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Shrinking Cities in Belarus. Spatial Differentiation of Demographic Development

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A B S T R A C T

Global economic shifts, demographic transition, political, social, and environmental changes, as well as local crises, have led to the emergence of shrinking cities around the world. The present article assesses the dynamics and scale of demographic shrinkage of Belarusian cities for three intercensal periods: 1989–1999, 1999–2009, 2009–2019. The geographical study of shrinking cities in Belarus was carried out using the conceptual foundations of the shaping factors and criteria for identifying shrinking cities, theoretical approaches to assess demographic processes, and a set of methods (mathematical and statistical, demographic trajectories, grouping, classification matrices, balance, geographical systematization, cartographic and GIS-technologies). The aim of the study was to evaluate the trends of dynamics, scale and differentiation of demographic development of shrinking cities by regions in Belarus, over the period of 1989–2019. Based on international experience, the criteria of shrinking cities applied to the territory of Belarus were defined for the first time, thus becoming a subject of scientific research novelty. The main criteria of demographic contraction of the Belarusian cities are: population decrease over the period between 1989 and 2019, negative annual growth of population, and regressive demographic balance. The shrinking cities of Belarus are heterogeneous in demographic development and divided into three types: 1) outpacing shrinkage (since 1989); 2) catching-up shrinkage (from 1999–2009); 3) reversible demographic trend, with the dominance of the cities in the second category (68%). The dominance of shrinking cities in Belarus is typical for three regions, namely Viciebsk, Mahilioŭ and Homieĺ, which reflects the general trend of depopulation in the eastern and northeastern regions of the country. Establishing a typology of shrinking cities in Belarus represents a scientific innovation and provides a corresponding basis for a differentiated approach to setting promising strategies for their future development.

1. INTRODUCTION

The Republic of Belarus is a country that is experiencing pan-European trends in demographic development – decline in birth rates, natural population decline, and negative population dynamics due to the demographic transition (Antipova, 2020). Against this background, Belarusian cities are shrinking. However, compared to shrinking cities in Europe and the USA, where their emergence in the 1970s and 1980s was initially predominantly associated with the crisis phenomena of socio-economic

development and crises of the urban economy (Fol and Cunningham-Sabot, 2010), in Belarus the demographic factor dominates the landscape of urban shrinkage since the 1990s. However, demographic shrinkage is caused not only by demographic factors. The specifics of city shrinkage are also determined by social, economic, spatial-functional and territorial aspects. The importance of taking into account many aspects in the study of urban shrinkage, including demographic aspects, is not doubted and is currently taken under consideration by scientists of individual countries (Xizi et al., 2024; Xizi et al., 2025).

In the second decade of the 21st century, the demographic factor of urban shrinkage attracts scientific interest among European geographers (Haase et al., 2014; Stryjakiewicz and Jaroszewska, 2022) and is being actively developed. In this regard, studies conclude that urban spaces are being marginalized in several post-socialist countries (Gligor et al., 2024). This aspect is also the subject area of our research. Spatial differentiation of the shrinking cities development is observed depending on the economic and geographical location, population size and other factors (Alves et al., 2016; Kirillov et al., 2023). Thus, in the context of the development of theories of urban settlement and urbanization (Szymańska, 2007; Pacione, 2009), it seems relevant to assess the heterogeneous set of shrinking cities based on dominant factors (the nature of population dynamics, natural movement, population migration). This research focused on the analysis of the dynamics trends, intensity, and spatial differentiation of demographic contraction in Belarusian cities over three decades (1989–2019). Therefore, in our article the demographic factor serves as the basis for analyzing urban shrinkage in the Republic of Belarus. The study put forward three scientific hypotheses: 1) the shrinking of Belarusian cities is mainly caused by changes in the structure of urban settlement, characterized by polarization of population dynamics across city classes, and demographic transition; 2) demographic shrinkage is most obvious in cities with a small population (less than 20 thousand people); 3) Belarusian cities are differentiated by the nature of demographic shrinkage. In terms of scientific novelty, this study is the first to develop criteria for shrinking cities in Belarus, taking into account international experience and local demographic characteristics, and to develop a typology of shrinking cities based on the nature of demographic contraction. The methodological approaches used to develop the typology can be applied to the analysis of shrinking cities in other countries of Central and Eastern Europe and the post-socialist region.

A significant part of previous research of Belarusian cities was related to the study of urban settlement system (Antipova and Fakeeva, 2012), identification of differences in the demographic development of cities compared to rural areas (Antipova, 2020), and monotowns (Antipova and Titov, 2016). A review of studies on shrinking cities around the world by a group of scientists confirms the lack of such studies in Belarus (He et al., 2023). The geographical systematization of shrinking cities in Belarus carried out by the authors is presented as a scientific basis for the development of differentiated revitalisation strategies for shrinking cities as part of the research project "Improving the theoretical and methodological foundations of regional demographic security and human capital in the Republic of Belarus in the context of globalization of the world economy" within the State Research Programme "Society and Humanitarian Security of the Belarusian State" (subprogram "Economy" for 2021–2025).

2. THEORY AND METHODOLOGY

2.1. Theoretical background of the research

The theoretical basis of the current research covers the scientific results in the field of shrinking cities analysis, devoted to the factors of shrinkage, definitions and criteria of shrinking cities, spatial and temporal differentiation of its development.

