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The influence of demographic processes on the formation and effective use of human capital in the context of regional economy

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Abstract. The purpose of this study was to identify existing problems in the utilisation of human capital in urban and rural regions of Azerbaijan. For this purpose, demographic data for 2000-2024 were analysed, and experts in the field of human resource management and human capital development were interviewed. As part of the research, a comprehensive analysis of human capital and demographic processes in Azerbaijan was carried out. Concepts related to demographic transition and human capital accumulation were considered, which made it possible to reveal the importance of quality educational programmes, decent pay and attractive conditions in periods of change in the age structure of the population. According to the survey data, 30% of respondents from rural areas pointed to the shortage of skilled labour, which might have affected technological innovation and economic growth rates in the regions. Urban respondents also confirmed this trend, with 35% noting difficulties in finding specialists with the required skills. In addition, it was revealed that the share of elderly people (over 60 years old) in the population structure tended to reach 15%, which posed new challenges for the social protection system. To overcome the negative consequences of population ageing, the need to develop mechanisms to engage the older generation in economic activity was justified. It was analysed how infrastructure constraints, public policies and urbanisation affected the professional mobility and competitiveness of workers; the results showed that with proper support from public institutions and employers, as well as the involvement of educational institutions in the constant updating of curricula, it was possible to mitigate the negative effects of population ageing and the shortage of qualified specialists. The research showed that maximising the economic potential of regions in the conditions of accelerated population ageing and migration processes required the interaction of state institutions, business and educational organisations

Keywords: population ageing; migration; public policy; infrastructure constraints; advanced training; urbanisation

Introduction

Demographic processes are increasingly influencing the socio-economic development of countries and regions: changes in the age structure of the population, migration flows, and declining birth rates are creating new challenges for labour markets, education, and social protection systems. These processes exacerbate the need to rethink strategies for the utilisation of human capital, which is a key factor of sustainable economic growth and social stability. From a regional economic perspective, factors such as educational attainment, access to health services and vocational training can be seen as determinants of human capital formation. For developing countries (Azerbaijan included), it is important to take into account the specificity of regions, as differences in the level of development of urban and rural areas have a significant impact on the dynamics and quality of human capital.

Studies on the impact of demographic and economic changes on human capital and the labour market in Azerbaijan have identified existing challenges and directions for development. H. Baghirov *et al.* (2022) showed that the Russian-Ukrainian war has changed trade flows, increased migration and required adaptation of labour resources, which at the same time opened new opportunities in the energy sector of Azerbaijan. According to K.V. Abdurakhmanov (2023), ageing population and migration led to the outflow of skilled labour from Azerbaijan. The author recommended a systematic approach to labour market adaptation through retraining programmes and support for older workers, and pursuant to S. Pürhani *et al.* (2022), investments in education and health can stimulate economic growth and reduce social inequality.

The problem of using human capital to realise demographic potential and fight poverty is also relevant. M. Idrees *et al.* (2022), in a study, revealed that demographic dividend can only contribute to economic growth

if human potential is effectively utilised through education and training, while S. Harnani (2023) stated that economic growth does not guarantee poverty alleviation with unresolved problems of high unemployment and inadequate quality of human capital. Although the reviewed studies have revealed significant interrelationships between demographic processes and the economy, the long-term impact of investments in human capital on poverty reduction remains understudied, especially in view of digitalisation and employment transformation.

The relationship between human capital development, innovation and economic productivity has been studied by a number of scholars. F. Rezaei *et al.* (2021) found that effective knowledge management has a positive impact on the productivity of organisations only if attention is paid to human capital development. That is, competent employees and knowledge sharing culture within the company play a crucial role in enhancing competitiveness. D.J. Deming (2022) noted that human capital forms the basis for sustainable growth if investments in education and skills start early in the life cycle and continue throughout life, and X. Zhang & X. Wang (2021) confirmed that the key indicators of the impact of human capital on the economy are education level, skills, and health.

Longevity and its impact on demographic and social sustainability are significant elements of sustainable development of society. Population ageing and declining fertility form new economic realities and, according to E. Gagnon *et al.* (2021), increase the pressure on labour markets and social systems. The authors conclude that solutions such as digitalisation and automation can compensate for labour shortages and increase the efficiency of the economy. J.W. Vaupel *et al.* (2021) also noted that increasing longevity increases pressure on health and pension systems, but also offers opportunities for the elderly population to

engage in economic and social life through retraining and flexible working conditions.

Despite the extensive body of research on human capital, the long-term impact of demographic change on the quality of the labour force and labour market adaptation to an ageing population remains understudied. The aim of this study was to examine regional differences in the formation and utilisation of human capital in different regions of Azerbaijan. To achieve this goal, the following objectives were set: to identify the main demographic trends affecting the labour market; to survey experts to identify regional differences in the formation of human capital; to identify the key problems and barriers faced by the regions.

Materials and Methods

Modern approaches to the theory of human capital, the role in the context of population ageing and the declining share of the working-age population were analysed. The concepts of the impact of investment in education, training, and health on sustainable economic growth were also considered, and statistical data on the demography of Azerbaijan

from the resources of the State Statistical Committee of the Republic of Azerbaijan (2012) and the President of Azerbaijan (Population of the..., 2025) were studied. Additionally, adaptation mechanisms, such as retraining and continuing education, aimed at activating older age groups were investigated, which revealed the need to integrate human capital theory with regional economic models.

