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APPROACHES TO FORECASTING DEMOGRAPHY TRENDS IN THE MANAGEMENT OF INTEGRATED AREA DEVELOPMENT

The article is devoted to the innovative approach in the management of the area development for Ukraine based on demographic forecasting. Demographic forecasting is an essential element of informational supply for development and implementation of mid- and long-term social-economic development strategy and public administration of the area development.

It is emphasized that the approach to solve this problem should be comprehensive. One of the modern options to settle the problem is based on borrowing European expertise on integrated development, which results, apart from social-economic growth and environment improvement, in significant increase in the number of European urban dwellers. Detailed demographic forecast should make a ground for decision-making and development of integrated area plans. Integrated development of areas, primarily urban ones, involves the development of all urban environment elements: transport, economy, economic and social infrastructure, etc. Therefore, it requires vertical integration, on one hand, of various public administration levels – national, regional, and local ones, and, on the other, of private sector and public society.

Based on the analysis of demographic forecasting methods, the authors propose their own approach to area population forecasting, combining the component method that considers the net migration indices, the future

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employment estimating method and the similarity (correlation) method. The authors offer their own approach for area population forecasting based on a combination of cohort group method (considers the net migration indices), future employment estimate and similarity (correlation) methods. The common indices (birth and death rates, migration) should be the key components. However, the factors for their future changes should be defined individually based on the trends in the city's social-economic development.

The proposed method takes into account the impact of the key drivers capable to change significantly the demographic forecasting when developing normative and functional demo-forecast options, and should make up the basis for social-economic strategic plans of urban development to be implemented by local authorities and self-government bodies.

The theoretical provisions are supported with practical data of demographic forecasting for the implementation of integrated development strategy for the town of Poltava (Ukraine). Authors argue that demographic forecasting is optimal under the following conditions: detailed social-economic analysis of the city; and identification of strengths and weaknesses, and opportunities and threats. Based on the performed analysis and the objectives of perspective development, one can assess the opportunities for the improvement of demographic situation in the cities.

Keywords: *innovation in the management of area development, integrated area development, demographic forecast, demographic forecasting methods, demographic development driver*

Introduction. Demographic forecasts are the vital element of informational support to develop and to implement the mid- and long-term strategy of social economic development. Understanding demographic forecast as rigorous data on future local, regional, national and global changes in population number, replacement and structure allows to identify major objectives of human development.

Globally, demographic forecasts are used for the following:

– To develop the population policy and human development programs;

– To develop science-based human development models;

– To assess the future changes in environment conditions, etc.

To develop such a forecast, the index of total population or the number of a specific social-demographic group are used; hence, such forecasts are not detailed [1].

Nationally and regionally demographic forecasts are used for the following:

- To develop national and regional development programs, as well as programs for sectoral development and for the placement of production facilities;

– To identify the country's natural economic growth rate;

– To develop social, pension, and medical insurance programs;

– To develop the employment and workplace forming policy;

– To identify the demand for food, power, accommodation, social-living, medical, educational, transportation and other services.

Apart from the above, demographic forecasts ensure the opportunity to foresee expected birth and death rates, life span and future migration, that, beside the national and regional strategic decision making, allows to survey the dependence of these indices on various factors and general global trends in their dynamics [2-5]. It is also common to use demographic data

in business, primarily, in marketing and management (demographics) to identify the market capacity for certain goods and services [6,7]. Such forecasts, as a rule, require detalization by age, gender, working ability and economic activity, marital status, education level, etc.

Forecast data reliability depends, of course, on forecast period duration, input data accuracy, validity of selected hypotheses and demographic prognostics [3]. It should be noted that the most reliable demographic forecasts are developed for small areas with specific social-living conditions and statistics available on population size and structure. This is the case primarily of the cities, whose economic growth can influence significantly the economic growth of the country, and its transition to qualitatively new stage of the social development; such growth can be ensured only based on data about natural drivers, which include population size and strategy of the improvement of its qualitative and quantitative parameters.

The population control problem is urgent for Ukraine: under the UNO global forecast, Ukraine is among the countries, which will have a population reduction by more than 15% by year 2050 [1], and current population replacement shows all signs of a demographic crisis [3].

And the approach to solve this problem should be a comprehensive one. One of the modern options to settle it is based on borrowing the European expertise on integrated development, which results, apart from social-economic growth and environment improvement, in a significant increase in the number of European urban dwellers. Such approach is innovative to the management of area development in Ukraine.

Integrated area (principally urban) development, is an approach that considers the development of all urban elements: transport, economy, economic and social infrastructure, environment, etc. thus requiring a vertical integration between various management levels – national, regional, local ones on one hand, and private sector and public society on the other. The principles of integrated urban development are set in the Leipzig Charter on Sustainable European Cities and Guiding Principles for Sustainable Spatial Development of the European Continent [8,9]. Presently, four cities of Ukraine (Vinnytsya, Zhytomyr, Poltava, are Chernivtsi) are developing the Integrated Urban Development Concept. We believe that a detailed demographic forecast should form the basis for decision-making and plans of integrated urban development.