The modern demographic situation in the countries of Central and Eastern Europe is characterized by a number of distinctive features in the second decade of the 21st century, which are caused by the second demographic transition. According to UN Population Division data for 2023, these countries are facing a steady natural decline (6‰) with a total birth rate of 9‰ and a total mortality rate of 15‰. Central and Eastern European (CEE) countries are experiencing demographic ageing in the context of natural decline. The share of the population aged 65+ years is 18%, while the share of the population aged 0-14 years is 17% (Demographic Yearbook, 2024). According to the UN scale, such a value corresponds to an extremely high degree of ageing. As a result of these two processes, the countries of the region exhibit both population decline and negative population dynamics. Between 2010 and 2023, the population in CEE countries decreased by 3%. Compared to other European regions, the distinctive features of the demographic situation in CEE countries are higher mortality rates and annual population decline (Zotic and Alexandru, 2024).

The problem of shrinking cities (stagnation of development and spatial polarization) is relevant for many countries in Europe, the US, and a number of Asian countries, which justifies a comprehensive study of this category of cities in both developed and developing countries (UN-HABITAT, 2008; Aurambout et al., 2021; Haase et al., 2017; Naigang et al., 2024). Shrinking cities have a specific trajectory of urban development that in many ways follows different

development factors than in the case of growing or stable cities. Population decline is an indicator of urban shrinkage, the tip of an iceberg, that is the result of an underlying complex set of factors, typically including economic recession (Wichowska, 2023), demographic stagnation (Weaver et al., 2017), decline or neglect (Großmann et al., 2013), change in urban settlement patterns (Haase et al., 2016; Stryjakiewicz and Jaroszewska, 2022; Miljanović et al., 2023). All these aspects have been developed in our study.

In the plurality of existing national definitions, shrinking cities are defined as cities that have undergone depopulation as a result of a complex combination of acting factors – crisis of the city economy, obsolescence of economic activities, curtailment of industrial production, population migration to more competitive settings, ageing population, etc. (Oswalt, 2005).

The main demographic criteria defining shrinking cities include: 1) more than 1% average annual and 10% total population decline (Oswalt et al., 2006; Kirillov et al., 2023); 2) annual population decline of more than 0.15% (Stryjakiewicz and Jaroszewska, 2022); 3) a shrinking city as a region whose population change rate is lower than the national average (Turok and Mykhnenko, 2007); 4) population decline in the region continue more than two years (Wiechmann, 2008). Earlier studies by the authors on the dynamics of urban settlement structure in Belarus showed that its dynamics were uneven within classes based on population size and the conditions for the formation of the category of shrinking cities (Antipova and Fakeeva, 2012). From this perspective, the analysis of shrinking cities in Belarus is relevant to the subject area of the study (Table 1).

Table 1. Criteria for defining shrinking cities across different approaches.

No.	Criteria for defining shrinking cities	Scientists-authors
1	More than 1 % average annual and 10 % total population decline	Oswalt (2005)
2	A shrinking city as a region whose population change rate is lower than the national average	Turok and Mykhnenko (2007)
3	Population decline in the region continues more than 2 years	Wiechmann (2008)
4	Annual population decline of more than 0.15 %	Stryjakiewicz and Jaroszewska (2022)
5	1 % average annual of population decline or more than	Kirillov et al. (2023)

Comprehensive empirical analysis of a large number of variables – demographic, migration, economic (Hartt, 2018; Bartosiewicz et al., 2019; Takashi, 2024) – should be used to identify the underlying causes and interrelationships between the factors of shrinking cities. Based on this insight, comprehensive studies of shrinking cities in post-socialist countries have been conducted (Wu et al., 2022; Miljanović et al., 2023), using: a. time series – Poland (Musiał-Malago, 2017), Russia (Batunova and Gunko, 2018; Batunova, 2019) and its individual regions (Antonov et al., 2016), Kazakhstan (Sergeeva and Tereshchenko, 2022); b. the historical approach – Japan (Hattori et al., 2017); c. the typological approach – the Republic of Korea (Kim et al., 2022), Portugal (Alves et al., 2016), and others. The spatial and temporal approach is applied in the study of shrinking cities in China and East Asia (Yang et al., 2021; Xizi et al., 2024), and Poland (Musiał-Malago, 2017; Bartosiewicz et al., 2019), which allows establishing regional/spatial differentiation (Guo et al., 2021), these being also reflected in our study.

The rising trend of urban shrinkage draws attention to cities in certain countries that, while expanding at the macro level, are experiencing decline at the micro level. More localized analyses of specific contributing factors help identify the key drivers of shrinkage and support the development of targeted urban policies (Segers et al., 2020). Such a multiscale approach is used in the current research paper.

Despite the general trend of demographic decline in many post-Soviet cities, as exemplified by those analyzed in Belarus, certain urban centers in Central and Eastern Europe have adopted digital solutions aimed at counteracting urban stagnation and enhancing civic participation. Hence, Alba Iulia, Romania, serves as a relevant example, advancing a model of digital urban governance and local identity through smart city initiatives (Nicula et al., 2022). This experience is constructive in terms of the prospective use of international experience in selected shrinking cities in Belarus.

2.2. Research materials and methods

In methodological terms, the economic and geographical analysis of shrinking cities in Belarus was carried out in several stages, employing a combination of methods – mathematical and statistical analysis, demographic trajectories, grouping, classification matrices, balance methods, geographical systematisation, cartographic and GIS-technologies. The information base of the study includes official demographic statistics of the National Statistical Committee of the Republic of Belarus, which is publicly available. Contrary to similar studies of shrinking cities,

we analysed the demographic contraction of Belarusian cities at two levels.