The total number of respondents was 382, of which 257 were male (67.28%) and 125 were female (32.72%). The average age of the participants was 39.6 years. The sample was formed non-randomly from experts directly related to human resource management and human capital development. The sample included human resource managers, recruitment specialists, trainers, and consultants in the field of professional development of employees, as well as analysts engaged in strategic planning of human resources. This choice was driven by the need to obtain a professional assessment of the state of human resource capacity and to identify key issues and challenges associated with demographic change. Figure 1 showed the distribution of survey respondents by region of Azerbaijan and the location of the organisations.

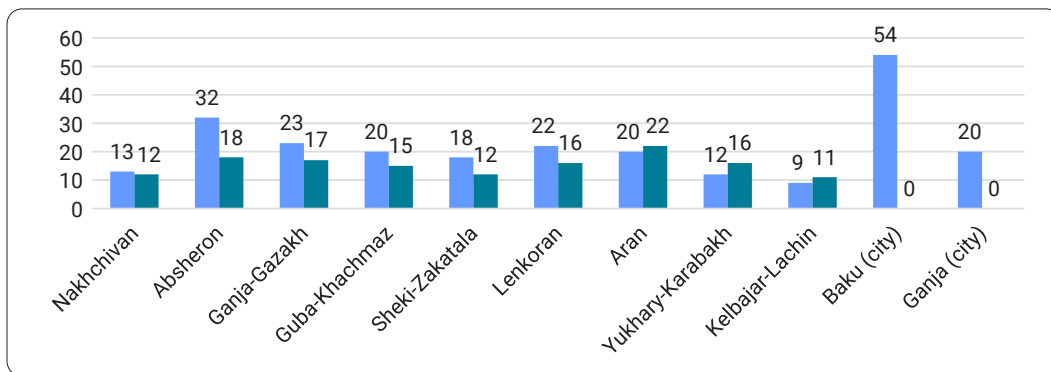


Figure 1. Distribution of respondents by type of locality

Source: compiled by the authors

The study was conducted in the second quarter of 2024 in compliance with the ethical standards specified in the Code of Ethics (American Sociological Association, 1997): respondents' participation was completely voluntary and informed; the respondents were also

guaranteed anonymity, and the information was used exclusively for scientific purposes. Study participants were sent questionnaires created in Google Forms format to the email accounts (Table 1). The questionnaire included the following questions:

Table 1. Questionnaire

No.	Question	Variance of answers
Block 1: Regional affiliation of the respondents		
1	In which region/city do you work?	a) Nakhchivan; b) Absheron; c) Ganja-Gazakh; d) Guba-Khachmaz; e) Sheki-Zakatala; f) Lenkoran; g) Aran; h) Yukhary-Karabakh; i) Kelbajar-Lachin; j) Baku (city); k) Ganja (city).

Table 1, Continued

No.	Question	Variance of answers
Block 1: Regional affiliation of the respondents		
2	Where is your company/organisation located?	a) city; b) rural area.
3	What personnel problem do you face most often?	a) lack of qualified specialists; b) high level of migration from the region; c) limited access to education and training; d) lack of vacancies for young people; e) other.
Block 2: General questions about demographic processes		
1	How do you assess the demographic situation in your region? (Assess on a scale from 1 to 5, where 1 – the situation is very bad, 5 – the situation is good)	open answer
2	What changes in the population of the region do you consider the most important?	a) decrease in the birth rate; b) increase in the number of the elderly; c) migration of young specialists; d) movement of population from villages to cities; e) other.
Block 3: Formation of human capital		
1	What problems with human resources do you observe in your organisation?	a) there are not enough young workers; b) there are not enough qualified specialists; c) there are many vacancies but no suitable candidates; d) the level of staff training is below the required level; e) there are not enough financial opportunities to offer decent salaries and attractive working conditions to specialists; f) other.
2	What role does education in your region play in personnel training? (Assess on a scale from 1 to 5, where 1 – does not help at all, 5 – plays a key role)	open answer
Block 4: Efficiency of human capital utilisation		
1	Which groups of employees in your organisation are experiencing the greatest difficulties?	a) young people (under 30 years old); b) middle-aged employees (30–50 years old); c) older employees (50+ years).
2	What, in your opinion, prevents the effective utilisation of human capital?	a) lack of human resources; b) poor infrastructure; c) low wages; d) lack of investment; e) other.
Block 5: Recommendations and perspectives		
1	What measures could improve the situation with human resources?	a) improvement of labour conditions; b) increasing salaries; c) development of professional training; d) programmes to attract young specialists; e) development of infrastructure; f) other.
2	What would help older employees to work better?	a) flexible working hours; b) retraining opportunities; c) improved working conditions; d) other.
3	How do you assess the support of the state in solving personnel problems? (Score on a scale from 1 to 5, where 1 – no support, 5 – support at a high level)	open answer
Block 6: Consideration of regional peculiarities		
1	To what extent does the specifics of your region influence the personnel situation? (Assess on a scale from 1 to 5, where 1 – does not influence at all, 5 – influences very strongly)	open answer
2	What features of the region do you consider important for the development of personnel policy?	a) economic conditions; b) the level of migration; c) infrastructure development; d) social policy; e) other.

Source: compiled by the authors

The collected data from the questionnaires were exported to Microsoft Excel for further processing; systematisation of responses, frequency distribution analysis, calculation of % age and arithmetic mean values were carried out. The results were visualised using charts and tables for visual presentation of the survey results. Student's t-test was used to test the differences in responses between urban and rural respondents. The analysis confirmed that the differences between the groups were statistically significant ($p < 0.05$).

