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CONSIDERING DEMOGRAPHIC PROCESSES FOR PLANNING THE DEVELOPMENT OF THE EDUCATIONAL SERVICES SYSTEM AT THE REGIONAL LEVEL IN UKRAINE

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INTRODUCTION

Demographic issues in Ukraine have significantly worsened due to an unfavorable age-sex structure of the population, negative attitudes toward childbirth, and both internal and external migration, particularly caused by Russian aggression. The number and structure of the population in different regions determine the prerequisites for providing educational services. For instance, the number of preschool– and school-age children affects the capacity of preschool groups and school classes. The number of post-school youth influences the enrollment capacity of vocational and higher education institutions. Additionally, specific patterns of educational migration exist, especially for higher education. Therefore, it is essential to consider forecasts of the population's age-sex structure and educational migration trends for proper planning of the education sector at the regional level.

Research by Ukrainian scholars mainly focuses on assumptions regarding changes in population size and structure, as well as educational migration at the national level. However, it is also necessary to highlight the consideration of demographic changes and migration processes at the regional level for planning the development of the educational services system. Currently, local statistics (at the territorial community level) are not well established, making it difficult to obtain information on the age structure and other demographic characteristics of the population. To properly forecast the number of education seekers at the regional level, it is crucial to combine population projection calculations with assumptions about the directions and volumes of external and internal educational migration. Taking into account the impact of demographic processes on the number of education seekers at the regional level and identifying educational migration trends will allow for a well-grounded approach to planning the development of the educational services system.

1. Demographic processes in Ukraine and their impact on the number of education seekers at the regional level

The education sector is a crucial factor in Ukraine’s post-war recovery. At the national level, scientific research and key strategic documents, such as the

Strategy for the Development of Higher Education in Ukraine for 2022–2032[1], emphasize the need for the establishment of an innovative economy, smart specialization, and the promotion of human development. In particular, *Research and Innovation Smart Specialization Strategies (RIS3)*, which are widely applied in European countries, are considered by Ukrainian researchers and practitioners as a tool for regional development planning[2]. Accordingly, the role of educational institutions in these processes must be a priority.

A key factor here is the changing trends in the number of potential consumers of educational services. Demographic processes in Ukraine have been studied by numerous scholars and research institutions. The country's leading scientific institution in this field is the *Ptukha Institute for Demography and Social Studies of the National Academy of Sciences of Ukraine*, whose researchers conduct a wide range of studies, including demographic forecasting. For example, Aksyonova S. has examined the impact of various factors – such as the pandemic, war, and forced migration – on the expected birth rate. She has particularly noted the accumulation of a significant number of postponed births and suggested that a higher birth rate after the war should not be expected compared to previous years[3]. The website of this research institution features *National Demographic Forecasts*, with the latest one dated 2023 and covering the forecast period up to 2035. However, the published forecasting results are not detailed at the regional level. At the same time, as acknowledged by the researchers themselves, it is impossible to make reliable predictions about the population size and regional distribution of Ukraine until the war is over.

At the regional level, an additional challenge in calculating demographic indicators arises due to the impact of decentralization on statistical data collection. Specifically, data recording at the level of former districts has ceased, while data collection at the community level has not yet been established. Therefore, the development of municipal statistics is a pressing task, as it would provide data on the gender and age composition of the population at the level of territorial communities. Decentralization has enabled local self-government bodies not only to plan and implement

[1] Про схвалення Стратегії розвитку вищої освіти в Україні на 2022-2032 роки : розпорядження Кабінету Міністрів України від 23 лютого 2022 р. № 286-р. URL: https://zakon.rada.gov.ua/laws/show/286-2022-%D1%80#Text

[2] Смарт-спеціалізація регіонів України: методологія та прагматика реалізації: монографія. Львів: ДУ «Інститут регіональних досліджень імені М. І. Долішнього НАН України». 2022. С.67. URL: https://ird.gov.ua/irdp/p20220006.pdf

[3] Аксьонова С. Компенсаційний приріст народжуваності в Україні: очікування, чинники, перепони. *Демографія та соціальна економіка*. 2022. 50(4). 3-22. URL: https://doi.org/10.15407/dse2022.04.003

measures for stimulating local economic development more effectively but also to plan the development of the education system at the local level. In doing so, it is crucial to consider long-term forecasts of population size and structure. Overall, the lack of statistical information due to the absence of a well-established data collection system at the territorial community level, along with other mentioned factors, complicates the identification of demographic changes and their trends.