The first level is an analysis of the dynamics of urban settlement structure in Belarus by city class based on data from four censuses (1989, 1999, 2009, 2019), with the aim of identifying the city class most vulnerable to decline The 2019 finalisation of the analysis is related to the restriction of open access to official demographic data of the National Statistical Committee of the Republic of Belarus after the last census. In order to study the demographic shrinkage of Belarusian cities, we analyzed seven indicators: population by census years, population dynamics for 1989-2019, annual population dynamics, total fertility rate, total mortality rate, total natural decline rate, and net migration rate. At the same time, indicators of the structure of urban settlement were calculated: 1) the number and share of cities by classes of population size; 2) the number of population living in classes of cities by population size. This set of indicators is sufficiently representative and complete in order to analyze the demographic shrinkage of Belarusian cities and can be used to assess the demographic shrinkage of cities in other countries. To establish the strength of the relationships between the main factors of demographic shrinkage in Belarusian cities, we conducted a correlation analysis for 1989 and 2019. The dependent variable was the population size of shrinking cities, while the independent variables were the population above working age, the number of employed people, and net migration.

The second level is microgeographical. The analysis of the second level consisted of several consecutive stages. Initially, the following indicators were calculated: 1) population growth/decline for 1989–2019; 2) annual population dynamics for three intercensal periods – 1989–1999, 1999–2009, 2009–2019; 3) natural population movement coefficients; 4) net migration coefficient; and 5) demographic balance. The demographic balance of administrative territorial unit (ATU) (Table 2), based on combinations of components of natural population movement, or Web's types of demographic regime is an important tool in geodemographic research. Calculated at the microgeographical level (Musiał-Malago, 2017; Bartosiewicz et al., 2019; Antipova and Li, 2021), demographic balance provides scientific basis for the development of socio-economic and demographic policy measures.

Table 2. Hypothetical types of demographic balance of ATU.

Balance type	Demographic component typologies		
1. Progressive (P)	+N>+M	+N<+M	+N=+M
2. Contrast Factor (CF)	+N>-M – CF_{+N}		+N<-M – CF_{-M}
	-N<+M – CF_{+M}		-N>+M – CF_{-N}
3. Regressive (R)	-N>-M	-N<-M	-N=-M

Explanation: natural increase – +N, natural decrease – -N, positive migration balance – +M; negative migration balance – -M.

Next, the main criteria of shrinking cities were identified: 1) negative dynamics of urban population for 1989–2019; 2) negative annual dynamics for three intercensal periods; 3) regressive or contrast-factor type of demographic balance based on a single negative factor – natural decrease or migration outflow. Threshold values were the average values of negative dynamics across the country and deviations from it. In 1989–2019 the average urban population decline in the Republic of Belarus was 12%, the average value of annual population decline was 0.3%. Following on that, shrinking cities of Belarus using grouping methods, demographic trajectories (Parysek and Mierzejewska, 2012) and classification matrices were analyzed and systematized into groups and types depending on: 1) the period of demographic shrinkage onset; 2) the decrease in urban population over 1989–2019; 3) annual urban population decrease; 4) and type of demographic balance. GIS technologies are actively used to identify the spatial polarization of demographic processes and the sustainability of urban spaces (Avădănei, 2019; Nistor et al., 2019). In this study, GIS tools were also used to identify spatial heterogeneity in demographic dynamics in shrinking cities and to map the results. Using ArcGIS software we mapped the research results and compiled 8 maps for 53 shrinking cities for 1989 and 2019.

3. RESULTS AND DISCUSSION

The modern urban settlement structure of Belarus has been shaped over a long period of thousands of years by a complex set of natural, historical and socio-economic factors. The network of cities in Belarus in the second half of the twentieth century underwent significant changes under the influence of the active process of urbanization, which resulted in a constant growth of both the urban population and the number of cities. According to the last census of the USSR in 1989, there were 94 cities in the BSSR, and in 1999, according to the first census of the Republic of Belarus carried out under the sovereign conditions, there were 104 cities. The growth in the number of cities is connected to administrative transformations. In the context of the current study, administrative transformations of towns are understood

as changes in their administrative status (e.g., transition of an urban-type settlements to a city and *vice versa*).

In the structure of the urban population of Belarus until 2009, the practice of urban planning traditionally identified 8 classes: tiniest (less than 5 thousand people), tiny (5-10), small (10-20), semi-medium (20-50), medium (50-100), large (100-250), largest (250-1000), cities-millionaires (more than 1000). However, due to population decline, the decrease of urban population, as well as taking into account the new practices of the urban planning policy of the Republic of Belarus, a generalized classification of cities is currently used. It is represented by three classes: small cities (towns) (less than 20 thousand people), medium (20-100), large and largest (more than 100). The current urban settlement structure, along with the overall settlement system of any country, is relatively stable. There are no major changes in the number of cities in Belarus. In 2009, there were 112 cities. According to the latest census of 2019, there are 115 cities in the country. The number of cities increased due to the transfer of three urban settlements (Astraviec, Kruhlaye, Bialyničy) to the status of towns.

3.1. Urban settlement structure dynamics in the Republic of Belarus

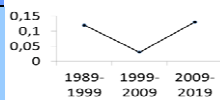
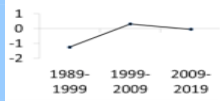
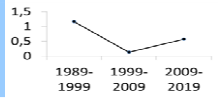
The Republic of Belarus is a country with a population of less than 10 million people, where 9200.6 thousand people live in as of January 1st, 2023. The dynamics of population is characterised by a steady trend of decline since 1993 (Antipova, 2020). Between 2009–2019 the annual decrease is 0.1%. Urban settlement in Belarus is characterised by several trends for the period 1989–2019. *Firstly*, the country's urban population increased annually. Between 2009–2019, the annual growth rate was 0.3%. *Secondly*, the urban settlement structure is characterised by small population size (Antipova and Fakeeva, 2012), i.e. there is the predominance of cities with less than 20 thousand people. This trend is stable, and it has been proven empirically (Table 3). Calculations showed that the share of this city class was 67% in 1989, 2009, 2019.