Thus, forecasting an integrated urban development system stipulates the development of several scenarios of demographic forecast: the realistic, analytical, normative and functional ones. Implementation of integrated urban development concept will allow to overcome the negative trends in demography and greatly improve the demoeconomic situation.

The purpose of the survey is to analyze and justify the innovative demographic forecasting methods complying as much as possible with the goals and objectives of the integrated area development, taking into account the impact of the key drivers capable to change the demography forecast significantly when developing its normative and functional options.

Literature Review. Methods to forecast urban and rural population, their benefits, limitations, data requirements, and complication level were described in researches [10-12]. T. Chapin and K. Diaz-Venegas used extrapolation and correlation methods, and to forecast migration – a scenario approach [13]. I.Mussio and C.Tondo applied the scenario approach combining it with extrapolation method, population migration, natural growth and employment forecasts in Germany [14]. American scientists also recommend to use the integrated projection models based on cohort group and employment methods [15]. R. Dennis, R.Howick and N. Stewart forecast the Great Britain urban population size combining the cohort group and extrapolation methods [10].

Juha M.Alho considers the financial sustainability of public finances in the context of stochastic demographics. He tailors standard nonparametric regression techniques to the task of computing the required future conditional expectations [16]. Finnish scientists consider

using stochastic demographic forecasts in quantitative evaluations of fiscal sustainability that include the effects of population ageing [17]. T. Wilson introduces a probabilistic model which is suitable for large subnational regions and which produces both population and household forecasts. [18]. S. De Iaco and S. Maggio propose a dynamic model for describing and predicting Italian age-specific fertility rates. In particular, a Gamma function, slightly modified in order to include time-varying stochastic parameters, is used to describe the variations of the age-specific fertility rates over time [19]. Han Lin Shangad and his colleges propose a statistical multilevel functional data method, where both mortality and migration are modelled and forecast jointly for females and males. The forecast uncertainty is incorporated through parametric bootstrapping [20]. C. Rueda and P. Rodríguez introduce multivariate state space models for estimating and forecasting fertility rates that are dynamic alternatives to logistic representations for fixed time points [21].

Methodology. Conventional methods to forecast urban and rural population were adopted back in 1974 by United Nations Organizations and are still recommended for use [22]. The following ones of them are the most applied practically to develop the region and community population size forecast:

1. Graphical or mathematical projections of the past population growth curve (trend method or mathematical extrapolation method).

2. Forecasts based on correlation of population growth in a city or neighborhood similar to other cities (similarity or correlation method).

3. Population net migration and natural growth methods (cohort group/ component method).

4. Forecasts based on specific assessment of future employment (economic-demographic models).

Each method has its benefits, limitations, data demands, complication level, etc. [10-12]. It is recommended to apply mathematic extrapolation and correlation methods for the local government objectives. These methods have low demands to the data, are simple to apply and capable to generate accurate and rather useful outcomes in a timely manner. In particular, T. Chapin and K. Diaz-Venegas from State Florida University used extrapolation and correlation methods when developing their Local Government Guide to Population Estimation and Projection Techniques [13].

The cohort group method considering the net migration indices is a common one. Net migration is usually forecast verifying its highest and lowest levels prior to applying the cohort group method to estimate the natural growth. The migration estimate takes into account the changes, which occurred within the previous periods and are likely to occur.

The comparison or similarity method stipulates that, if two areas are of similar specifications such as geography, climate, economic potential, education, culture, natural resources, etc., their growth models should be similar. A forecaster selects a developed city, with similar specifications and with previous population level or employment growth curve similar with the growth trends of the one under investigation. Then the target city development is forecast similarly with the past growth of the developed reference area. The simplest way is to select a developed city with similar features where the previous population level or growth curve are similar to the growth trends of the city being studied.

Forecasts based on employment estimation are usually based on the economic development forecasting method. As any urban population capability depends greatly on job opportunity supply, economic development and working force forecast is the ground for population forecasting. Working force forecast transformation into the population forecast is based on applying forecast working force share to total population size ("labor force participation factor").

Scenario approach and multistage models are used very often to forecast the population size, allowing to correct migration trends, birth rates and life span. In particular, in order to forecast the size of total and work capable population in Germany, Irene Mussio and Christian Tondo applied the scenario approach combining it with extrapolation method, population migration, natural growth and employment forecasts. The key variables, considered capable to influence the model parameters, were the level of economic development and better living conditions as a migration factor, state social reproduction policy, level of pension and health care support as a life span factor [14].

American scientists [15] also recommend to apply integrated projection models based on the cohort group and employment methods as the most accurate demography forecasts under the following basic variable indices: birth rate, death rate and migration. Thus, to forecast the birth and death rates it is recommended to use Lee-Carter model, and to forecast the migration – the scenario approach.

The scenario approach was also used by T. Chapin to forecast the population of Florida districts [13], where the optimistic forecast considered the following population growth factors: qualitative housing market, social-economic development improvement, infrastructure development, education and health care quality, migration policy for the foreigners, etc.

R. Dennis, R.Howick and N. Stewart forecast Great Britain urban population size combining the cohort group and extrapolation methods, and considered the migration, being influenced primarily with accommodation quality, urban infrastructure, job opportunities, etc., to be the major driver for the positive trend in population size [10].