We have proposed an approach for identifying demographic changes at the regional level based on available data on the structure of the young population in newly established districts (formed as a result of the decentralization reform). The results of this approach can be taken into account when planning the development of the educational services system. The results of demographic forecasting should be incorporated into strategies, explanatory notes to general plans of settlements, city passports and community profiles, as well as comprehensive plans for the spatial development of territorial communities.

Particular attention should be given to the forecasting period. According to methodological recommendations[4], strategic planning for territorial development covers a long-term period of seven years. Similar forecasting periods are recommended for determining the key design parameters of the *comprehensive plan for the spatial development of a territorial community*: a medium-term period (6–10 years) and a long-term perspective (over 10 years)[5]. Moreover, certain measures, such as the construction of a school, are inherently long-term and capital-intensive. They should be based on well-founded calculations of the demand for educational services over an extended period. The *Guide to Territorial Community Development Planning*[6] suggests developing a "community profile" that not only reflects the current state of the community but also outlines its development opportunities. Among other recommendations, the guide advises including an explanation in the "community profile" of how demographic changes may be linked to the age structure of the population in the territory.

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[4] Методичні рекомендації щодо порядку розроблення, затвердження, реалізації, проведення моніторингу та оцінювання реалізації стратегій розвитку територіальних громад. Практичний коментар для територіальних громад, що розробляють стратегії для реального використання. *Всеукраїнська Асоціація об'єднаних територіальних громад*. С. 4. URL: https://hromady.org/pro-asociaciyu/biblioteka/

[5] Склад та зміст містобудівної документації на місцевому рівні. ДБН Б.1.1-14:2021. Київ: Мінрегіон України, 2022. С. 49. URL: https://e-construction.gov.ua/laws_detail/2860260340841580391?doc_type=2

[6] Васильченко Г., Парасюк І., Єременко Н. Планування розвитку територіальних громад: навчальний посібник для посадових осіб місцевого самоврядування / Асоціація міст України. Київ: ТОВ «Підприємство «ВІ ЕН ЕЙ», 2015. С. 54. URL: https://www.auc.org.ua/sites/default/files/library/1plangrweb.pdf

More than ten years ago, Ukraine implemented an international technical assistance project titled *"Building Capacity for Economically Justified Regional and Urban Development Planning in Ukraine"* (EBED Project)[7]. Through this initiative, demographic forecasts were developed for six cities: Dnipro, Drohobych, Kryvyi Rih, Lviv, Nikopol, and Chervonohrad. The corresponding computer models relied on statistical data to generate assumptions and perform calculations, including the distribution of births by mothers' age, external and internal migration by age and gender, and mortality rates by age and gender. Unfortunately, not all of this data is available on the official websites of the State Statistics Service of Ukraine and regional statistical offices. As a result, applying such computer models for demographic forecasting at the regional level (for cities, towns, districts, or territorial communities) is highly challenging due to the need for extensive data collection and systematization. Additionally, using these models requires specific skills, including an understanding of their structure and functionality. Therefore, a simpler approach was developed that allows for demographic forecasting for cities, towns, districts, and territorial communities, or individual settlements based on a smaller volume of initial data[8]. The proposed approach is based on analyzing changes in the population size within adjacent five-year age groups over the past five years. Statistical data can be obtained from the websites of the State Statistics Service of Ukraine. However, since data on the population structure of territorial communities is not available there, it is advisable to use data for the district where the respective community is located.

The approach has been implemented in a computer model (developed in MS Excel) for forecasting over a 20-year period. The initial input data consists of population numbers for five-year age groups: the first group includes individuals up to 4 years old, the second group covers ages 5 to 9, and so on. The analytical model calculates changes in the size of age groups occurring every five years due to factors such as mortality and migration, while the first age group is also affected by birth rates. Forecasting the size of the youngest age group relies on the *Total Fertility Rate* (TFR), which essentially represents the number of children born per woman. The TFR has fluctuated over the years: it declined in most regions of Ukraine from the early 1990s, then increased from the early 2000s, but slightly declined again after 2012[9]. In the

[7] Розбудова спроможності до економічно обґрунтованого планування розвитку областей і міст України» (Проект РЕОП). URL: https://ebed.org.ua/uk/publications

[8] Матвіїшин Є.Г., Дзюрах Ю.М. Прогнозування демографічних змін на сільських територіях в областях України. *Аграрна економіка*. Т.14. №1-2. 2021. С. 91-102. URL: https://doi.org/10.31734/agrarecon2021.01-02.091.