Results

Theoretical analysis of the influence of demographic processes on human capital

Human capital theories developed in the 21st century suggest that investments in education, professional development and health are valid methods for sustainable economic growth (Qamruzzaman *et al.*, 2021; Sarwar *et al.*, 2021; Almutairi, 2024). However, in the context of demographic change, these theories require revision and adaptation to adequately respond to the challenges facing regions with declining populations. Classical approaches to human capital link its quality to the level of education, professional skills and health status of the working-age population. Nevertheless, the processes of natural population decline and ageing of society are transforming the age structure of the labour force, which has a direct impact on labour productivity. The increase in the proportion of older workers is accompanied by the need to find new methods for adopting new technologies, rising costs of maintaining employee health and an increased need for measures to adapt the work environment (Pang *et al.*, 2021; World Health Organization, 2021; Gong *et al.*, 2022). This necessitates a reorientation of investments: the focus is shifting from training young professionals to supporting the professional activity of older age groups.

One of the most significant areas of adaptation of the concept of human capital is the inclusion of approaches that consider the return on investment in the context of the demographic crisis. In a situation where the share of young working-age people is declining, the economic return on investment in older workers is increasing. Retraining and continuing education programmes for such workers are strategically important mechanisms for reducing the burden on the economy and maintaining gross domestic product growth. A related consequence of natural population decline is increased competition for limited resources of able-bodied labour. This is especially true in regions where migration processes intensify the problem: the most mobile and qualified personnel choose to move to economically more developed centres. In such conditions, human capital theory should be integrated with regional economic models that aim to create attractive working and living conditions for the retention and development of local human resources.

Population ageing, which is an integral part of natural attrition, has introduced an additional challenge for human capital management. Older workers have considerable accumulated experience but often face labour market constraints and lack of opportunities for professional growth, which requires the development of institutional mechanisms to encourage the participation in economic life. Such mechanisms could include tax incentives for employers to offer jobs to older employees or the introduction of flexible work schedules. Some scholars also believe that population attrition can increase the degradation of human capital (Adeleye *et al.*, 2022; Jones, 2022; Goldin, 2024). The integration of human capital theory with regional development concepts points to the need to invest in infrastructure, education, and health to maintain the socio-economic potential. A decline in the country's fertility rate can have a significant impact on the formation and reproduction of human capital (Fig. 2).

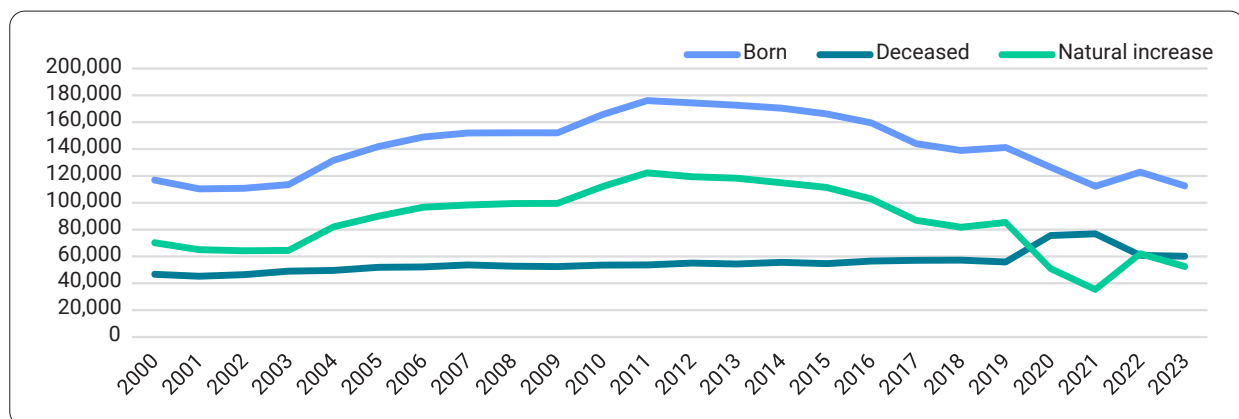


Figure 2. Dynamics of births, deaths and natural increase in Azerbaijan, 2000-2023

Source: compiled by the authors based on Population of the Republic of Azerbaijan (2025)

A decline in the number of children and young people can lead to a reduction in the base for the future working-age population, which weakens the economic potential

of regions and the country as a whole, and also creates the threat of untimely replacement of losses caused by the retirement of older generations (Table 2).

Table 2. Population of Azerbaijan by age groups

Age groups	Thousands of people						%					
	2019	2020	2021	2022	2023	2024	2019	2020	2021	2022	2023	2024
0-4	771.8	687.1	663	637.2	635.7	608.8	7.7	6.9	6.6	6.3	6.3	6
5-9	829.7	825.5	809.9	777	738	709	8.3	8.3	8.1	7.7	7.3	6.9
10-14	637.6	798.7	818.1	838.7	843.2	843.2	6.4	8	8.2	8.4	8.3	8.3
15-19	646.8	651.3	673.7	698.7	729.2	762.2	6.5	6.5	6.7	6.9	7.2	7.5
20-24	760.6	692	661.1	644.5	640.2	637.4	7.6	6.9	6.6	6.4	6.3	6.3
25-29	916.8	879.7	844.9	801.4	759.8	721.1	9.2	8.8	8.4	8	7.5	7.1
30-34	919.8	927.9	936.3	941	930.6	912.8	9.2	9.3	9.3	9.4	9.2	9
35-39	787.8	793.2	819.7	847.5	873.8	899.1	7.9	7.9	8.2	8.4	8.6	8.8
40-44	651.3	665.9	690.1	715.5	742.6	769.1	6.5	6.7	6.9	7.1	7.3	7.5
45-49	622.6	579.2	582.6	587.9	603.2	625.4	6.2	5.8	5.8	5.8	6	6.1
50-54	648.6	618.2	611.1	605	589.9	579.2	6.5	6.2	6.1	6	5.8	5.7
55-59	643.7	618.2	612.9	603.6	600.7	597.4	6.5	6.2	6.1	6	5.9	5.9
60-64	466.1	514.9	540	562	580.8	585.8	4.7	5.2	5.4	5.6	5.8	5.8
65-69	277.3	316.1	342	364.6	396.7	429.4	2.8	3.2	3.4	3.6	3.9	4.2
70+	401	406.1	420.7	438.7	462.7	500.9	4	4.1	4.2	4.4	4.6	4.9

