

Urbanization and industrialization of space in Ukraine: Realities, changes and forecasts for the future

*Mykola Habrel*¹, *Natalia Lysiak*^{1*}, *Mychajlo Habrel*² and *Marta Dobrowolska*²

¹Lviv Polytechnic National University, 12 Bandery str., 79013, Lviv, Ukraine

²King Daniel University, 35 Konovaltsia str., 76018, Ivano-Frankivsk, Ukraine

Abstract. The purpose - characterize the processes and changes in the urban and industrial sphere of Ukraine, evaluate new realities and justify their future forecast in spatial manifestation. Research results. The article includes the concepts: urbanization, industrialization, spatial organization and development; nature and assessment of processes, phenomena and trends in urbanization and industrialization, spatial transformations in cities and regions; forecasting urban-industrial changes and their spatial manifestation. The research was conducted on the comparison of processes, phenomena and changes in the cities and regions of Ukraine. The authors try to combine rational and irrational components, to systematically assess the impact of the processes and phenomena of urbanization, industrialization and entrepreneurship on the spatial organization and development of cities and regions of Ukraine. The state and challenges in the relationship "urbanization - industrialization (entrepreneurship)" were investigated using the five-dimensional urban planning space model substantiated by one of the authors. Ukrainian cities combine industrial, trade, transport and administrative functions. There are also highly specialized centres: industrial, transport, resort, religious, military. Cities growth is mainly due to the expansion of the service economy. Most jobs are created in this area. Migration flows lead to changes in the composition of the urban population with a characteristic predominance of women and people of post-working age. Some Ukrainian cities have a "motley" social structure. This causes a change in population settlement within the city itself. "Values", "needs" and "activities" of man and society should be central in state development and spatial organization concept. Having a multi-level character, cities have the following properties: reproduction; cyclicity; motivations; individualization, can be real and virtual; variable or permanent; depend on the means and conditions of implementation. Communities have become the most important level of spatial planning in Ukraine today — they make decisions about activities, construction and events on their territory. This will ensure the development of the state, its regions and cities along an effective trajectory. The author's proposals can be used in the General State Planning Scheme and the Regional Planning Scheme. Conclusions. Reconstruction in Ukraine after the war must begin with critical infrastructure: electrical networks, roads, railway connections, gas supply, water pipelines, communication systems; schools and hospitals, provision of

* Corresponding author: natali.bila@gmail.com

temporary housing who have lost it. It is important to focus on creating jobs and generating income, supporting and developing entrepreneurship, spatial and urban policy, and strengthening the energy sector. At the same time, traditional values should not be lost. Relocated enterprises will return to their "historical homeland" after the war and the stabilization of the situation we are talking about resource- and personnel-dependent, as well as areas with high added (intellectual) value. Exceptions will be made by enterprises relocated abroad.

1 Introduction

New realities in the urban and industrial sphere of Ukraine have spatial consequences. There is a need to investigate processes, phenomena and changes in cities and regions of Ukraine in order to substantiate forecasts of the future development of cities. The task is set in the article:

- clarify the concepts of urbanization, industrialization, spatial organization and development;
- to characterize and evaluate processes and phenomena in cities and regions in Ukraine — trends in urbanization and industrialization, spatial transformations (relocation);
- to give a forecast of urban-industrial changes and their spatial manifestation.

The theory, methods and practical provisions of social logic were used for the research. A system of knowledge, rules, values, roles (functions and responsibilities), expectations, beliefs, cognitive assumptions, rules used for research by the authors as more important for understanding things against rational market analysis. The authors try to combine rational and irrational factors and evaluate their influence on the spatial organization and development of regional systems, processes and phenomena of urbanization, industrialization and entrepreneurship. The study of the raised problem is concentrated around research:

- the connection between industrialization and urbanization, the role of urbanism in entrepreneurship and their spatial manifestation. The interaction of "urbanization - industrialization" and the impact on the space of the region, which is explained by the social "embeddedness" of enterprises and entrepreneurs in the environment, is obvious. The spatial development of cities and settlements depends on the type and specificity of business activity and the level of industrialization;
- the influence of the phenomena of globalization and local (regional) context on urban processes and entrepreneurial activity. The structure of economic activity of the region forms long-term entrepreneurial and spatial development;
- the impact of digital technologies and innovations on industry and entrepreneurship. Zhang, T., Stough, R. & Gerlowski (2022) note that people with low and high digital "intelligence" are more likely to become entrepreneurs than those with average levels [1]. The desire to be an entrepreneur grows stronger with age. Living in central cities and in places with higher unemployment increases the chances of being an entrepreneur. Tur, E. Burelos, and M. McKelvin (2022) highlight the role of technology, innovation, and invention in entrepreneurship [2]. They emphasize the phenomenon of late recognition of high-level technologies (nanotechnology). This explains the fundamentally different requirements for new firms and the social environment.

The impact of wars and conflicts, their consequences (material, social and environmental losses), and their spatial manifestation. Artuc et al. (2022) take into account the complex impact of wars on welfare in data-limited environments, taking into account mobility and labor flows [3], reflecting Hotz and Miller (1993) migration [4]. The study is based on the

idea of assessing the welfare impact of wars and concepts related to migration decisions and the problem of choice. This more fully reflects both human casualties and material losses (destruction of housing, critical infrastructure, environmental pollution). There are also intangible (cultural) consequences, such as loss of social trust, psychosocial trauma, and institutional degradation not only in conflict zones but also in "non-conflict" areas.

All studies emphasize the importance of the spatial component, but interpret it in different ways. The authors of this publication focus on the spatial aspect, examining the status and challenges in the "Urbanization - Industrialization (enterprise)" nexus. One of the authors used the model of five-dimensional urban space [5]. This is a new perspective on taking into account activities when justifying urban planning decisions and spatial development of regional systems.

2 Clarification of key provisions and their essence

Urbanization is a process of growing role in cities and urban life, accompanied by intensification and change in activities. Traditionally, the process of urbanization is manifested in the following aspects: demographic - an increase in the share of urban population; social - increasing the number of people who lead the urban lifestyle (regardless of their place of residence); economic - increasing the role in the economy of the country; Spatial - territorial growth of urban systems.

The process of urbanization is related to the emergence and development:

1) agglomerations - a spatial association of settlements that form common social, economic, infrastructure and other connections. Agglomerations are characterized by: continuous construction, joint engineering and transport infrastructure, entrepreneurial concentration and strong socio-production connections that create an agglomerational effect;

2) suburbanization - rapid development of suburbs in large cities, movement of activity from the center to the periphery as a result of the action of the set of factors and conditions;

3) false urbanization - growth of the urban population without ensuring the quality of living conditions, lifestyle, activity that characterizes cities. There is also a poorly predictable industrialization of the country and regions;

4) "consumer urbanization" - "economic growth without economic development", characterized by crisis phenomena in the natural and social environment of the city.

Industrialization is the process of creating large industrial industries in all sectors of the country's economy. It is characterized by specialization of production, pace, goals, financing and consequences of activity, social and production relations. Industrialization is the basis for the development of small industries and productive forces, increasing the level of well-being of humans.

Spatial organization is the structural, parametric, spatial and temporal orderliness and coordination of elements and connections in space. It ensures the efficient use of the potential of space and the integrated development of urban systems. The concept of settlement is important here - the process of gradual distribution and redistribution of the population in the territory through the creation of new and development of existing settlements. It includes a network of settlements, functional and territorial relations between them, population migration, etc.

Spatial planning is a joint process of forecasting, scientific substantiation and implementation of effective spatial organization and development of territorial systems of different hierarchical levels. The tasks of location (production facilities, residential buildings, social and critical infrastructure), functional zoning, communication (transport), etc. are important in planning. We highlight the following location theories that we believe are useful for the study: behavioral theory, focused on non-economic factors, which focuses on

decisions with limited consideration of economic reality; A. Weber's theory (modified for industrial tasks). To study the problem and predict the future urbanization and industrialization of Ukraine's space, we use a significant and time-tested five-dimensional space model (L-F-U-G-T) [6]. The model contains all the characteristics and the entire set of interactions for solving urban and spatial planning of any complexity. Let us define the following:

- the model helps to understand and comprehend the essence of things, to properly formulate and structure tasks (to build a tree of goals);
- the model does not give a ready solution - it allows to analyze and evaluate the state of the system, to make mental synthesis to justify the solutions;
- tasks in urbanism today are mainly non-marked and poorly predictable. Without rejecting rationality (thinking with tables and graphs), we consider the basic understanding of processes and phenomena in the system;
- L - F (human - function) interactions are important for the task, then conditions (U) are imposed, for which utility, convenience, resources, and other measurements are important. A function is associated with needs - as a means of meeting the needs of a person or community. If there are no needs, then no function is needed to meet them;
- for urbanization and spatial planning, the placement of functions, their structure (basic, auxiliary, external, internal, coordination) and functionality are important. Conditions may be such that the function becomes unprofitable and its placement is inappropriate;
- the ratio of utility to costs (socio-ecological and economic consequences) determines the effectiveness of decisions. The criterion for assessing the interaction of the human-function dimensions is the usefulness of solutions. The usefulness (price of the service) for a person or community may be too high to implement;
- in spatial modelling, it is important to establish the boundaries (not only territorial) of the system (whether the element is in the system or outside it), i.e. whether it is more profitable for the function to be inside the system or outside it;
- the economy and industrialization are closely interacting and oriented towards the market and market relations (fast money). The urban and spatial economy has a socio-ecological essence. Key concepts: entrepreneurship, human capital, social responsibility.

3 Urbanization and industrialization of Ukraine - urban settlement, assessment of processes and phenomena

The level of economic growth of cities and regions can be assessed by various indicators. The most important ones are: GDP per capita, average regional salary, food consumption, services per capita, transport and engineering communications, and indicators of education and healthcare development. During the 20th century, the economic potential of Ukraine's regions was shaped by many factors. The availability and volume of natural resources were

dominant. The concentration of significant reserves of ores and fuel in Donbas and Prydniprovia became the basis for the formation of metallurgical centres of the mining industry.

The allocation and development of productive forces requires a combination of national, regional and local interests in the location of new facilities and the efficient use of local resources. This is important for the development of market infrastructure and regional markets for the production and sale of goods and services. Prioritizing the growth of innovative industries with a quick payback period and resource efficiency for investment activities will facilitate and enable the continued growth of a strong, sustainable and more diverse economy.

The Eastern region of Ukraine has well-developed industries such as fuel and energy, ferrous and non-ferrous metallurgy, chemical, automotive, aerospace, and heavy engineering. Soon, a comprehensive restructuring and technical re-equipment of promising enterprises in the coal, metallurgical, chemical, machine-building and energy sectors will be carried out. It also envisages structural reform of the entire industrial and territorial complex and balancing the development of basic industries with the real needs of the economy. There are hopes that defense industry enterprises will be restored; measures to employ the population in the context of diversifying production, organizing public works, and creating new jobs, especially in mining towns and villages, will also be implemented [7]. Increasing the capacity of the light and food industries, as well as improving the environmental situation by introducing zero- and low-waste technologies, re-profiling certain enterprises, and reclaiming disturbed land. In the Eastern region of Ukraine, the structural restructuring will focus on technical re-equipment and efficiency improvement of enterprises in such industries as tractor and agricultural machinery, automotive, electronic, electrical and food industries. Increasing domestic production of gas, oil, and refined products; specialization of agricultural production, increasing its marketability and efficiency will also be a priority. For the Eastern region, it is important to focus on increasing the efficiency of using the existing scientific and technical potential and location features [8].

In the Western region of Ukraine, the share of agricultural and automotive production, as well as the production of electronic and electrical products using modern technologies, has increased. There are also chemical and petrochemical enterprises, as well as timber, light industry, and food processing. The western region of Ukraine has the potential to develop healthcare industries of national and international importance. Cross-border cooperation within European regions is developing. The tourism industry of Ukraine and the restoration of hundreds of ancient castles and fortresses have significant prospects for development and attraction of foreign investment. The availability of unique healing mineral waters and therapeutic mud at Ukrainian resorts is attractive to people from many countries.