[9] Населення України. Демографічний щорічник. Київ: Державна служба статистики України, 2022. С. 58.

developed computer model, the TFR can be set based on the user's assumptions regarding its future deviation from the calculated value for a specific area.

The results of our forecasting calculations for several settlements in the Lviv region indicated negative trends in changes in the number of children in Ukraine[10]. For example, Figure 1 shows the forecasting results for the population of children aged 5-15 in the town of Boryslav for the period up to 2038.

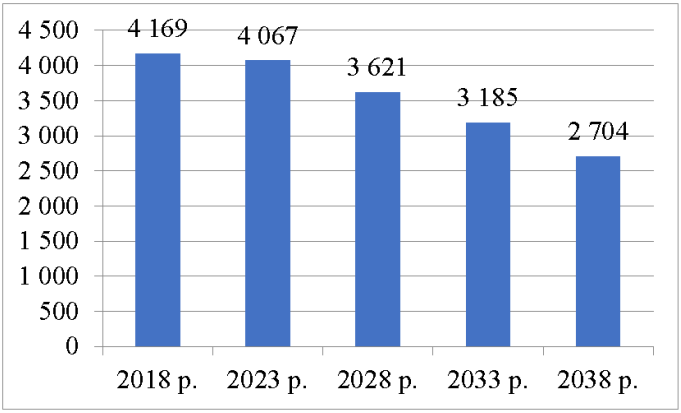

Fig. 1. Projected number of children aged 5–15 in Boryslav, Lviv region

Source: Calculated by the authors

By the way, similar negative trends, manifested in the decline of the young population, are characteristic of most European countries[11]. It is important to conduct forecasting calculations not for the region as a whole but for specific communities or settlements. This is confirmed by the relatively different results for several settlements (the city of Lviv and some towns) in the Lviv region, as shown in Table 1.

[10] Матвіїшин Є.Г. Урахування демографічних змін у територіальних громадах під час стратегічного планування їх економічного та соціального розвитку. Децентралізація публічної влади в Україні: здобутки, проблеми та перспективи: матеріали всеукраїнської науково-практичної конференції за міжнародною участю (15 березня 2019 р., м. Львів) / за наук. ред. проф. П. Гураля, проф. О. Сушинського. Львів : ЛРІДУ НАДУ, 2019. С. 105-110.

[11] Matviyishyn Ye. Ukraine's Population Compared to European Post-Communist Countries in 1990 and 2020. *Journal of Geography, Politics and Society*. 2021. Vol. 11. No. 4 (2021). 46–54. URL: https://doi.org/10.26881/jpgs.2021.4.05

Table 1

Data on the population aged 15 and under in certain towns of the Lviv region in 2018 and forecasting results until 2038

Towns	Population aged 15 and under		Change over 20 years	
	2018	2038	Persons	%
Boryslav	6101	3937	-2 164	-35,5%
Drohobych	13668	8621	-5 047	-36,9%
Morshyn	706	474	-232	-32,9%
Novyi Rozdil	4217	2455	-1 762	-41,8%
Sambir	5590	3603	-1 987	-35,5%
Stryi	8872	5218	-3 654	-41,2%
Truskavets	2810	1582	-1 228	-43,7%
Chervonohrad	12625	7604	-5 021	-39,8%
City of Lviv	111859	83316	-28 543	-25,5%

Source: Calculated by the authors

Given the obtained results, it is necessary to consider, within the framework of spatial planning, the feasibility of constructing new preschool institutions and schools only in areas where the provision of such services is not ensured according to the capacity of these institutions and the service radius in terms of accessibility. A rational solution in some cases could be to place a preschool institution in the same building as a school.

The described approach requires the availability of statistical data over a continuous period of at least 5 years. By the way, based on *an analytical study of the need for statistical information at the municipal level*[12], a relevant draft law was developed. Until detailed demographic data at the level of territorial communities are formed, the source of information may be the statistical database at the level of newly established districts, although it is limited to data as of the beginning of 2021 and 2022.