Based on the above, the authors offer their own approach for area population forecasting based on combination of the cohort group method considering the net migration indices, future employment estimate and the similarity (correlation) methods. The common indices should be the key components: birth and death rates, and migration; however, the factors for their changes in the future period shall be defined individually based on the trends in social-economic development of the city.

Results. In order to develop an integrated area (city) development strategy, firstly, it is required to draw up the realistic demographic forecast revealing the assumed changed in the population size and structure based on the present trends in the dynamics of the natural population change factors such as birth rate, death rate and migration. The most common method for this type of demographic forecast is the age group shifting (cohort group or component method), mentioned above.

Birth rate factors are estimated by this analysis of index trend history, taking into account the social-economic development of the country, urban area, and fertility indices as well.

Age groups are shifted considering the likelihood of each age group to live up to the next age cohort group, identified under so-called Mortality Tables.

Migration, as a forecasting object, differs a lot from other demographic processes. If changes of natural population movement parameters stipulate quite a long period, and the working force will show this change in extra 20 years lag, the population migration parameters might change in several years.

The following key directions in forecasting the migration can be identified: estimates via application of main trends extrapolation principle, migration modeling, and demographic table methods. The results of such a forecast, as a rule, show quite a pessimistic future number of urban dwellers, that corresponds totally to the forecasts on total Ukraine population decrease as well [3]. Current political and economic situation in the country within the recent

years stimulates the current and significant population and work force outflow to the European countries, and no positive changes are expected yet. Birth rate decrease and constant death rate increase have their adverse impact as well.

Thus, the developed realistic forecast of Poltava dwellers shows that, if nothing changes dramatically in urban social-economic development, its population will be decreasing year by year and by year 2050 it the city population might be approximately 215 thousand persons only or will be reduced by 25% vs. 2015 population which is 289 thousand persons under the data of Chief Statistics Department in Poltava region (Figure 1).

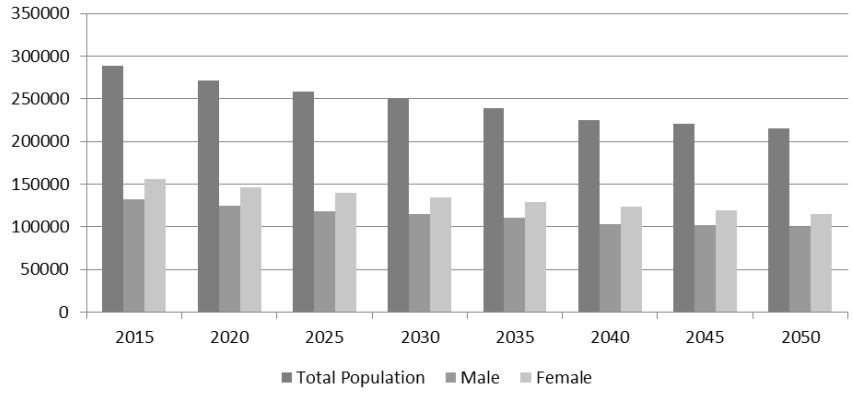


Figure 1. Basic Forecast of Poltava Population by 2050 under the Cohort Group Method

Source: compiled by authors

According to this forecast, there will be changes in population structure as well, namely, the share of working age population will decrease and the unemployable age population share will increase (Figure 2, 3).

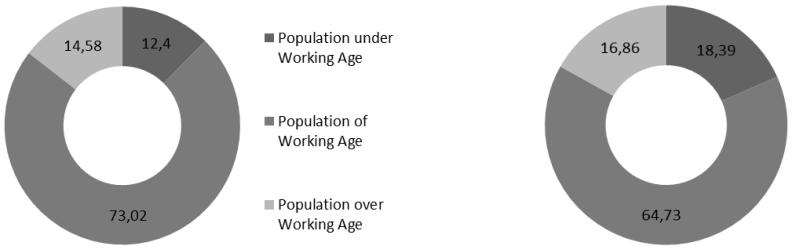


Figure 2. Poltava Population Structure in 2015 and 2030, %

Source: compiled by authors.

It is clear that the integrated urban development strategy, including Poltava, shall be aimed to increase the number of urban dwellers, thus, the factors capable to improve the demographic situation should be identified and considered.

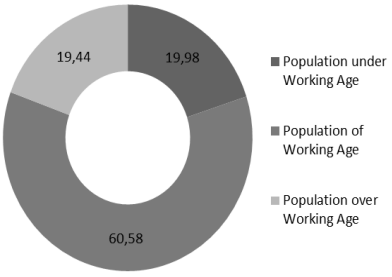


Figure 3. Poltava Population Structure in 2050, %

Source: compiled by authors

As we see it, very few factors can change the negative demographic trends present in the cities of Ukraine, in particular in Poltava, and ensure at least the slowdown of population decrease rate, namely:

– Positive migration balance;
– Increase in birth rate,
– Decrease in death rate and life span extension.

The area population optimistic forecast can be developed within the system of its integrated development objectives based on combination of component method considering the net migration indices, future employment assessment method and similarity (correlation) method.