4 Cities - regional and industrial centers of Ukraine. Characteristics and analysis of their processes

Cities as centers of population, production, management, cultural and scientific achievements become centers of economic relations. Their functions are diverse. In Ukraine cities have industrial, transport, trade, distribution and non-economic (administrative, scientific, cultural, etc.) functions. Cities that combine industrial, commercial, transport and administrative functions are most common. There are also highly specialized centers: industrial, transport, scientific and university, resort, religious, as well as military bases in Ukraine. Today, urban development and job creation are mainly due to the growth of non-production sectors.

Migrations have an impact on the structure of the urban population, contribute to an increase in the share of working age people. The local indigenous population in the cities is decreasing. Some Ukrainian cities have a "motley" structure. This has an impact on the

population placement within the city itself. A lot of internally displaced persons sometimes creates additional socio-cultural problems related to communication and tolerance [9].

In Ukraine, urbanization takes place according to the "center-periphery" type. A similar view of urbanization is related of "economic dualism" concept, based on the existence of "traditional" and "modern" sectors, considers situations when: a) the city extracts resources for development from peripheral territories, b) the city is "indifferent" to neighbouring districts; c) the city imposes a growth model for the periphery [10].

The study assessed the state and dynamics of urban growth in Ukraine to identify the main trends and the impact of socioeconomic factors on urban growth. The values of 23 indicators for 2015-2020 were selected and calculated for 22 regional centres of Ukraine. The analysis made it possible to identify:

- positive development dynamics in the pre-war period in 2015-2020 of such large cities as Kyiv, Kharkiv, Ivano-Frankivsk, Zaporizhzhia, Lviv, Mykolaiv, Chernivtsi, Odesa, Sumy, Kropyvnytskyi, Vinnytsia, Uzhhorod, Chernihiv, Kherson. On the other hand, the cluster of depressed cities with a low value of the integral index includes the cities of Poltava, Zhytomyr, Khmelnytskyi, Dnipro, Cherkasy, Rivne, Ternopil, Lutsk, Chernihiv, Uzhhorod, Vinnytsia, Kropyvnytskyi, Sumy, Odesa, Chernivtsi, Mykolaiv, Lviv, Zaporizhzhia, Ivano-Frankivsk, Kharkiv, and Kyiv. (Fig. 1).

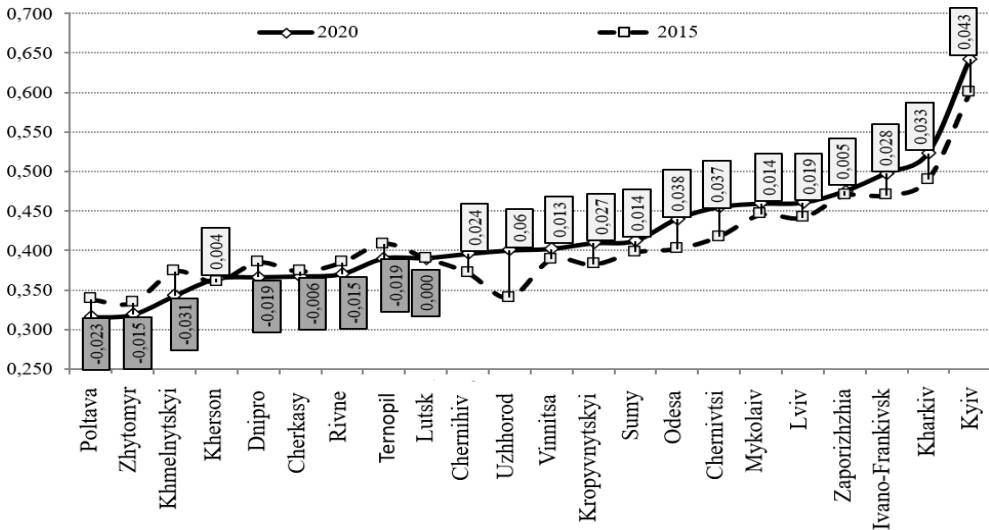


Fig. 1. Integral index of growth of large cities - regional centres of Ukraine in the pre-war period 2015- 2020; Source: author's calculations