[12] Аналіз потреб у місцевій статистиці. Аналітичний звіт. Київ: Проєкт USAID «ГОВЕРЛА», 2024. 127 с. URL: https://cid.center/analytics/analysis-of-the-status-and-needs-for-data-and-local-statistics-in-ukraine/

2. Identification of educational migration and its consideration as a prerequisite for providing educational services in Ukraine at the regional level

From the perspective of state regulation in the education sector, it is important to consider not only demographic data on the structure of the young population but also information on educational migration. Researchers have noted that due to Russian military aggression, educational institutions in several regions have suffered significant material damage, and some were forced to relocate to other regions[13]. Bezzubko L. and Topchiy K. focused on internal and external educational migration, classifying external educational migration based on time (temporary, pendulum, rotational, and permanent) and the level of legalization (legal and semi-legal), among other criteria. These researchers proposed viewing educational migration as a resource for developing Ukraine's and its regions' innovative and cultural potential and for shaping a unified humanitarian space[14]. The need they identified for developing a national migration policy aimed at encouraging the return of educational migrants to Ukraine is particularly relevant. Naporchuk D. highlighted the increased risks of a significant portion of the civilian population not returning home due to the prolonged war, the destruction of the economic system, and the challenges of Ukraine's socio-economic recovery[15]. It is likely that external educational migration is also influenced by these factors. Internal educational migration can be assessed based on trends in changes in the number of people of the relevant age group observed in previous years.

In general, the quantitative indicators of the population by age largely depend on demographic reproduction and migration processes, including educational migration. According to forecast estimates[16], considering a range of challenges and threats that will persist even after the end of hostilities in Ukraine, the population may decline to 28.9 million by 2041 and to 25.2 million by 2051. This indicates the risk of a decline in demand for educational services. At the same time, maintaining a high level of educational mobility may lead to additional losses of human potential. The necessity of

[13] Lisogor L., Rudenko N., Ivashenko S. Educational and Occupational Potential of Ukraine: Main Challenges and Ways of Improvement under Current Conditions. *Demography and Social Economy*. 2023. 51(1). P. 24. URL: https://doi.org/10.15407/dse2023.01.023

[14] Беззубко Л., Топчій К. Освітня міграція в Україні. *Галицький економічний вісник.* 2020. Том 65. № 4. 217-223. URL: https://doi.org/10.33108/galicianvisnyk_tntu2020.04.21

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[16] Про схвалення Стратегії демографічного розвитку України на період до 2040 року : розпорядження Кабінету Міністрів України від 30 вересня 2024 р. № 922-р. URL: https://zakon.rada.gov.ua/laws/show/922-2024-%D1%80#Text

strategic planning for demographic reproduction, aimed at stabilization and further stimulation, is undeniable. This is a requirement for national security and sustainable human development, serving as the foundation for implementing state regulatory mechanisms in all sectors, including education, both during martial law and for Ukraine's post-war recovery.

At the regional level, changes in the age structure of the population can be considered when developing strategic plans for the education sector, including forecasting the enrollment capacity of preschools and schools, as well as estimating the potential number of applicants for vocational and higher education. Data on the population structure of regions are available on the website of the State Statistics Service of Ukraine; however, they are only available up to the beginning of 2022. At the regional level, data on the population structure of districts are available, but only for two years – 2021 and 2022. Therefore, it is advisable to consider an approach proposed for determining migration movements at the local level, which could be utilized once proper data collection and reporting at the level of territorial communities are established. Since such local statistical data are not yet available, existing data on the population structure of districts can be used as a basis. This approach is based on comparing current changes in the sex-age structure of the population with changes caused solely by mortality, with any deviations indicating migration by sex and age groups.

The demographic information on the website of the *Main Department of Statistics in the Lviv region* is incomplete: data on the sex-age structure of the population are limited to the age of 70, and mortality rates are not displayed separately for different types of settlements (rural areas or cities). Therefore, mortality rates were taken from the State Statistics Service of Ukraine's website for the Lviv region, where these rates are differentiated for urban and rural populations of both sexes. For illustration, Figure 2 presents the corresponding chart for the female population in the cities of the Lviv region.

By the way, for age categories over 50 years, the age-specific mortality rates in 2021 were higher compared to other years. This can be explained by increased mortality due to the COVID-19 pandemic. Clearly, as a result of the Russian-Ukrainian war, mortality rates will be higher from 2022 onward, especially among the male population. However, these statistical data have not yet been published by the State Statistics Service of Ukraine. To test the approach for assessing migration movement, the available statistical data up to 2022 were taken into account.