Whilst justifying the migration level, it is required to consider the trends of the previous periods and the changes likely to occur under the presence of favorable and unfavorable factors, which affect urban migration and which should be considered in the integrated urban development concept. Therefore, it is necessary to review and to estimate the potential outcomes of such changes for migration level within the forecast period.

There is a variety of migration reasons. The main ones are as follows:

– striving for better economic opportunities. It is the migration from the regions of relatively low economic development to the regions with high profit level;
– striving for better living conditions or housing. It refers mostly to the short-distance migration within region or district;
– demand for softer or more acceptable climate conditions, etc.;
– migration on health care or education reasons according to the existing infrastructure;
– migration of near relatives (wives, husbands, pre-schoolers) together with their families.

Under the data of State Statistics Service of Ukraine, in 2015, 12 per a thousand of Ukrainians changed their settlement. More than half of all the migration is done within the region and only 1/3 – between the regions. The migration between cities and villages prevails in the internal migration. Rural population is decreased due to youth outflow into the cities, which contributes to its ageing. The direction of the internal migration is influenced mostly by the following: higher government social payments, and more developed social infrastructure and conveniences common in the large cities.

The level and fluctuations of the national economic activity have their noticeable impact on internal population migration. People are more eager to move to a new location when the business is at high ebb. The level of the economic activity influences the migration direction as well. When the employment is high or increasing, as a rule, there is a working force movement from the rural area and small towns to the medium-scale and large cities due to the relatively higher wages and economic opportunities. However, during the economic depression, migration, as a rule, is directed from the cities to the rural area, mostly because of the people's hope to get the living minimum by farming. Apart from that, the developed social

and economic connections in the urban areas will prevent any movement back to the village in the future.

During a long period, in Ukraine, the village supplied the population for the cities. Mostly it occurred via the youth outflow. Lack of proper employment opportunities in the village, along with the student migration typical for the rural youth, resulted in significant losses of young rural population, first of all, those aged 15-19, whose intensity of leaving rural areas is 3-4 times higher than that of total rural population. According to estimates of the Demography Institute, in the nearest 10 years the rural areas will lose between 9 and 14% of their economic active population due to their migration to the cities [23-24].

The income level per capita and expansion/decrease in economic opportunities for the population in cities are likely to greatly affect the direction and size of net migration. Local employment has a prevailing impact on the changes of population size in most regions. Increased natural growth of regional population and persons demanding supply of goods and services, itself results in the expansion of regional economic opportunities and employment. However, if the job opportunities in a city exceed the natural growth rate of the working age population, then people will flow there.

The birth rate in the cities will increase with the increased employment and incomes and with better provision of accommodation, infrastructure, and social services. Also, the inflow of pre-working age population will contribute to the potential for birth rate increase.

The improvement of urban economic development level and increase in population profit, qualitative social sector and health care has a positively influence on the life span extension and death rate decrease.

Thus, optimistic urban demography forecast is based on the hypothesis of economic activity and employment increase, both nationally and locally. Such assumptions are derived from the analysis of the trends of individual economic indices, expected employment in current economic sectors and opportunities for the development of the tertiary and quaternary sectors.

Let us show the above on Poltava's example. We consider the following to be the major factors to influence the urban population increase (Table 1).

Table 1

Factors to increase Poltava population within the forecast period

Directions of Population Size Increase	Components	Factors	Increase Drivers	Poltava Advantages
Migration	Inflow with students, university graduates	Higher education establishments of various profiles, range of faculties, vocational schools, job opportunities	Opportunity to create scientific park or techno park or business-incubator; Opportunity to develop creative industries	Range of faculties; Popular universities have their famous scientific schools and highly qualified staff to teach oil&gas production, health care, construction, engineering, economy, agronomy; large share of young population, educated population
	Labor migration from other cities of the region, other regions	Job opportunities in conventional and new economy sectors; Good wages, other profits; Developed and high quality social sector, convenient infrastructure, and comfort for living and leisure time; Housing affordability and high quality; Environment		

Table 1 (end)

Migration	Labor migration from other cities of the region, other regions	Job opportunities in conventional and new economy sectors; Good wages, other profits; Developed and high quality social sector, convenient infrastructure, and comfort for living and leisure time; Housing affordability and high quality; Environment	Development of conventional production and services sectors	Real estate and areas available for renovation, opportunity to attract foreign investments and implement the international projects
	"village-city" migration		Region capital functions, opportunity to develop the entertainment sector	Geographical location, transport accessibility and mobility, administrative status
	Return of the youth that left earlier		Developed real estate market	Developed construction sector, affordable and good housing
			High recreation potential, health care system	Developed network of health care facilities, specialized medical services
Increase of Birth Rate		Inflow of working age population, income increase, developed and high quality social sector, healthy environment, sufficient housing supply	Similar	-«-
Increase of Life Span and Decrease of Death rate		Increased incomes, developed and high quality social sector, healthy environment	Similar	-«-

Source: compiled by authors.

Thus, the most likely types of migration, capable to influence Poltava population size, are the following:

1. Migration of rural population to the city (hypothesis assumes a migration of 9-11% of economically active rural population aged 20-45 and their dependants from rural areas of Poltava region to the cities within 10 years). Providing that such category of population in Poltava region in 2015 was 230.5 thousand persons, and more than a half of the migration process occurs within the region itself, the reserve of such migration is rather significant [23-24].