Table 3. Urban settlement structure of Belarusian cities by population.

City classes by population, ths. people	A. Population, ths. people				Share of class in the population, %			
	1989	1999	2009	2019	1989	1999	2009	2019
Small, less than 20	842.5	852.6	855.3	866.1	13.4	12.9	12.7	12.4
Medium, 20–100	1255.2	1098.1	1132.4	1127.1	19.9	16.6	16.8	16.1
Large and largest, more than 100	4196.9	4682.9	4745.7	5014.4	66.7	70.5	70.5	71.5
Total	6294.6	6633.6	6733.4	7007.6	100	100	100	100
City classes by population, ths. people	**B. Number of cities, units**				**Share of class in the number of cities, %**			
	1989	1999	2009	2019	1989	1999	2009	2019
Small, less than 20	77	75	77	77	67.0	65.3	67.0	67.0
Medium, 20–100	26	25	24	24	22.6	21.7	20.9	20.8
Large and largest, more than 100	12	15	14	14	10.4	13.0	12.1	12.2
Total	115	115	115	115	100	100	100	100

Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.

Table 4. Population dynamics in Belarusian cities.

City classes by population, ths. people	Population, ths. people				Population dynamics, % 1989–2019	Annual growth/decrease, %			Population trend
	1989	1999	2009	2019		1989-1999	1999-2009	2009-2019	
Small (less than 20)	842.5	852.6	855.3	866.1	102.80	0.12	0.03	0.13	
Medium (20 – 100)	1255.2	1098.1	1132.4	1127.1	89.8	-1.25	0.31	-0.05	
Large and largest (more than 100)	4196.9	4682.9	4745.7	5014.4	125.5	1.16	0.13	0.57	

Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.

The third trend involves heterogeneous dynamics processes in the city classes, more stable growth in large and largest cities, unstable growth in medium-sized cities, and minimal growth in the class of small cities (towns) due to the economic recession, migration to larger cities and administrative

transformations (see Table 4). Towns are the most vulnerable to demographic shrinkage, which is also stated in the studies of Polish scientists (Bartosiewicz et al., 2019).

3.2. Structural and geographical differences of Belarusian shrinking cities

3.2.1. Macro-level of analysis

Calculations for 1989–2019 show that shrinking cities began to appear in the Republic of Belarus at the end of the twentieth century. The main factors of their emergence were, firstly, migration of population from smaller cities to larger ones due to industrialization and migration transition in 1970–1980, secondly, natural population decrease in the 1990s, caused by the demographic transition, and thirdly, the political and socio-economic transformation caused by the collapse of the USSR in the 1990s. As previous studies of various authors (Antipova, 2020) have shown, the Chernobyl accident didn't influence on the negative demographic dynamics (fertility, natural population movement, excluding migration) in the cities of the Republic of Belarus in general.

During the first intercensal period – 1989–1999 –, 26 shrinking cities were formed in Belarus as a result of steady natural population decline. By the next period – 1999–2009 –, the number of shrinking cities increased by almost 2 times, their number totaling 50. The main reasons were the socio-economic instability of the country, associated with transitional and transformational trends in the economy and demographic transformations – birth rate decline in the period after the collapse of the USSR, «delayed births» due to the uncertain situation. Over the period 1989–2019, 53 shrinking cities emerged (46.1% of all cities of Belarus). There were dynamic changes in the demographic development of shrinking cities in Belarus over the period between 1989–2019. Over 1989–2019, the total population of shrinking cities decreased by 6% from 1633.7 to 1529.2 thousand people (Table 5).

Table 5. Demographic indicators of shrinking cities in Belarus.

Period	Population, ths. people	Natural population growth/decline, ‰	Net migration, ‰	Period	Annual population decrease, %
1989	1633.7	+7.7	5.4		
1999	1648.5	-2.7	1.5	1989–1999	-0.09
2009	1574.7	-2.4	-8.9	1999–2009	-0.64
2019	1529.2	-3.4	0.4	2009–2019	-0.45

Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus

The pattern of natural population movement has fundamentally changed in shrinking cities – natural increase at the beginning of the period under study was replaced by natural decline. Migration movement experienced three waves. In the period from 1989 to 1999, there was a positive balance, which decreased almost five times in ten years, reaching its minimum values. From 1999 to 2009 there was a transformation of the balance – the character of migration became negative. Over the last intercensal decade, the large-scale outflow of population has decreased in shrinking cities, and the migration mobility became extremely low – 0.4 ‰. These changes are reflected in the trajectories of shrinking cities in Belarus for 1989–2019 (Fig. 1).