- intensification of depopulation processes due to a rapid decline in the birth rate. In 20 of the 22 cities, the situation with population reproduction has deteriorated. This has also affected business activity and prompted the need to introduce measures to promote a positive image of Ukrainian cities and increase urban attractiveness for young and active people. The most significant losses in demographic potential were experienced by the following Ukrainian cities: Chernivtsi, Kyiv, Cherkasy, Poltava, and Kharkiv (Fig. 2);

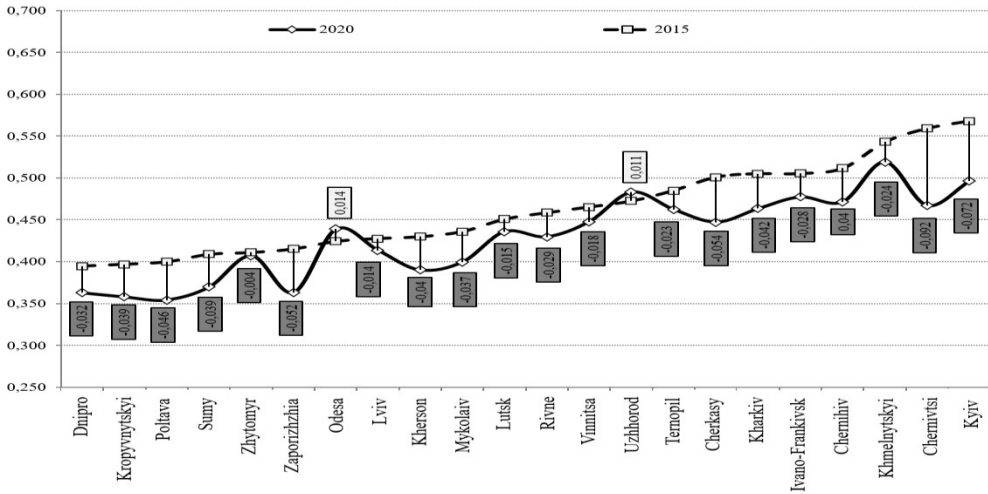


Fig. 2. Integral index of growth of large cities - regional centres of Ukraine: demographic aspect; Source: author's calculations

- the labour market and the education sector are systemic nuclei that accumulate human resources and contribute to the growth of modern cities. Kyiv as the capital of Ukraine deserves special attention. The index value of 0.86-0.97 indicates an extremely high level of development and attractiveness of the capital's labour market. However, we also observe a significant decrease in the number of students in Ukrainian cities during 2015-2020. (Fig. 3);

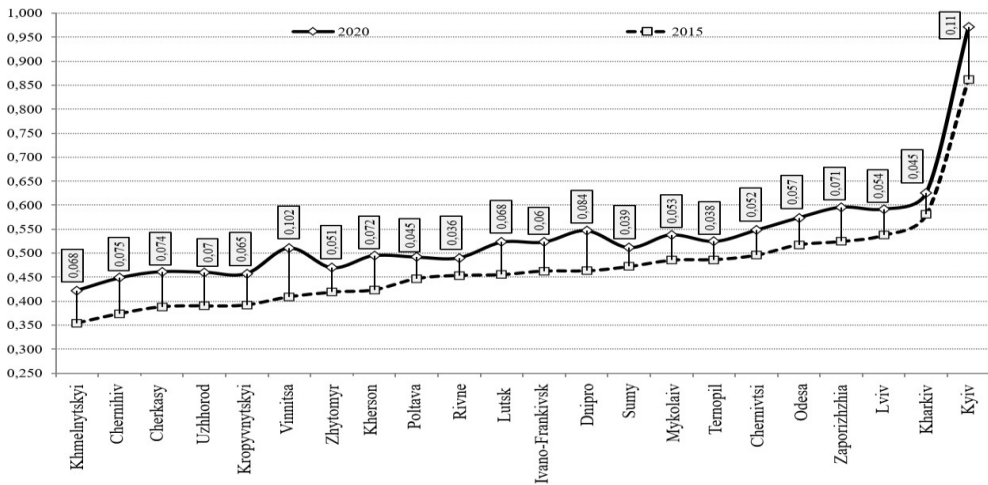


Fig. 3. Integral index of growth of large cities - regional centres of Ukraine: labour market and education; Source: author's calculations