2. Migration increase due to the students that come to study in higher and vocational educational establishments from other areas and stay for a permanent living (population groups aged 15-19 and 20-24).

3. Labor migration driven by economic development, with attractiveness due to both employment and wages. According to data obtained during the survey done by IOM in 2014-2015, the number of internal labor migrants in Ukraine exceeds 1.6 million and is up to 9% of economically active population. Therefore, in the nearest future the internal labor migration might increase by 50% [25].

4. Reverse migration of the university graduates who left the city after the graduation. Creation of new job opportunities, increased wages, infrastructure development, qualitative social services within the cities and housing affordability will make young people return to Poltava and will attract specialists from neighboring regions.

Estimates of the optimistic forecast of Poltava population development are based on the scenario approach and have two scenarios. The first scenario assumes:

– increased infrastructure and expectations of reasonable economic development and potential for population increase, with subsequent adjustment of birth rate indices due to the inflow of rural population in accordance with its size in Poltava region and migration rates (as verified by the Institute of Demography of Ukraine);

– inflow of students and graduates, based on birth trends in Poltava region and in Ukraine in 1997-2016 and increased attractiveness of local education establishments.

The second scenario assumes:

– changes in the economic structure towards the development of innovation and creative industries, and the potentials for the population increase, with subsequent adjustment of birth rate indices due to the inflow of rural population, in accordance with its size in Poltava region and migration rates;

– inflow of students and graduates, as well as workforce from the other cities of Poltava region and other regions of Ukraine due to the formation of an innovative economic infrastructure, development of the creative sector, facilitation of small business development, increased social protection and health care, etc. [26];

– return of the city's university graduates who previously moved to study in the large cities of Ukraine and abroad.

The optimistic forecasting under the first scenario was developed combining the component method (with the consideration of net migration indices), and the future employment assessment method. And the optimistic forecasting under the second scenario – combining the component method, future employment assessment and similarity (correlation) methods. In the process of forecasting the trends in economic development and employment, taking into account the retrospective indices, and justifying the migration value, the regression equations were applied. In order to describe the economy trends, the authors considered models of simple fluctuating development and simple linear-fluctuating development. The forecasting results are shown in Fig. 4-5.

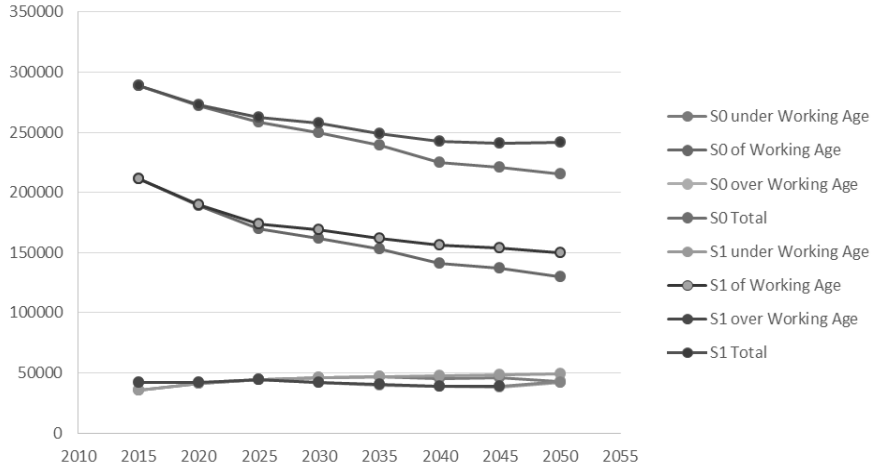


Figure 4. Forecast of Poltava Population Size under Basic Scenario vs. Optimistic Scenario 1, *persons*

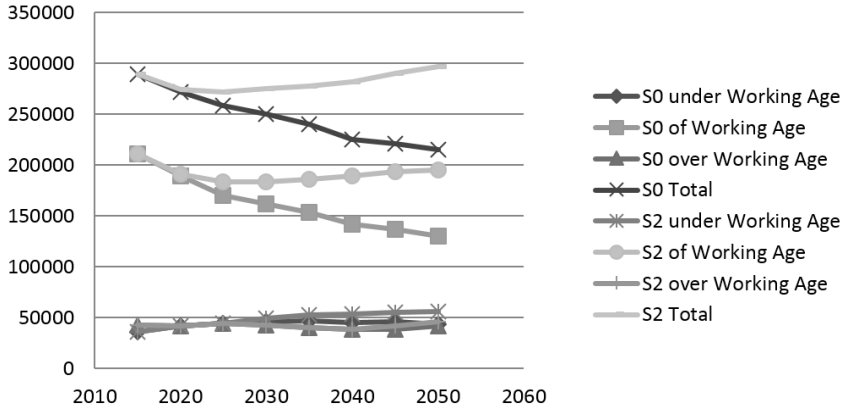
Source: compiled by authors.

