest saturation level of quality retail space per 1000 citizens is in Bratislava, the capital of Slovakia – 1405 sq. m, Warsaw – 1013 sq. m, Prague – 711 sq. m, Bucharest – 595 sq. m, Kyiv – 535 sq. m, Sofia – 396 sq. m, Belgrade – 360 sq. m. If all the planned facilities are put into operation in 2020, Kyiv may reach 3rd place with an indicator of 801 sq. m per 1,000 inhabitants.

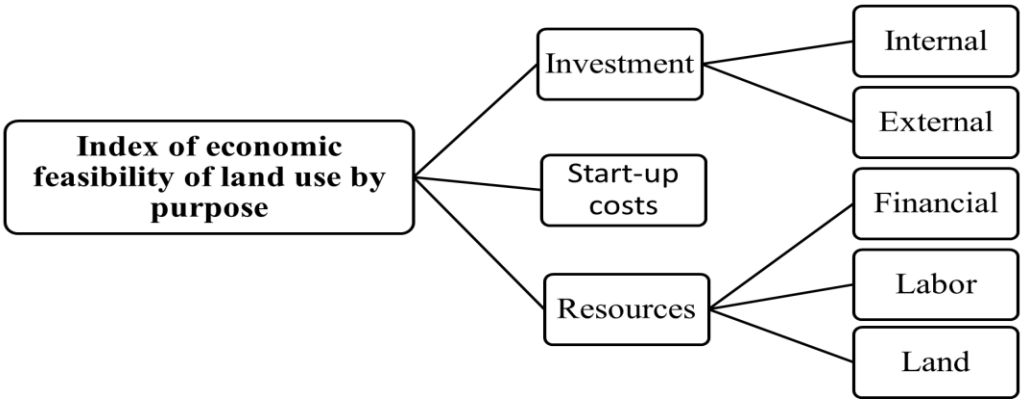

Fig. 4. Index of economic feasibility of land use by purpose

Conclusions and future perspectives. A new period of urban development requires new theories and qualitatively new research. It is an indisputable fact that urbanization is a process that will continue. Its pace will be determined by the state of the world and regional economy, as well as innovation and the results of the fourth industrial revolution. In our future research, special attention will need to be paid not only to the economic and social components of the urbanization process but also to environmental factors. Environmental issues are one of the main problems in the process of urbanization. This is due to the rapid development of infrastructure, development of cities and adjacent areas. And as a result – an uncontrolled very rapid increase in population, an increase in the number of personal transport and the development of new enterprises. All these factors negatively affect the quality of life in cities and can reduce the attractiveness of real estate. Therefore, people do not move to such centers but begin

to build others. The proposed Index of economic feasibility of land use by purpose is a result of mathematical modeling of main economic parameters that include land use, such as land price, real estate prices, investment ratios, and personal income levels (Fig.°4). It will serve as a foundation to build a more robust economic model that will describe conditions needed for future economic growth, efficient land used patterns in urban and sub-urban areas. It should be noted that for making more accurate future predictions, land use patterns, and economic data of close (up to 50 km) and distant sub-urban areas (region) should be studied and added to the model.

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ЕКОНОМІЧНІ АСПЕКТИ ЗЕМЛЕКОРИСТУВАННЯ В МІСТІ КИЄВІ ТА ПРИМІСЬКИХ ТЕРИТОРІЯХ

В. А. Назаренко

Анотація. *У статті автор зосередив увагу на аналізі поточного стану землекористування за видами економічної діяльності підприємств, регіональними економічними та фінансовими даними, щоби запропонувати нову сучасну модель економічно ефективного планування землекористування для комерційних та некомерційних підприємств та установ. Результати досліджень можуть слугувати важливим матеріалом для процесу прийняття рішень про те, як розвивати наявні земельні ділянки та райони міста в контексті нового глобального економічного розвитку. Наведено детальний огляд нинішніх тенденцій землекористування в місті Києві на основі аналітичних даних та*

наукових гіпотез. Автор статті вважає, що це дослідження буде корисним для урядових організацій, органів місцевого самоврядування, міжнародних організацій, приватних установ та деяких науковців і дослідників.

Метою цієї роботи є побудова сучасної наукової моделі, що ґрунтується на загальному розумінні основних економічних проблем ефективного землекористування з урахуванням нинішніх даних, а також короткострокового та довгострокового планування. У статті наведено огляд містобудівної документації та статистичних даних столиці в контексті інформації про нерухомість, міське населення, економічні дані, включно з дослідженнями даних про нерухомість і курс валют до середньостатистичної зарплати в Києві, починаючи з 2000 років. Важливо не надто суттєво зосередитися на нинішніх моделях і системах, оскільки вони занадто покладаються на припущення і складні розрахунки, які важко використовувати в реальному плануванні. Замість цього ми будуємо наші дослідження на реальних даних, тому розробляємо прогноз розміру інвестицій у землекористуванні та середні ціни на нерухомість на найближчі 5 років.

У статті відзначено наявну проблему невідповідності сучасних норм і нормативно-правових актів в Україні щодо раціонального та ефективного землекористування та планування, особливо для місцевих органів влади та комерційних організацій. Автор дослідження обґрунтує, чому економіка в умовах урбанізації потребує нового погляду. У статті використовується інформація про планування міста Києва. Київ – вдалий приклад європейського міста, яке інтенсивно розвивається, тому запропоновану модель можна розробити на основі даних міського економічного планування та землекористування. Це дослідження може допомогти вирішити наявні проблеми урбанізації в Україні та позитивно вплинути на економічний розвиток міста та регіону.

Ключові слова: *урбанізація, економіка, економічне моделювання, сучасні проблеми міст, управління земельними ресурсами, зонування, просторове планування, стратегічне планування.*