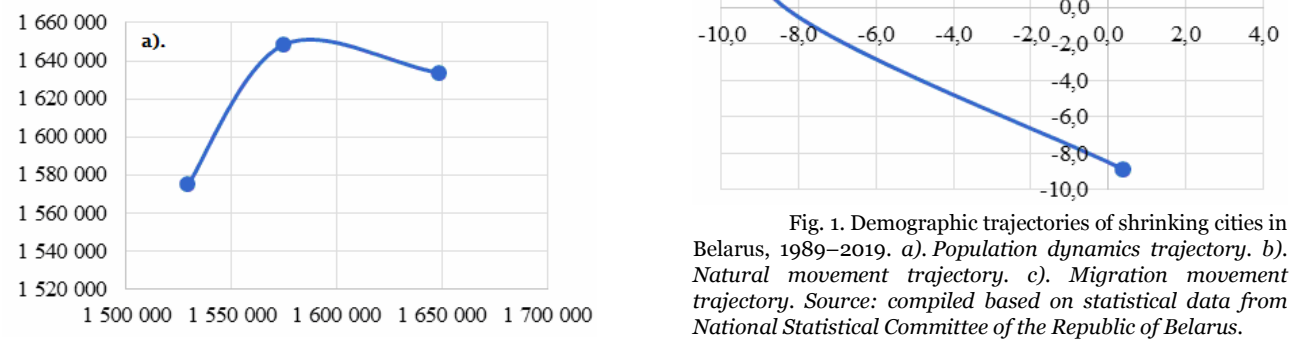


Fig. 1. Demographic trajectories of shrinking cities in Belarus, 1989–2019. *a). Population dynamics trajectory. b). Natural movement trajectory. c). Migration movement trajectory. Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.*

To establish the strength of the relationships between the main factors of demographic shrinkage in Belarusian cities, we conducted a correlation analysis and compiled a correlation matrix (Table 6).

Table 6. Correlation matrix of the strength of relationships between population size and selected indicators of shrinking cities in Belarus.

1989	Population, persons	Population older than working age, persons	Employed population, persons	Net migration, persons
Population, persons	1.000	0.993	0.988	0.767
Population older than working age, persons	0.993	1.000	0.971	0.746
Employed population, persons	0.988	0.971	1.000	0.798
Net migration, persons	0.767	0.746	0.798	1.000
2019	**Population, persons**	**Population older than working age, persons**	**Employed population, persons**	**Net migration, persons**
Population, persons	1.000	0.998	0.991	0.782
Population older than working age, persons	0.998	1.000	0.986	0.764
Employed population, persons	0.991	0.986	1.000	0.838
Net migration, persons	0.782	0.764	0.838	1.000

Explanation: The matrix is based on indicators for 53 shrinking cities that were used in the Classification matrix (Table 10). Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.

Analysis of the data for 1989 showed a strong correlation between the population of shrinking cities and the population above working age (0.993), the economically active population (0.988), and net migration (0.767). In 2019, the correlation strengthened across all indicators.

3.2.2. Micro-level of analysis

There is a clear regional differentiation of shrinking cities in Belarus. The largest number of shrinking cities is typical for the Homieĺ, Viciebsk and Mahilioŭ regions. The situation in the Homieĺ region is explained by the predominance of towns in the urban settlement structure, which are the most vulnerable to demographic contraction. Viciebsk region is the most demographically aged region of the country, where natural population decline appeared much earlier than in other regions. The Mahilioŭ region is characterized on average by a lower level of socio-economic development compared to others regions, which affects demographic processes in cities and leads to negative population dynamics. The Belarusian Paliessie region (Brest region), as well as the metropolitan Minsk region are defined by the smallest number of shrinking cities (Table 7, Fig. 2).

Table 7. Regional structure of shrinking cities in Belarus by intercensal periods, units.

Regions	Total number of cities, units	Number of shrinking cities by intercensal periods, units		
		1989–1999	1999–2009	2009–2019
Brest region	21	3	14	12
Viciebsk region	19	4	17	16
Homieĺ region	18	12	13	12
Hrodna region	15	0	14	7
Minsk region	25	1	16	7
Mahilioŭ region	17	6	16	14
Republic of Belarus	**115**	**26**	**90**	**68**

Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.

The shrinking cities of Belarus show significant population losses over 1989–2019, 12% on average. In ten cities the reduction was more than 20%. These are Davyd-Haradok, Kosava, Barań, Haradok, Dzisna, Dubroŭna, Vasilieviči, Naroŭlia, Chojniki and Kryčaŭ. In cities with an industrial function, such as Barań (enterprise producing equipment and electronics for the defense industry), Kryčaŭ (enterprise producing cement and building materials), Kosava and Dzisna (woodworking enterprise), there was a reduction in the economic capacity of city-forming industrial enterprises due to changes in market conditions, which was a precondition for the outflow of labour resources and population decline (by more than 20% in the period

1989-2019). These trends in shrinking cities with mono-industrial specialization may lead to the marginalization of the urban environment (Gligor et al., 2024).

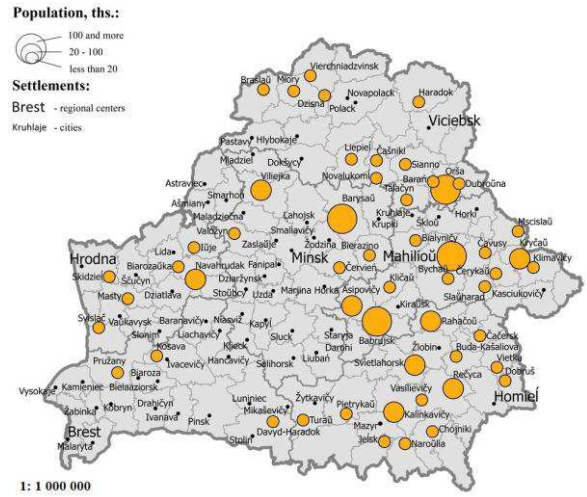


Fig. 2. Distribution of shrinking cities in Belarus by population size, ths. people, 2019. *Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.*

As a result, in Belarus, the demographic shrinkage of these cities led to the transition of the city function from industrial to services. The timely development of differentiated strategies for the development of shrinking cities through smart city initiatives (Nicula et al., 2022) is an important step towards their revitalization.