Source: compiled by the authors based on Population of the Republic of Azerbaijan (2025)

The presented data showed significant changes in the structure of the age groups of the population. The decline in the number of infants and children was particularly noticeable: in the 0-4 years age group, the increase decreased by more than 20 % over the five years from 2019 to 2024, indicating a decline in fertility. The 5-9 years group has also shown a declining trend, due to the same reasons. The increase in the number in the 10-14 and 15-19 age categories is maintained by those born between 2000 and 2010, when fertility dynamics were increasing, but it can be assumed that these groups will also soon decline as less numerous generations follow.

The number of young people aged 20-24 and 25-29 is also declining. This situation may be related to the fact that fertility rates have been falling between 1990 and 2005, as well as to the outflow of young people in search of better opportunities abroad. At the same time, the group of 30-34 years old showed insignificant reduction (0.76% for the period under consideration) and stable leadership as the most numerous age group of the population of Azerbaijan.

At the same time, it should be noted that the decrease in the number of young people is not accompanied by a decrease in the requirements to the quality of education. On the contrary, according to scholars, the need to improve educational programmes is increasing as each unit of human capital becomes critical for economic growth (Abdelnabi, 2022; Rothomi & Rafid, 2023). Employers may face a shortage of young professionals, leading to changes in the labour market, including increased demand for automation and technology that can compensate for labour shortages. These changes transform the labour market and have social consequences that weaken the role of youth in social life and innovative development.

As for the following age categories, the situation is opposite: in five years, the 35-40 and 40-44 age groups have shown growth of 14% and 18% respectively, which can be

explained by the peculiarities of the demographic wave caused by the increase in birth rates in the 70s-80s of the 20th century, whose representatives are now moving into older age categories (State Statistical Committee of the Republic of Azerbaijan, 2012).

The increasing share of older people in the total working-age population creates new challenges for employment and training systems: maintaining the employment of older people requires the introduction of flexible working conditions, which entails additional costs for employers. At the same time, older workers need to update the skills, especially in the face of rapid technological change, but existing training programmes are often not tailored to the needs, creating additional barriers to the integration into modern labour markets.

It is important to note that the 60-64, 65-69 and 70+ age groups are steadily increasing, although the 50-54 and 55-59 groups are decreasing. Such dynamics may be related to the effect of natural attrition in the 50-59 age groups, which may indicate problems in the health system, working conditions or living standards in earlier periods. Thus, not all members of these generations reach older age groups. However, increasing the proportion of the older population is an opportunity for the State: through the implementation of appropriate policies, the inclusion of this group of citizens in social and economic life can be achieved.

Demographic ageing is changing the structure of the economy, with health care, social protection and care for older persons becoming important sectors. The development of these areas requires the training of personnel to work in these areas. The increasing number of older persons in the population also increases the costs of health and social care systems, and the additional costs can strain the economy and limit investment in other important areas (e.g., education and infrastructure).

At the same time, older generations, despite the extensive professional experience, have limited opportunities to

participate in the creation and implementation of innovations. This requires the introduction of programmes that promote intergenerational cooperation in order to harness the experience of older workers together with the creative potential of young people.

The demographic structure of Azerbaijan's regions is characterised by differences between urban and rural

areas (Fig. 3). The urban population of the country continues to increase due to internal migration, which leads to concentration of economic activity in large cities (Baku, Ganja and Sumgait). Urbanisation is accompanied by improved access to educational, health and vocational opportunities, but increases demographic and socio-economic disparities between regions.

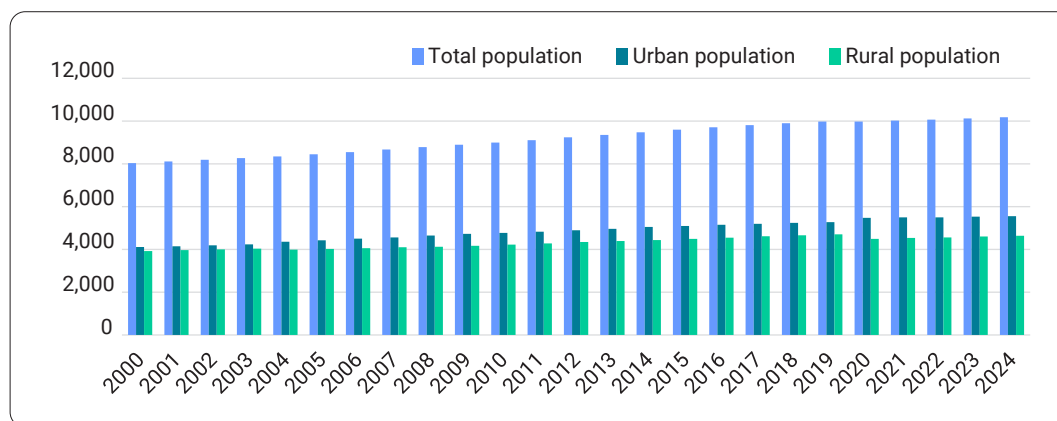


Figure 3. Population of Azerbaijan in 2000-2024

Source: compiled by the authors based on Population of the Republic of Azerbaijan (2025)

The 3.4% decrease in the population in rural areas can be explained by low-income levels, limited access to quality services and infrastructure, and reduced employment opportunities. This problem most often affects young people, resulting in an ageing rural population and a decline in the economic activity. The loss of the labour force in rural areas can create a vicious cycle: population decline undermines opportunities for local economic development, which in turn accelerates migration.