- the indicators characterizing the environmental situation in Ukrainian cities have the lowest values. Despite the trend toward a moderate reduction in emissions of harmful substances from almost 22 tons to 17 tons per 1,000 population in 2015-2020, the environmental condition of Ukrainian cities is unsatisfactory, especially in densely populated cities - regional centres in the South and East of Ukraine (Fig. 4);

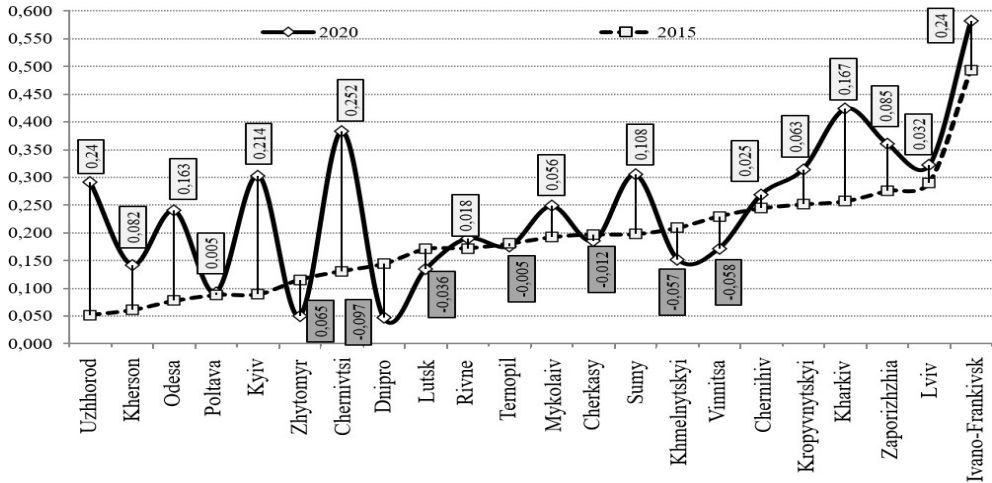


Fig. 4. Integral index of growth of large cities - regional centres of Ukraine: environmental aspect; Source: author's calculations

- the intensification of urbanization processes is traced as a result of economic indicators: business activity (a 10% increase in the number of enterprises per 10,000 populations and an increase in the concentration of enterprises in urban agglomerations by almost 5%), an increase in the volume of foreign economic activity per 10,000 populations by more than 50% (Fig. 5).

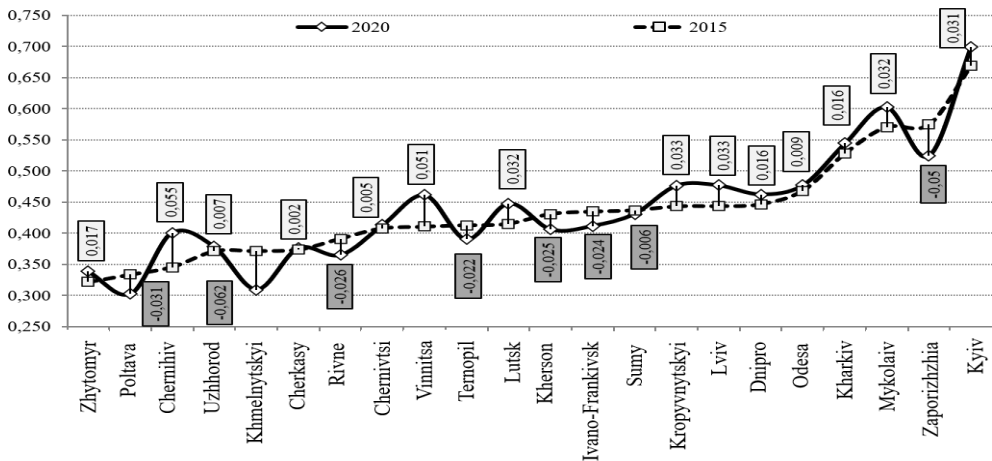


Fig. 5. Integral index of growth of large cities - regional centres of Ukraine: business activity; Source: author's calculations