For example, in Dzisna (Viciebsk region) the population decreased by 39%. This is one of the smallest cities in the country, where the number of inhabitants was 1551 in 2019. The main pattern is the prevalence of high population shrinkage in towns (40%) (Fig. 3).

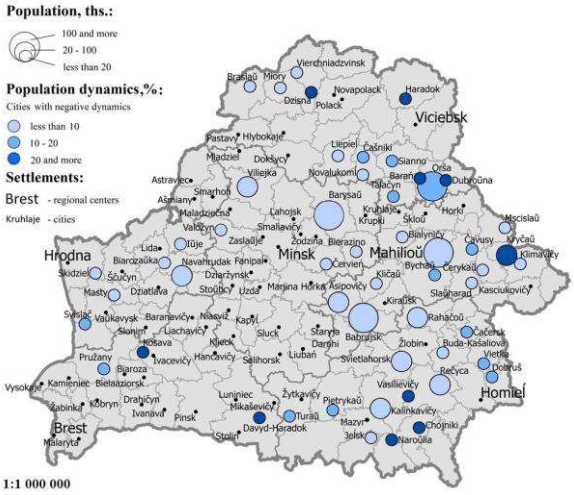


Fig. 3. Distribution of shrinking cities in Belarus by population dynamics for 1989–2019, %. *Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.*

The majority of shrinking cities with high population decline rates are located in Viciebsk region, which has the most unfavorable demographic situation in the country. Calculations show that the class with the largest number of shrinking cities is represented by the towns (small towns according to the classification of Belarusian cities) of the Republic of Belarus. Their share in the structure is of 75.5% (Table 8).

Table 8. Structure of shrinking cities in Belarus by population size classes, 1989–2019, %.

City classes by population, ths. people	Total number of cities, 2019, units	Number of shrinking cities, 1989–2019, units	Structure of shrinking cities by population size classes, %
Small (less than 20)	77	40	75.5
Medium (20 – 100)	24	9	17.0
Large and largest (more than 100)	14	4	7.5
Total	**115**	**53**	**100.0**

Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.

The unevenness of the demographic contraction onset in the studied category of cities is caused by the differences in the natural population movement between 1989–2019. In 1989 natural increase prevailed in the shrinking cities, and only the smallest cities (Dzisna and Turaŭ) experienced natural decline (Fig. 4). In 1999, only 5 such cities remained, and by 2019 most of them showed natural decline. Only four towns (Čačersk, Slaŭharad, Žlobin and Naroŭlia) retained natural increase. All of them are located in the area of radioactive contamination after the Chernobyl accident.

The analysis of population migration in shrinking cities allowed establishing temporal shifts. In 1989, the majority of shrinking cities in Belarus were centers of inflow of young able-bodied population from rural areas, so most of them had a positive migration balance (Fig. 5). Only in the cities located in the zone of radioactive contamination after the Chernobyl accident there was an outflow of population.

In 2019 shrinking cities differentiated in terms of migration patterns. Negative migration balance occurs in 54% of them. Migration of old-age population from large cities to smaller cities is not yet so widespread in Belarus as in other European countries.

The Republic of Belarus is characterized by a contrast-factor type of balance (CF_{-N}), in which natural decrease exceeds the positive migration balance (-N>+M). In 1989 the progressive type of balance (P) prevailed in shrinking cities (70%), and in some cities

the contrast-factor type was observed on the basis of migration loss (CF_{-M}) or on the basis of migration growth (CF_{+M}) (Fig. 6).

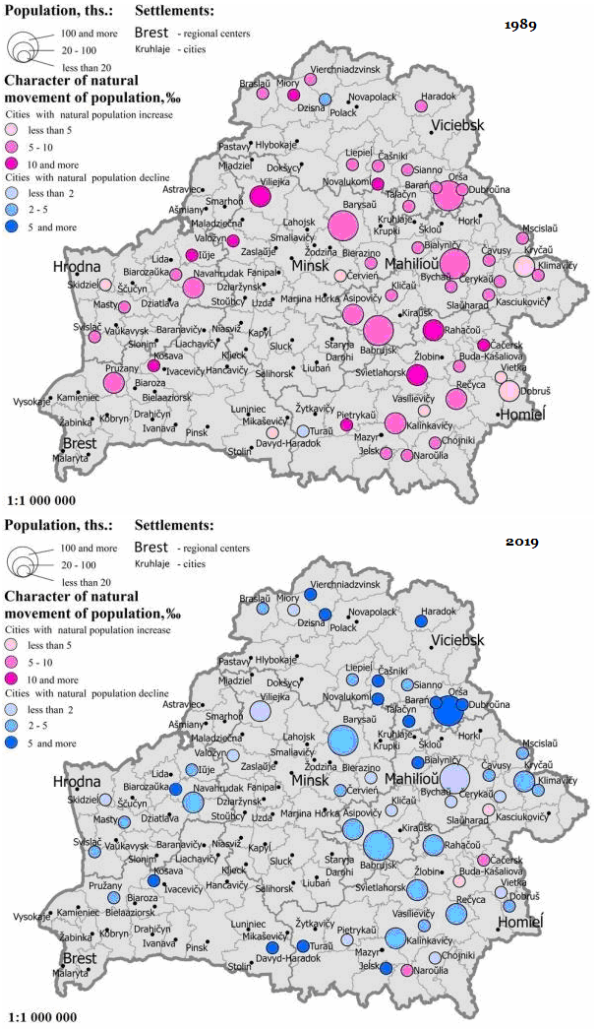


Fig. 4. Distribution of shrinking cities in Belarus by the characteristics of natural population movement, ‰. *Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.*