Differences in the level of development between urban and rural areas may be related to the insufficient involvement of rural areas in national economic processes. In the context of Azerbaijan, this problem is particularly relevant, as rural areas play an important role in ensuring the country's food security and preserving cultural traditions. The current situation requires a systematic approach aimed at gradually increasing the attractiveness of rural areas. By investing in infrastructure, developing local labour markets and creating opportunities for entrepreneurial activity, it is possible to help reduce migration and create more sustainable conditions for long-term economic growth in rural areas, strengthening the contribution to the overall development of the country.

Emigration of highly qualified specialists remains an important demographic and economic challenge for Azerbaijan. The desire of professionals to find more favourable conditions for professional fulfilment and life abroad leads to a drain of significant human capital, which hampers national development. Reduction of innovation potential becomes one of the consequences of such an outflow: it is known that when specialists with high competences in various fields (e.g., information technology, health care, science,

and education) become unavailable to the country's economy, this limits the possibility of introducing advanced technologies and reduces the state's competitive position in the international arena (Hermele, 2021; Elsner, 2022).

Public resources invested in education and training often yield returns outside the country, leaving a gap between the investment in human capital and its contribution to the national economy. This imbalance has long-term implications for economic sustainability. Furthermore, the emigration of skilled workers creates additional social challenges: skills shortages, especially in health and education, can lead to a decline in the quality of services, which exacerbates social inequalities as access to high-quality services becomes difficult for a large part of the population.

To mitigate the negative consequences of the departure of the educated population, it is necessary to focus on creating more favourable conditions for professionals within the country through competitive remuneration, prospects for professional growth and improvement of the overall quality of life. At the same time, it is important to develop repatriation programmes that will help those who have previously left the country to return and effectively integrate these programmes into the national economy. Such initiatives can significantly strengthen Azerbaijan's human capital and create a sustainable basis for its economic development.

Empirical analysis: Results of a survey of specialists in the field of human capital management

Representatives of all regions of Azerbaijan took part in the survey, which made it possible to cover the diversity of opinions and assess the peculiarities of human capital in different parts of the country (Fig. 4).

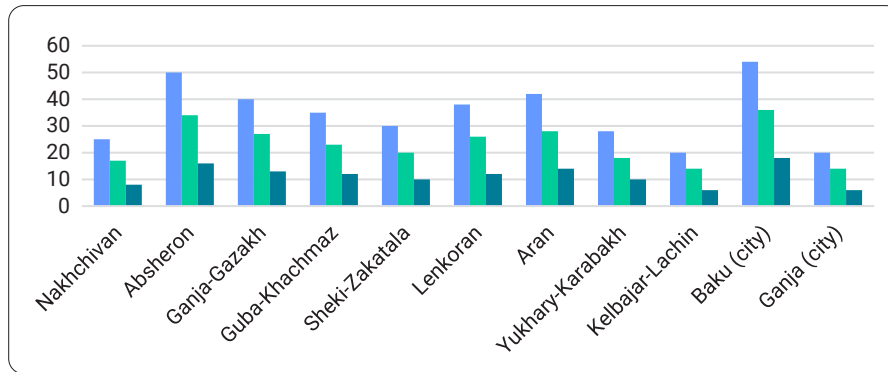


Figure 4. Regional affiliation of survey participants

Source: compiled by the authors

The distribution of respondents from urban and rural areas reflected the urbanisation trend: two thirds of

respondents were from cities. Data on the most widespread personnel problems in the regions are presented in Figure 5.

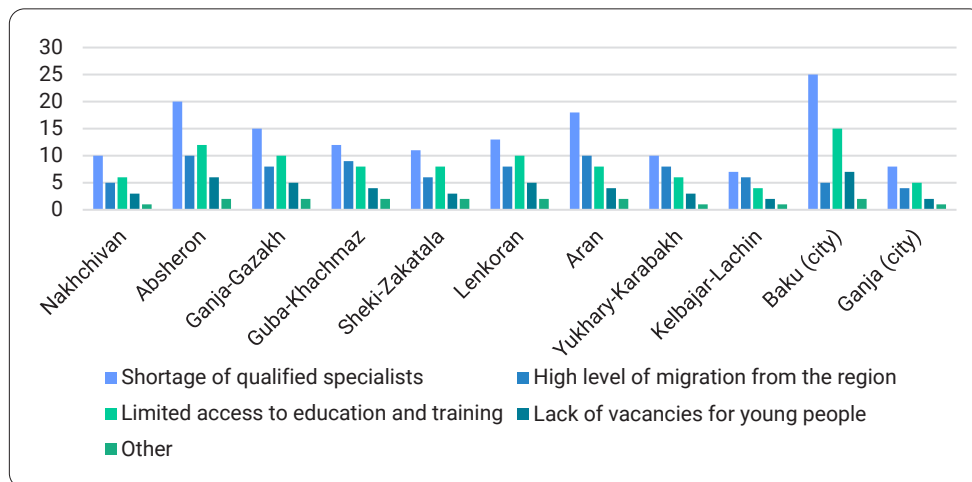


Figure 5. Distribution of experts' responses to the question about the personnel problems being encountered most often
Source: compiled by the authors

The answers received indicated that the most common problem faced by respondents is the lack of qualified specialists – it was reported by 39% of survey participants. This problem is most pronounced in Baku (25 respondents or 46%) and Absheron region (20 respondents or 40%), which indicates high competition for qualified personnel in economically more developed zones.