The results of the calculation showed that the pace and dynamics of urban growth in 2015-2021 were too slow and insufficient, despite some progress in changing the values of the integrated growth index. The uneven and significant asymmetry of the state and dynamics of development of Ukrainian cities leads to an imbalance in the country's territory and increasingly negative demographic trends. There are also disproportions in the cost of living between cities, unequal access to jobs, infrastructure and services for different categories of society. Kyiv, as the capital of Ukraine, is many times ahead of other cities in terms of the integrated assessment [11].

Assessment of processes and phenomena in the urban and industrial sphere of Ukraine:

- a global catastrophe has occurred - Russia has destroyed the global security architecture, dealt a blow to international relations, the world is facing a global food crisis, and political destabilization is growing. Ukraine is at the center of these processes;
- the Eastern region of Ukraine is more urbanized and has retained the Soviet economic system (mono-cities and large city-forming industries);
- the Western region of Ukraine is also urbanized both in terms of the number of cities and urban population, but there is a historical and mental difference;
- a large number of settlements in the Western region of Ukraine have the status of historical;
- unsystematic changes in the distribution of the population in Ukraine are the result of the war unleashed by the Russian Federation;
- differences in the economic system during the period of Ukraine's independence (preservation of industrial enterprises in the east of Ukraine and liquidation of large industrial facilities in the west of the country);
- a change in the economic paradigm (many urban residents are unaccustomed to working in factories and plants "at home");
- a lot of migrant workers employed at plants and factories abroad, and an increase in the number of self-employed individuals. If the situation in the country changes, we can expect that a large number of people will return to work at the newly established plants and factories in Ukraine;
- relocation of enterprises from the Eastern to the Western and Central regions of Ukraine;
- there is inertia (lack of initiative) among residents of small towns ("sleeping cities");
- socialization of relocated displaced persons is almost impossible;
- different social and behavioural models of life in cities of different regions;
- specialization of Ukraine's regions in the context of division of labour and cooperation to create a domestic market and deep integration of industries and regions into the national space;
- transformation of economic activity towards those sectors that demonstrate upward growth dynamics (agricultural sector, IT industry, construction, defense industry, aircraft and rocketry, services) and industries that have comparative and competitive advantages in global markets;
- Ukraine continues to be one of the main suppliers of agricultural products to the world market (cereals, sunflower oil, poultry meat), which are important for solving the food problem;
- new economic, financial, intellectual and socio-psychological prerequisites for economic restructuring of the country have been created, but there is a need to focus on the demand for domestic products in the national and international markets;
- the existing political and administrative and legal environment (tax system, lending) is not conducive to small and medium-sized businesses;
- external financing from traditional international institutions (IMF, World Bank, EBRD) [12], private investors and a special international fund for the revival of Ukraine's economy is envisaged;
- the prerequisites for innovative growth are based on a high level of education of the population, the availability of a significant number of specialists in the information and computer technology sector, and the availability of the Internet and communication systems;

- programs for the post-war reconstruction of Ukraine's economy are created with specific deadlines, funding, and institutional mechanisms.

5 Forecasting urban-industrial changes in cities and regions

The development of the state and its space should be oriented toward improving the efficiency of its functions. The concept should be centred on the "needs" and "activities" of a person and society. We consider satisfying the needs of the community to be the main vector of spatial growth. Having a multilevel character, needs have the following properties: reproduction; cyclicity; motivation; individualization. They can be real and virtual; of varying duration or permanent; depend on economic and financial means and conditions of realization.