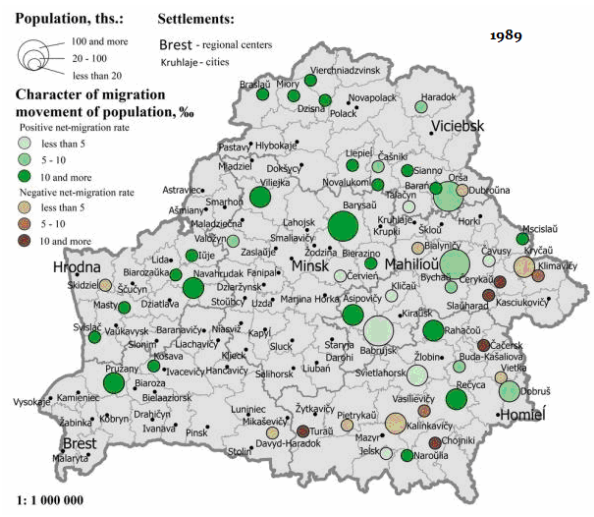


Fig. 5. Distribution of shrinking cities in Belarus by the characteristics of total (external and internal) migration population movements, ‰. *Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.*

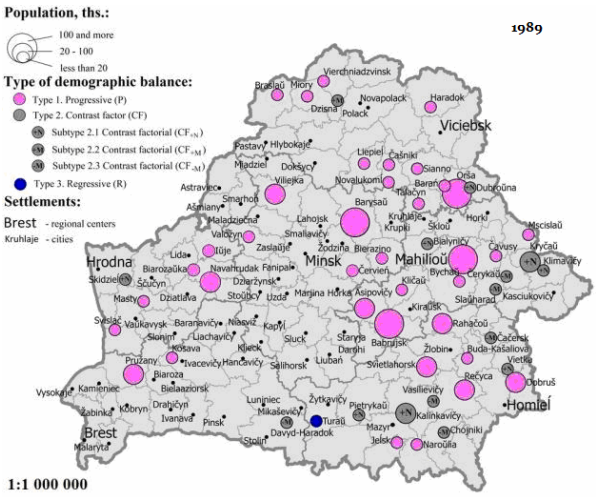


Fig. 6. Distribution of shrinking cities in Belarus by the characteristics of the demographic balance. *Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.*

Only one city had a regressive type of balance (Turaŭ). In 1999 significant structural shifts began to occur (Table 9). 42% of cities started to show a regressive type of balance, and 36%, by a contrast-factor type based on migration loss. By 2009 the share of cities with a regressive type of balance increased to 64%. This is also the predominant type of balance in shrinking cities of the Republic of Belarus at present time.

Table 9. Distribution of shrinking cities in Belarus by the nature of demographic balance.

Period	Types of demographic balance											
	Progressive (P)		Regressive (R)		Contrast-factor (CF)							
					CF_{+M}		CF_{-M}		CF_{+N}		CF_{-N}	
	units	%	units	%	units	%	units	%	units	%	units	%
1989	37	70	1	2	1	2	6	11	8	15	0	0
1999	5	9	22	42	19	36	1	2	0	0	6	11
2009	3	6	34	64	5	9	7	13	0	0	4	8
2019	4	8	29	55	11	21	0	0	0	0	9	17

Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.

In general, the analysis revealed that the Belarusian shrinking cities are heterogeneous in demographic development, which made it possible to differentiate them comprehensively by the nature of demographic shrinkage (Table 10). They were grouped into three types using the classification matrix: *Type 1. Cities of outpacing shrinkage:* stable negative population dynamics in three intercensal periods (1989–2019) and regressive type of demographic balance (since 1999); *Type 2. Cities of catching-up shrinkage:* negative population dynamics in two intercensal periods (1999–2019) and mainly regressive type of demographic balance; *Type 3. Cities of reversible demographic trend:* negative population dynamics (1989–2019) and a reversal to a progressive type of demographic balance.

Table 10. Classification matrix of Belarusian cities by the nature of demographic contraction.

Population decrease, %, 1989 –2019	Types of demographic balance, 2019			
	Regressive (R)	Contrast-factor (CF)		Progressive (P)
		CF_{-N}	CF_{+M}	
More than 20	Davyd-Haradok, Barań, Dzisna, Dubroŭna, Vasilievičy, Kryčaŭ	-	Chojniki, Haradok, Kosava	Naroŭlia
10–20	Orša, Svislač, Turaŭ, Bychaŭ, Čavusy, Talačyn, Pietrykaŭ	Sianno, Čašniki	Vietka, Pružany, Dobruš	Čačersk
Less than 20	Jeĺsk, Svietlahorsk, Biarozaŭka, Iŭje, Masty, Navahudak, Skidzieĺ, Barysaŭ, Červień, Bialyničy, Asipovičy, Kasciukovičy, Čerykaŭ, Mscislaŭ, Kalinkavičy, Rahačoŭ	Vierchniadzvinsk, Novalukomĺ, Bierazino, Viliejka, Valožyn, Rečyca, Babrujsk	Braslaŭ, Liepieĺ, Miory, Kličaŭ, Mahilioŭ	Buda-Kašaliova, Slaŭharad

Source: compiled based on statistical data from National Statistical Committee of the Republic of Belarus.