The second most significant problem was limited access to education and training, noted by 24% of respondents (92 out of 382). It should be noted that although the capital city, with its developed educational infrastructure, might show lower rates of this problem, 28% of respondents indicated the problem of limited access to education and training, which is high for a region with such resources. One possible explanation is competition for quality education: the capital may have a shortage of places in leading educational institutions or a lack of educational programmes that meet the demands of the labour market. In addition, limited access to retraining and additional training for working professionals may have affected respondents' perceptions.

Another factor could be the overload of educational infrastructure due to high population concentration.

At the same time, the high indicator in Baku may indicate specific requests of employers who expect higher qualifications from candidates than in the regions. Thus, the problem may be related not so much to the objective availability of education as to the high level of requirements in the labour market. A high level of migration from the region was mentioned by 21% of survey participants. This problem is most acute for such regions as Aran (24%) and Guba-Khachmaz (26%), which may be related to the lack of sufficient number of jobs and low level of salaries in these regions.

The results of answers to the question about demographic situation showed significant differences in assessment between the regions of Azerbaijan. The highest average scores were observed in Baku (4) and Absheron (3.8), reflecting the relatively favourable situation in these regions. In particular, 40% of respondents in Baku (22 people) gave a score of 5, the highest %age among all regions. On the other hand, the lowest average scores were recorded

in Yukhary Karabakh (2.8) and Kelbajar-Lachin (2.9). The overall average score for the country was 3.4, indicating a moderate assessment of the demographic situation. However, the high polarisation between regions suggests the

need for a differentiated approach to solving demographic problems depending on territorial specifics. The most important demographic changes in the opinion of respondents are shown in Figure 6.

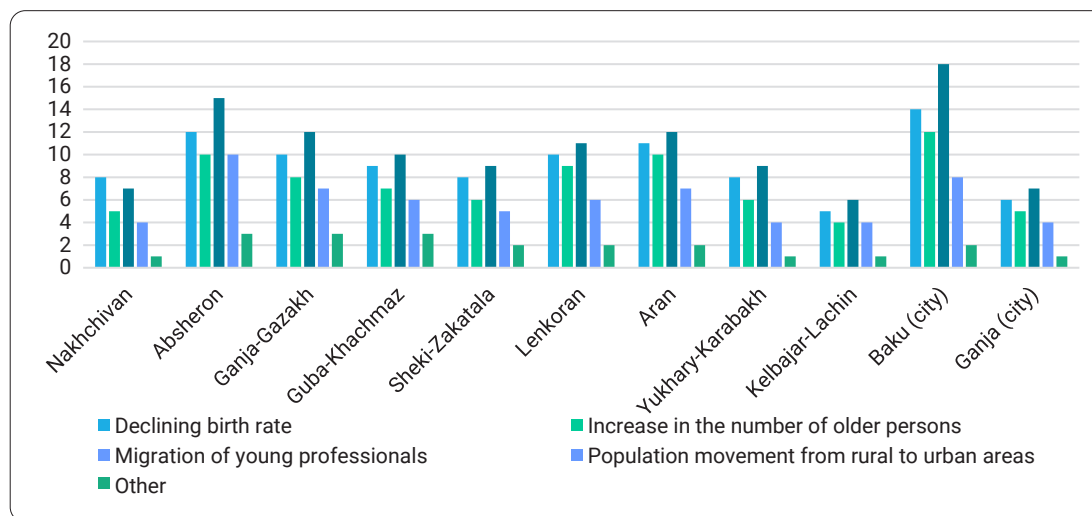


Figure 6. Distribution of experts' responses to the question about the most important demographic changes

Source: compiled by the authors

The survey results demonstrate that the most frequently mentioned change in the population of the regions is the migration of young professionals. This option was chosen by 30% of respondents (116 out of 382), and the highest %age of references to migration was observed in Baku – 33% (18 out of 54 respondents) despite the fact that when asked about staffing problems, respondents from Baku assessed migration as less significant. Since Baku, as an economic and cultural centre of the country, attracts specialists from other regions, the negative impact of migration on the local labour market remains low, emigration is perceived more as a general process affecting young people rather than a direct threat to the capital's staffing. High estimates of migration in Baku may also reflect concerns about brain

drain outside the country: the capital's companies and organisations often compete for talent internationally, which may reinforce the perception of this problem in the context of the global labour market.

In addition, a significant proportion of respondents from Absheron (30%) and Ganja-Gazakh (30%) also mentioned the migration of young professionals, indicating the need to create conditions for retention in these regions. It is worth noting that the decline in birth rate and increase in the number of elderly were the most relevant for the regions of Lankaran and Aran, where the share of responses was 26% and 24% respectively, indicating the challenges associated with ageing and changing population structure in these regions. The most worrying problems with labour resources for respondents are presented in Figure 7.