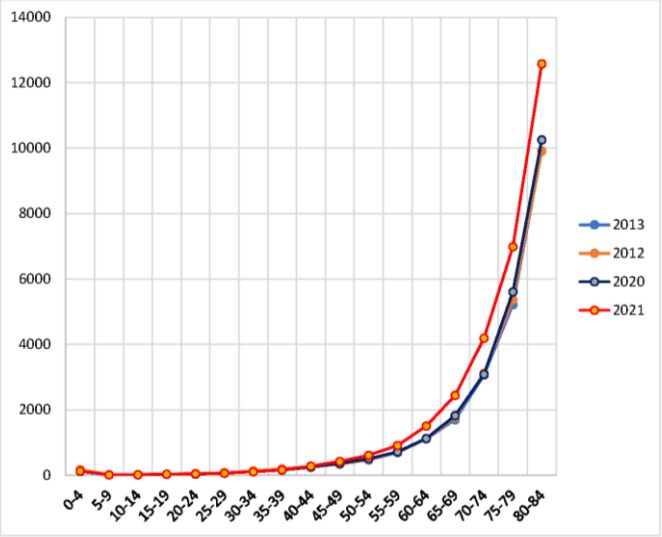

Fig. 2. Age-specific mortality rates for women in urban areas of the Lviv region (per 100,000 population of the corresponding age), according to the State Statistics Service of Ukraine

The approach to identifying migration movement (including educational migration) is demonstrated using data on the urban and rural female population of the Drohobych district in the Lviv region. One of the shortcomings of demographic data from the Main Department of Statistics in the Lviv region is that information is available only for 2021 and 2022 (as of the beginning of each year). Based on population structure data for the Drohobych district in 2021–2022, relative changes (per 100,000 population) were calculated and then compared with age-specific mortality rates. Migration movement (inflow and outflow) in 2021 was identified as deviations (the difference between relative changes in the population of each age group and age-specific mortality rates), multiplied by the district's total population (Figure 3).

For clarity, the graphs depict population outflow directed downward and inflow directed upward. In some age groups, "mirror" changes are noticeable: the rural female population decreased, while the urban female population increased. This can partly be explained by changes in the places of residence of the female population within the district. Peaks in the number of people leaving are also visible in both groups (rural and urban) at the ages of 17 and 21. The primary reason for the peak at 17 years is educational migration, as

young women leave for studies in other districts. The outflow peak at 21 years (observed only in the urban population) may be associated with graduates of the local pedagogical university leaving the Drohobych district. Summing up the results calculated using this approach for both female and male populations provides a comprehensive picture of migration processes in the studied year. Figure 4 presents the summary of migration movements in 2021 for all seven districts of the Lviv region, calculated using the described approach.

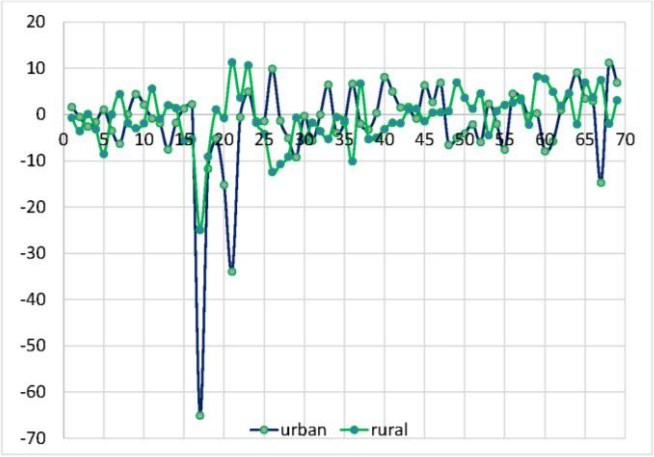

Fig. 3. Calculation results of migration movement of the urban and rural female population in the Drohobych district in 2021 (persons)

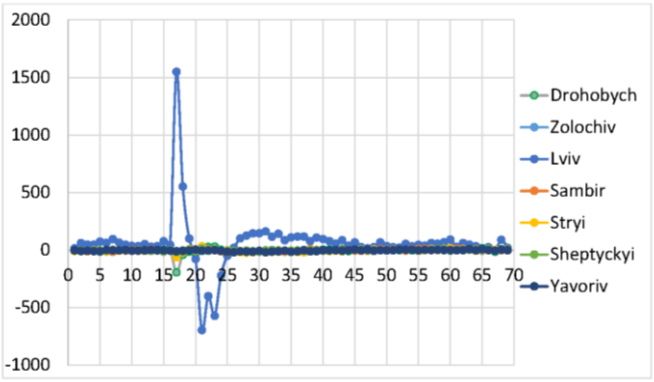

Fig. 4. Results of migration movement calculations for both sexes in all districts of the Lviv region in 2021 (persons)