Thus, under the optimistic scenario #1, providing no significant changes occur in social-economic situation of the city, the size of the population will be reduced and changed qualitatively, with a decrease in its able-bodied segment (who are at the same time the population of reproductive age), thus resulting in reduced birth rate.

Forecast scenario 2 assumes that the implementation of Poltava Integrated Urban Development Concept [26] will cause attraction and capitalization of significant investments into the city's economy within 2020-2025, creating new job opportunities, and, resulting in a significant growth of population of working age by 2030 and thereafter. Young migrants of working age, engaged in creative sector and knowledge-based activities, will start up their own families and have children, thus raising pre-working age population. Taking into account the "labor force participation factor", which is 0.431 for Poltava, if within the next 10 years in Poltava 2600 jobs are created in the creative sector, it will result in a population increase of approximately 6130 persons by 2030 due to this driver alone. Besides, economic improvement will result in increased birth rate.

Over time, constant attraction of the investments into the city's economy will create job opportunities not only in the basic sectors of economy, but also in the social and in services sector as well, because comfortable urban living environment is one of the key factors of attractiveness for labor force. Such a multiplication effect is expected to occur within 2035 - 2045. At the same time, implementation of the strategy to develop the city as a center of recreation and high quality medical services will allow to introduce a preventive health care system, to improve the quality of medical treatment and to reduce significantly the death rate of the aged population and extend the life span, resulting in increased size of this age group.

Based on the similarity method and forecast assessments of future employment in the new sectors of economy, and, considering the expertise (studied by the authors) of the positive impact of Finnish techno parks and British creative sector on demographic indicators within their location areas [23], the following forecast of Poltava population trend has been made (also considering the inflow of rural population and increased attractiveness for students).



S0 - Basic Scenario S2 - Optimistic Scenario 2

Figure 5. Poltava Population Size Forecast under Basic Scenario vs. Optimistic Scenario 2, *persons*

Source: compiled by authors.

The worst from the point of view of the population size and its working age share is the year 2025. After that, the situation in the city will improve, according to the forecast estimates. The share of the population of the working age will be higher than in the basic forecast.

Forecasting social-economic processes, including the demographic ones, requires developing an averaged and reasonable forecast scenario. For this purpose in order to develop the averaged demographic forecast for Poltava, we apply the method of weighted mean value. Based on expertise, the following weighing factors are defined: for the basic scenario – 0.3,

for optimistic scenario 1 – 0.3, for optimistic scenario 2 – 0.4. Such assessments were provided by the experts of the project "Integrated Urban Development in Ukraine" taking into account the long-term plan for implementation of the Integrated Urban Development Concept. All the calculated forecasts are compared in Figure 6.

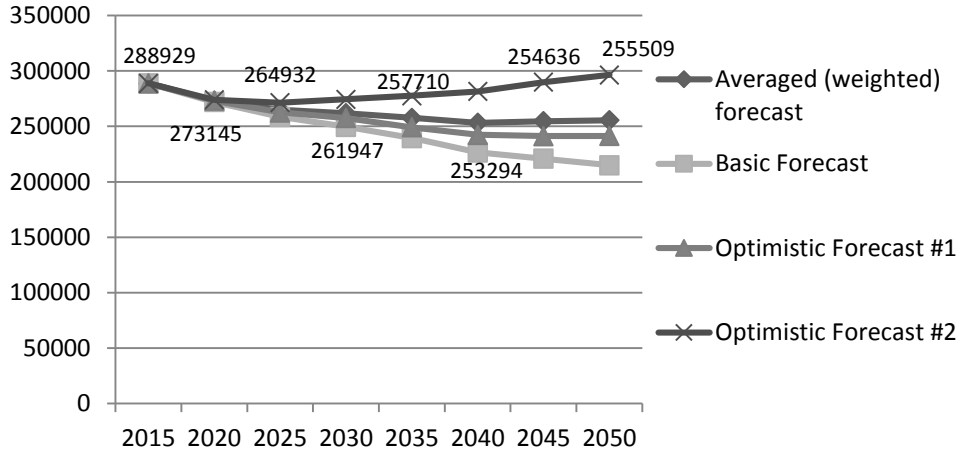


Figure 6. Averaged Forecast of Poltava Population Size till 2050, *persons*
Source: compiled by authors.

By the workability criteria, the averaged forecast of Poltava demographic development assumes the following structure of population by 2050 (Figure 7).

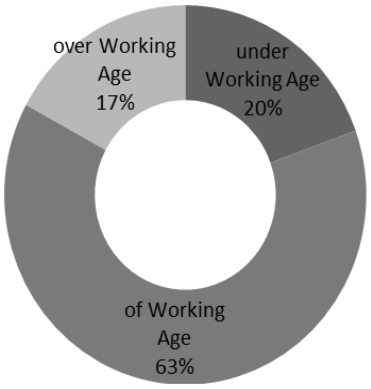


Figure 7. Forecast Structure of Poltava Permanent Population by the Workability Criteria under the Averaged Forecast in 2050, *%*
Source: compiled by authors.