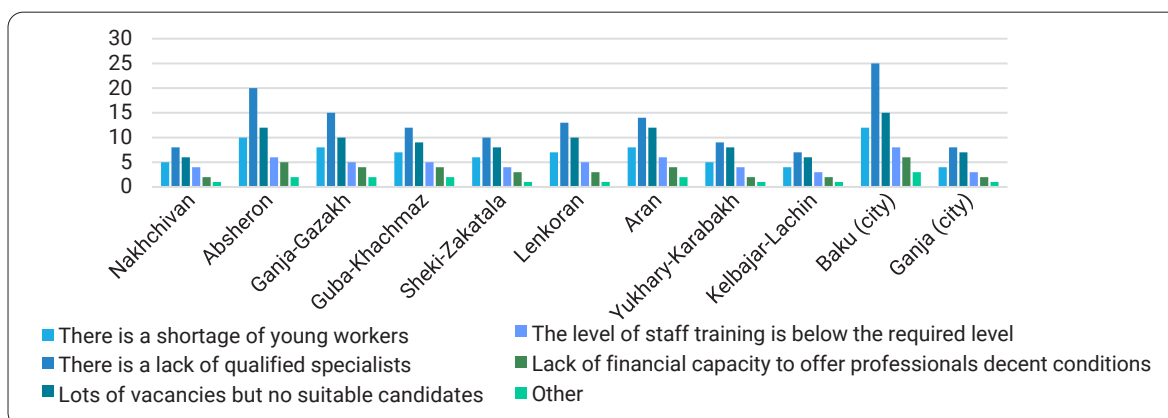


Figure 7. Distribution of experts' responses to the question about labour force problems

Source: compiled by the author

The data analysis confirmed that the distribution of answers to the question about problems with labour resources showed a stable pattern in all regions: in all cases, the most frequent answer was the lack of qualified specialists – this option was chosen by 42% of respondents (161 out of 382), followed by the answers about numerous vacancies without suitable candidates (27%) and insufficient level of employee training (14%). Financial constraints preventing from offering competitive labour conditions (10%) and lack of young employees (20%) remain important problems.

When asked about the role of education in staff training, the following data were obtained: the highest average score (4) was given by respondents from Baku, indicating the high level of educational infrastructure and its

importance for staff training. Absheron (3.8) and Ganja (3.7) also showed high results, which confirms the importance of these regions as centres of professional development. The lowest scores were given by respondents from Yukhara-Karabakh (2.8) and Kelbajar-Lachine (2.9). These data may indicate a lack of educational institutions or resources, which creates serious obstacles to the training of qualified personnel in these regions. The overall national mean score was 3.4, indicating a moderate perception of the role of education in addressing training challenges. Regional differences indicated the need to strengthen educational infrastructure in remote and post-conflict zones. The groups of staff experiencing the greatest difficulties in the work are summarised in Figure 8.

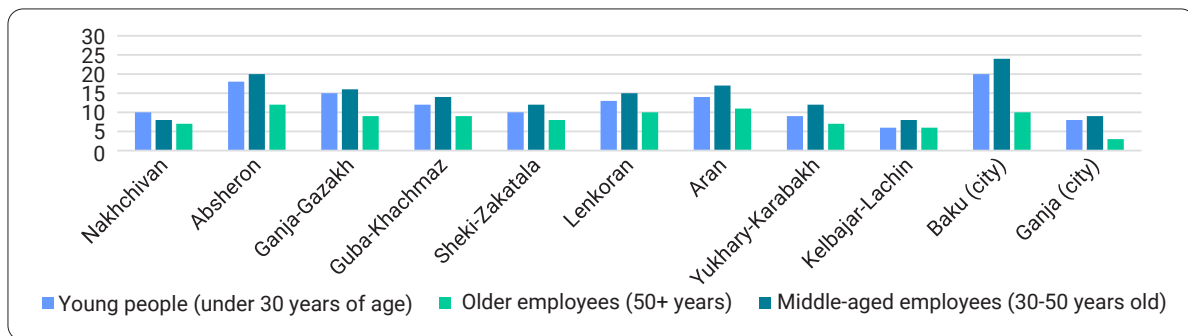


Figure 8. Distribution of experts' responses to the question about the category of employees experiencing the greatest difficulties in the company

Source: compiled by the authors

The survey revealed that difficulties in organisations are most often experienced by middle-aged employees (30-50 years old) – these difficulties were mentioned by 40% of respondents (155 out of 382). This group faces high demands both for professional qualifications and adaptation to the use of new technologies. Young people under 30 (35%, 135 out of 382) ranked second, which may

indicate a lack of experience or problems with adaptation in the working environment. Older employees (50+ years) were mentioned less frequently (24%, 92 out of 382), which may reflect the smaller size of this group in organisations or the less involvement in processes that require rapid adaptation. Barriers to the effective utilisation of human resources are revealed in Figure 9.

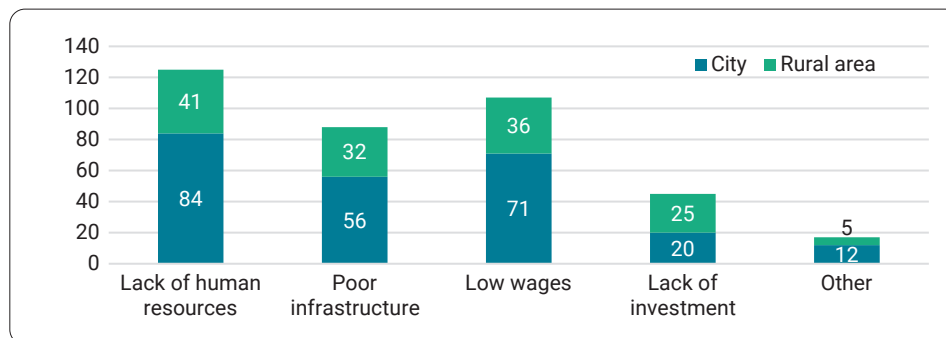


Figure 9. Distribution of experts' responses to the question about barriers to the effective use of human capital in cities and rural areas

Source: compiled by the authors

The most frequently mentioned problem for respondents from all regions was the lack of personnel, but this problem is more common in urban areas (35%) than in rural areas (30%), which may be due to high competition

for qualified specialists in cities, as well as migration of labour force abroad.