Due to the fact that the Lviv district includes the city of Lviv, which has a large population and many educational institutions, there is a noticeable high influx of 17-year-olds and an outflow of people aged 21 and 23. In other districts, compared to the Lviv district, migration movements are much weaker. They generally follow the opposite pattern (compared to the Lviv district): an outflow of young people at age 17 and an influx at ages 21–23. Figure 5 presents the corresponding graphs, excluding the Lviv district, in a more visually appropriate scale.

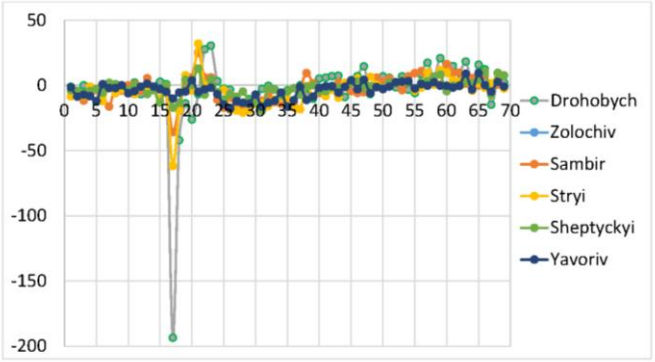

Fig. 5. Results of the calculation of migration movements of both sexes in the districts of the Lviv region (excluding the Lviv district) in 2021 (persons)

Identifying trends in migration movements at the local level is possible if a sufficiently long time period is considered for research. However, currently, published data on the sex and age structure at the district level are available only for two years (2021 and 2022) for both urban and rural populations, which allowed for the calculation of migration movements for 2021. Once data for subsequent years are published, new results will be obtained, enabling the identification of migration trends among different age groups. Each district may have its own "migration pattern," as some districts may have relatively strong institutions of higher and vocational education. At the regional level, the results of calculations performed at the district level can be summarized.

CONCLUSIONS

The described approach can be fully applied only if demographic data are published for several years, at least five. It is also necessary to consider population changes in districts due to forced migration during the full-scale Russian aggression. The population of some settlements has changed significantly due to internally displaced persons, including young people

pursuing various levels of education. To obtain detailed information at the territorial community level, data collection must be properly established. This can be comprehensively implemented after the introduction of local (municipal) statistics.

The described approach to making predictive calculations at the district level, following the decentralization reform in Ukraine, can be used to generate forecasts that should be considered in state regulation of the education sector and regional education system planning. The approach is based on comparing current changes in the sex and age structure of the population with changes caused solely by mortality–deviations indicate population migration by sex and age. Migration flows of different age groups have been determined for the seven districts of the Lviv region, revealing intensive educational migration among individuals aged 17–23. In particular, the Lviv district shows a significant influx of 17-year-olds and an outflow of 21– and 23-year-olds. This is evidently due to the fact that the Lviv district includes the city of Lviv, which has a large population and many educational institutions. In other districts, compared to Lviv, migration flows are much weaker and generally follow an opposite pattern: an outflow of 17-year-olds and an influx of individuals aged 21–23.

Besides demographic processes, another important factor to consider when planning the enrollment capacity of higher and vocational education institutions is the demand for specialists in relevant fields within local labor markets. Identifying these needs will be the focus of further research.

SUMMARY

There are several issues in the field of analyzing and forecasting changes in the demographic situation in Ukraine: the lack of initial information at the level of territorial communities; data at the level of districts, formed as a result of decentralization of state power in Ukraine, is available in regional statistics only for two years – 2021 and 2022. At the level of territorial communities, data is not centrally collected, which creates a need for the development of municipal statistics. For planning the development of the educational services system at the regional level in Ukraine, it is important to consider not only demographic data on the structure of the young population but also information on educational migration. Therefore, the developed approach to identifying migration flows for age categories of the population receiving educational services is highly useful. This approach makes it possible to make a forecast of the number of preschool children, schoolchildren, and post-school youth. To obtain detailed information at the level of territorial communities, the collection of data must be organized. Based on municipal statistics, it will also be possible to account for changes in the population structure of communities caused by internal displacement due to the Russian military aggression.

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