Comparison of urban population structure in 2050 with that, calculated under the basic scenario (Figure 3) shows a higher share of able-bodied population, which is the most considerable factor in both demographic and social-economic development of the city. Thus, the averaged forecast of Poltava population size shows its reduction to 261.9 thousand persons in 2030 and 255.5 thousand persons in 2050, meaning a reduction by 9.1% in 2030 compared to 2015 and by 11,3% in 2050. Migration related increase in population is possible only via internal migration within the country. Migration from the third countries to Ukraine is hardly probable due to this country's geographical position and economic situation. Preventing Ukraine's population outflow to Europe should become a key task for national and regional social-economic policy.

Conclusions. The demographic crisis in Ukraine cannot be overcome without sustainable development of its areas. Eurointegration requires applying, in the urban development, the principles of integrated approaches, whose first strategies are being developed jointly with international organizations displaying an innovative approach in the management of the area development in Ukraine. Demographic forecasting is an integral part of the Integrated Urban Development Concepts. And it is extremely important not only to develop the basic forecast of population size, but also to identify factors capable to influence greatly the increase in the number of future urban dwellers and to justify the optimal demographic forecasts. Objectives and opportunities for population increase are the basis for the development of strategic plans of social-economic development of cities, to be implemented by local authorities.

Creation of new job opportunities and building the economic capacity of the cities, improvement of their social infrastructure, and forming comfortable living environment are the potential opportunities to increase permanent urban population via such migration factors as the students/graduates stay for residence, labor migration from other regions, "village-city" migration, and return of those local dwellers who previously moved to work in other regions.

Inflow of able-bodied population for permanent residence in the city will result in birth rate increase, thus contributing to the city's population increase within the perspective period.

The demographic forecasting is optimized under the following conditions: detailed social-economic analysis of the city, and identification of strengths and weaknesses, and opportunities and threats. The performed analysis and the objectives of perspective development allow assessing the opportunities for improvement of the urban demographic situation.

References

1. UN (2017). World Demographic Forecast. Retrieved from https://iac.enbek.kz/sites/default/ files/.МИРОВОЙ.pdf [in Russian].
2. Steshenko, V., Homra, O. & Stefanovskiy, A. (1999). Demographic perspectives of Ukraine until 2026. Kyiv: Institute of Economics, NAS of Ukraine [in Ukrainian].
3. Libanova, E.M. (Eds.). (2006). Complex demographic forecast of Ukraine for the period up to 2050. Kyiv: Ukrainian Center for Social Reforms [in Ukrainian].
4. Croix, David de la & Gobbi, Paula E. (2017). Population density, fertility, and demographic convergence in developing countries. *Journal of Development Economics*, 127, 13-24. https://doi.org/10.1016/j.jdeveco.2017.02.003
5. Vyshnevskyi, A.H. (2015). After the demographic transition: divergence, convergence or diversity? *Obschestvennyie nauki i sovremennost – Social Sciences and Modernity*, 2, 112-129 [in Ukrainian].
6. Merrick, T. & Tordella, S. (1988). Demographics: people and markets. *Population Bulletin*, 43, 16-24.
7. Murdock, Steve H., Kelley, Chris, Jordan, Jeffry, Peccote, Beverly & Luedke, Alvin. (2006). *Demographics: a guide to methods and data sources for media, business, and government.* London: Boulder.
8. Leipzig charter on Sustainable European Cities. Retrieved from http://ec.europa.eu/regional _policy/archive /themes /urban/leipzig charter
9. Guiding Principles for Sustainable Spatial Development of the European Continent. Retrieved from http://www.mdrap.ro/_documente/dezvoltare_teritoriala/ documente_strategice/Sustainable%20Spatial%20Development.pdf
10. Dennis, R., Howick, R. & Stewart, N. (2007). Methods of Estimating Population and Household Projections. Science Report. Environment Agency, Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol.
11. Smith, Stanley, Tayman, Jeffrey & Swanson David. (2002). State and Local Population Projections. Methodology and Analysis. New York, Boston, Dordrecht, London, Moscow: Kluwer Academic Publishers. https://doi.org/10.1007/0-306-47372-0
12. Klosterman, Richard E. (1990). Community Analysis and Planning Techniques. Rowman& Littlefield.