Here are some of growth priorities:

1. The integrity of the spatial system, which covers both the settlement and the functional and planning structure of the territory, should be strengthened. It is important to coordinate the linear elements of the planning framework with the growth poles. Consider proposals for the location of logistics centres and industrial parks, the allocation of functional types of territories (environmental, mining, transport communications, etc.). It is important to ensure the socio-political integrity of Ukraine for effective spatial growth.
2. The new urban policy in the country should provide for a change in urban settlement on the basis of opposing the concentration (pulling) of the population into large cities and the destruction of villages and small towns as centers of their service. In the context of decentralization, small towns get new prospects - the production of ecological products as an alternative to new agricultural holdings and the development of recreation. The dispersion of the settlement structure and the development of small settlement elements should be prevented by redistributing resources in their favour, eliminating the lag in the development of small towns, which is currently a factor in slowing down Ukraine's growth.
3. Creating growth poles is traditionally associated with stimulating economic activity in large cities. Today, not only industry, but also the tertiary sector of the economy are becoming such poles. The creation of growth poles involves the transformation of the city-forming base of cities as centres of socio-economic activity; implementation of measures for the prospective development of territories in the war zone through their reindustrialization. This should also include the transformation and modernization of the country's old industrial regions. Reforming the settlement systems and justifying a new zoning scheme for Ukraine should be based on the principle of optimal distribution of administrative powers, equal accessibility of services and human-centeredness. These proposals should be reflected in the General Scheme for Planning the Territory of Ukraine.
4. Strengthen the differentiation of the spatial structure of Ukraine, taking into account the role that the territory plays in the settlement system, the specifics of its natural conditions, management, and historical and cultural features. It is proposed to develop new types and forms of management and expand the functional and typological diversity of space and industries: agricultural machinery and food industry, infrastructure, aerospace industry, chemical industry, automotive production, pharmaceuticals, IT technologies, green industries, transport, tourism (rural green tourism), a network of international transport corridors and historical and cultural centres.
5. Effective use of spatial potential is associated with the following tasks: to increase the spatial potential of the territory and its use, to develop engineering infrastructure and alternative energy sources (bioresources, wind and solar

energy), to promote the growth of additional capacities of nuclear power plants, to develop own oil and natural gas fields, to develop energy-saving technologies. The dynamic development of social infrastructure is driven by the rapid development of information technology and the formation of new values in society. Eliminating regional disparities in access to services requires special attention. The spatial potential of Ukraine is connected with land resources. Currently, the land structure is being transformed. There has been a significant increase in the area of settlements, especially rural ones. Over the past 30 years, the area of villages has increased three times more than the growth of urban areas. The increase in the area of rural settlements in contrast to the demographic decline requires research into the cause of this phenomenon in the regions of Ukraine. The following should be carried out: an inventory of lands in Ukraine; determine the structure of land management to ensure food security and other types of state security; to optimize the structure of agricultural entities.

6 Conclusion

1. The stated provisions should be laid down in the General Scheme of planning of the territory of Ukraine and transferred to the Territorial Planning Schemes of administrative regions level. Territorial communities have become the most important level today — they make decisions about activities, construction and events on their territory. The industrial-urbanization aspect should be reflected at all levels of spatial planning, taking into account its own tasks. This will avoid conflict situations and ensure the development of the state on an effective trajectory.
2. The reconstruction of Ukraine should begin with the reconstruction of critical infrastructure, in particular, power grids, roads, railways, gas supply, water pipelines, communication systems; reconstruction of schools and hospitals, provision of at least temporary housing for those who have lost it. In the future, the state and partners should direct efforts to the recovery of the economy as a whole and its growth. The main efforts should be focused on creating jobs and permanent sources of income generation, supporting and developing entrepreneurship, financial policy, strengthening the energy sector.
3. The relocated enterprises will return to their historical "homeland" - first (resource-dependent), - second (personnel-dependent), - third (areas with high added (intellectual) value). The only exceptions are companies that relocate abroad.
4. The level of urbanization of Ukraine's regions should not be linked to pre-war indicators and existing forms, and requires a new policy after the Victory. It is important that reconstruction does not become a blind reproduction of what was destroyed. This is an opportunity to apply the latest urban planning and architecture approaches to make Ukrainian cities more comfortable and inclusive for their residents.

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