Explanation:

Type 1. Cities of outpacing shrinkage (stable negative population dynamics in three intercensal periods (1989–2019) and regressive type of demographic balance (since 1999)).

Type 2. Cities of catching-up shrinkage (negative population dynamics in two intercensal periods (1999–2019) and mainly regressive type of demographic balance):

Subtype 2.1. Population decline from 5 to 20%, regressive type of balance or contrast-factor type based on natural decrease.

Subtype 2.2. Population decline from 5% to 20% and more and contrast-factor type of balance based on migration growth.

Type 3. Cities of reversible demographic trend (negative population dynamics (1989–2019) and a reversal to a progressive type of demographic balance).

The first type includes 13 cities, or 24.5%. These are mainly towns (less than 20 thousand people). Population decline over 1989–2019 was more than 10%. Geographically, all of them are located in the demographic periphery of Belarus (Viciebsk and Mahilioŭ regions). This is the most demographically unfavorable type of shrinking cities in Belarus.

The second type includes 36 cities, or 68%. There is a differentiation in the scale of population decline and types of demographic balance (both contrast-factor and regressive, the dominance of the latter). Subsequently, two subtypes are identified in this category: 2.1. cities with population decline from 5 to 20%, regressive type of balance or contrast-factor type based on natural decrease; 2.2. cities with population decline from 5% to 20% and more and contrast-factor type of balance based on migration growth. The first subtype includes 25 cities. The second subtype includes 11 cities.

The third type comprises 4 cities of Belarus (7.5%) (Naroŭlia, Čačersk, Buda-Kašaliova – Homieĺ region, Slaŭharad – Mahilioŭ region) which are characterized by a population decrease over 1989–2019 and a progressive type of demographic balance. Two cities, Naroŭlia and Čačersk, are located in the zone of radioactive contamination. This type of cities presents a peculiar phenomenon – relatively high birth rates compared to other Belarusian administrative districts and cities, which is due to the existing social benefits for families with children living in the radioactive contamination area. As a result, since 1999, the corresponding annual negative population dynamics trend has shifted to a positive one.

The demographic shrinkage of Belarusian cities poses serious problems and has a wide range of consequences for urban management. The shutdown of enterprises, the outflow of labor, a further decline in the birth rate, youth migration, and the transformation of the spatial and functional structure of cities are just a few of the problems that local authorities in shrinking Belarusian cities will have to address. Differentiating Belarusian cities by the nature of their decline allows us to conclude that the most problematic are the cities of the first type. Cities of the third type have a relatively more favorable nature of demographic decline. Cities of the second type occupy an intermediate position in terms of the extent of the problem. Taking into account that research on shrinking cities in Belarus is still in its early stages, this study, based on international experience, demonstrates the necessity of developing differentiated strategies for their revitalization (Nicula et al., 2022) and serves as a basis for further research to assess the sustainability of cities using, among other things, GIS modelling (Nistor et al., 2019).

4. CONCLUSIONS

The research results confirm the scientific hypotheses of the study. In the late twentieth and early twenty-first centuries the demographic contraction of Belarusian cities is caused by three main factors: 1) the compression of the urban settlement structure of the country and small-size settlement leading to the predominance of towns; 2) the demographic transition since the 1990s; 3) the political and socio-economic transformation in 1990s. Although the study period ends in 2019, due to limited access to more recent official statistics, the database developed for 53 shrinking cities in Belarus covering three intercensal periods provided representative results. Shrinking cities make up 46.1% of the structure of urban settlement of the Republic of Belarus. According to demographic trajectories for 1989–2019 shrinking cities are defined by population decrease, negative vector of natural population movement, reversible trend of population migration and general decline in the migration mobility. These trends can be explained by the demographic transition in Belarus. Demographic contraction depends on the population size of the city, and the highest annual contraction is typical for towns.

The shrinking cities of Belarus are heterogeneous in terms of demographic development parameters, which are proved by differences in the nature of natural population movement, migration and demographic balance. The special feature of Belarusian shrinking cities is the transformation of the demographic balance over 1989–2019, concluding in a shift in dominance from a progressive type in 1989 (70%) to a regressive type in 2019 (55%).

Shrinking cities predominate in the Viciebsk region due to demographic ageing, in the Homieĺ region, due to the prevalence of towns, and in the Mahilioŭ region, due to peripheral socio-economic development compared to other regions.

The most unfavourable type is represented by shrinking cities with a regressive type of demographic balance and stable negative population dynamics since 1989, which are geographically located in the demographic periphery of Belarus. These cities, in our opinion, should be the object of particular attention of the state and local authorities for the development of targeted assistance strategies taking into account the lack of their demographic development potential. The intermediate and predominant type of cities in Belarus is formed by cities with contrast-factor or regressive type of demographic balance and negative population dynamics since 1999. Differentiated development strategies are recommended for this type of cities, considering their differences in demographic balance. The phenomenon of demographic contraction in Belarus is represented by the reverse demographic type of cities, which have made a turn to the progressive type of balance since 2009. As some of the cities of this type are located in the area of radioactive contamination, in our opinion, they should be the object of special attention of scientists for conducting pilot studies to identify the underlying factors of the trend reverse with the subsequent creation of targeted development strategies.

All in all, this study identified the most demographically problematic cities in Belarus, revealed the heterogeneity of demographic contraction in the structure of urban settlement, and spatial polarization. The identification of these trends provides an incentive for further pilot studies to develop strategies aimed at counteracting urban stagnation in Belarus.

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