13. Chapin, Tim & Diaz-Venegas, Carlos. (2007). Local Government Guide to Population Estimation and Projection Techniques. A Guide to Data Sources and Metho-dologies for Forecasting Population Growth. Florida Department of Community Affairs. Division of Community Planning.
14. Mussio, Irene & Tondo, Christian. (2009, June). The implications of the current German demographic evolution. *Insight*. Retrieved from http://ssrn.com/abstract=1445410. https://doi.org/10.2139/ssrn.1445410
15. Tuljapurkar, Shripad. (2006). Population Forecasts, Fiscal Policy, and Risk. Final paper for the conference, "Government Spending on the Elderly" at The Levy Economics Institute of Bard College, April 28-29, Stanford University. Working Paper No. 471. https://doi.org/10.2139/ssrn.924627
16. Alho, Juha M. (2014). Forecasting demographic forecasts. *International Journal of Forecasting*, 30: 4, 1128-1135. https://doi.org/10.1016/j.ijforecast.2014.02.005
17. Lassila, Jukka, Valkonena, Tarmo & Alho, Juha M. (2014). Demographic forecasts and fiscal policy rules. *International Journal of Forecasting*, 30: 4, 1098-1109. https://doi.org/10.1016/j.ijforecast.2014.02.009
18. Wilson, Tom. (2013). Quantifying the uncertainty of regional demographic forecasts. *Applied Geography*, 42, 108-115. https://doi.org/10.1016/ j.apgeog.2013.05.006
19. De Iaco, Sandra & Maggio, Sabrina. (2016). A dynamic model for age-specific fertility rates in Italy. *Spatial Statistics*, 17, 105-120. https://doi.org/10.1016/j.spasta.2016.05.002
20. Shangad, Han Lin, Smith, Peter W.F., Bijak, Jakub & Wiśniowski, Arkadiusz. (2016). A multilevel functional data method for forecasting population, with an application to the United Kingdom. *International Journal of Forecasting*, 32: 3, 629-649. https://doi.org/10.1016/j.ijforecast.2015.10.002
21. Rueda, Cristina & Rodríguez, Pilar. (2010). State space models for estimating and forecasting fertility. *International Journal of Forecasting*, 26: 4, 712-724. https://doi.org/10.1016/j.ijforecast.2009.09.008
22. United Nations (1974). Manuals on methods of estimating population. MANUAL VIII. Methods for Projections of Urbanand Rural Population. New York.
23. Malynovska, O.A. Internal migration and temporary displacement in Ukraine in conditions of political and socio-economic threats. *niss.gov.ua*. Retrieved from http://www.niss.gov.ua/content/ articles/ files/ vnutrishnya_migratsia-45aa1.pdf [in Ukrainian].
24. Ukrainian society: migration dimension (2018). Ptoukha Institute of Demography and Social Studies of NAS of Ukraine. Kyiv. [in Ukrainian].
25. Migration in Ukraine: Facts and Figures. *iom.org.ua*. Retrieved from http://iom.org.ua/sites/default/files/ff_ukr_21_10_press.pdf [in Ukrainian].
26. Poltava-2030. Concept of Integrated Urban Development (2018). Institute of Urban Development CO. PCC. Poltava. Retrieved from https://drive.google.com/file/d/1Rzf_AaUJ29PNKfNoDts2Ar4BF7Z7Nt1D/view [in Ukrainian].

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ПІДХОДИ ДО ПРОГНОЗУВАННЯ ДЕМОГРАФІЧНИХ ПРОЦЕСІВ В УПРАВЛІННІ ІНТЕГРОВАНИМ РОЗВИТКОМ ТЕРИТОРІЙ

Стаття присвячена інноваційному для України підходу в управлінні розвитком територій на основі демографічного прогнозування. Розглянуто роль та значення демографічних прогнозів у забезпеченні реалізації стратегій соціально-економічного розвитку, зокрема, при реалізації стратегії інтегрованого розвитку територій. Підкреслено, що підхід до вирішення проблеми інтегрованого розвитку територій повинен бути комплексним.

Визначено, що один із сучасних варіантів такого вирішення ґрунтується на запозиченні досвіду Європи щодо розвитку територій, що й застосовує саме підхід інтегрованого розвитку, результатом реалізації якого, крім соціально-економічного зростання та поліпшення екологічної ситуації, є суттєве збільшення чисельності мешканців європейських міст. Зазначено, що саме деталізований демографічний прогноз повинен становити основу прийняття рішень та розроблення стратегічних планів інтегрованого розвитку територій.

Досліджено та обґрунтовано методи демографічного прогнозування, що найбільш адекватно відповідають цілям та завданням інтегрованого розвитку територій, з урахуванням впливу найбільш вагомих чинників, які здатні суттєвим чином змінити результати прогнозування демографічних процесів при розробленні нормативного та функціонального варіантів демопрогнозів.

Автори пропонують власний підхід до побудови прогнозу населення територій на базі поєднання методу компонент з урахуванням показників чистої міграції, методу оцінок майбутньої зайнятості та методу аналогії (співвідношення). Ключовими складовими залишаються

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загальноприйняті показники – народжуваності, смертності та міграції, – проте фактори їх зміни у майбутньому періоді визначаються індивідуально – залежно від соціально-економічних тенденцій розвитку міста.

Теоретичні положення підтверджені практичними даними прогнозування демографічних процесів при розробленні та реалізації стратегії інтегрованого розвитку міста Полтава (Україна). Автори стверджують, що створення нових робочих місць та економічне зростання міст, поліпшення їх соціальної інфраструктури, формування комфортного середовища проживання створять потенційні можливості припливу постійного населення міста за рахунок міграційних факторів: залишення на постійне місце перебування студентів навчальних зак-ладів, трудової міграції з інших регіонів, міграції "село – місто", повернення на постійне місце проживання тих мешканців, які виїхали на роботу в інші регіони. Відповідно до проведеного аналізу та цілей перспективного розвитку підхід допомагає оцінити можливості вдосконалення демографічної ситуації в місті.

Ключові слова: *інновації в управлінні розвитком територій, інтегрований розвиток територій, демографічний прогноз, методи демографічного прогнозування, фактори демографічного розвитку.*