Poor infrastructure is a problem in both rural and urban areas (23% each), indicating the need for modernisation

throughout the country. Low wages are also a common problem in rural areas (26%) and cities (29%); respondents identified this problem as the main obstacle to the effective use of human resources, as restrictions in economic activity

reduce the ability to offer competitive labour conditions. Lack of investment affects villages (18%) more than cities (8%). The measures that respondents consider most effective to overcome the existing problems are presented in Figure 10.

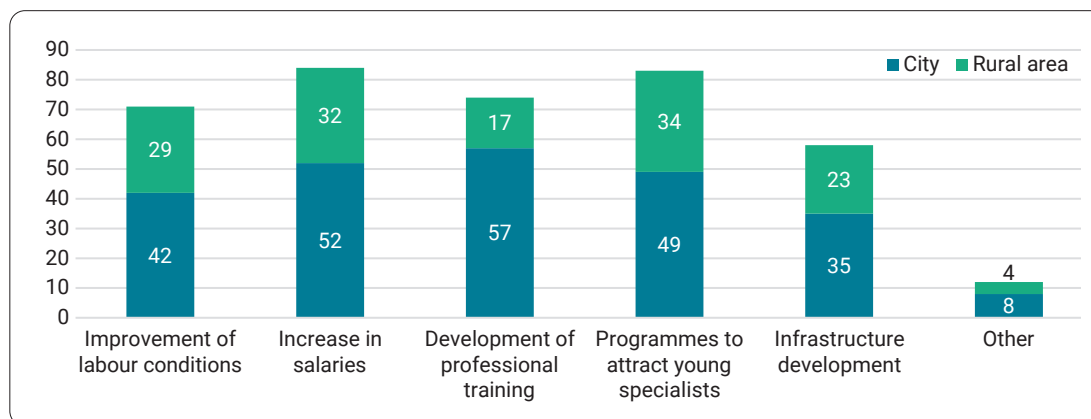


Figure 10. Distribution of experts' responses to the question about measures to improve the personnel situation in cities and rural areas

Source: compiled by the authors

The most popular measure, which, according to respondents, could improve the situation with human resources, was an increase in salaries. This option was chosen by 21% of respondents from urban areas and 23% of respondents from rural areas. The importance of financial motivation for increasing the attractiveness of work is the same in both urban and rural organisations. The prospect of using programmes to attract young professionals was assessed almost identically. The programmes were mentioned by 20% of urban respondents and 24% of respondents from rural areas, which indicates that the respondents understand the importance of creating conditions for professional growth and stability for young personnel, especially in rural areas. The development of professional

training was particularly relevant for urban respondents (23%), indicating a high demand for advanced training in the context of high competition for skilled labour. Infrastructure development was seen as more important for rural areas (17%) than for urban areas (14%), which is expected given the differences in access to basic services and working conditions in these regions.

Improving working conditions was supported by 17% of urban respondents and 21% of rural respondents, indicating the need for a better working climate to improve overall employee productivity. The measures that respondents considered most effective to integrate older workers into the ageing population of Azerbaijan are summarised in Figure 11.

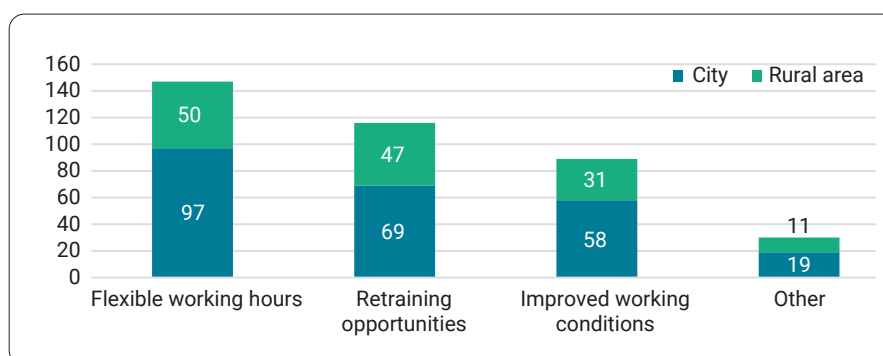


Figure 11. Distribution of experts' responses to the question on measures to improve the performance of older workers in cities and rural areas

Source: compiled by the authors

The most popular measure that respondents thought could help older employees work better was flexible working hours: this option was chosen by 40% of respondents

from urban areas and 36% of respondents from rural areas. Thus, it was found that the understanding of the need to adapt working hours to the capabilities and needs of older

employees is present among representatives of all regions of the state, which, however, may not always correspond to reality due to limited resources for training more employees or overloading the HR system.

The option of providing retraining opportunities was supported by 28% of urban respondents and 34% of rural respondents. The problem of training older employees in new skills to improve the performance is more acute in rural areas, which is a response to the trend of young people moving to cities and abroad and an attempt to preserve economic potential.

Evaluations of state support in solving personnel problems demonstrated respondents' perception of the level of this assistance: in urban areas, the largest number

of participants (29%) rated the support at 2 points, indicating low satisfaction with state support measures; a similar situation was observed in rural areas: 25% of respondents also gave a rating of 2, i.e., current state support measures are perceived as insufficient and do not meet expectations. State support was rated 1 by 25% of urban respondents and 29% of rural respondents, while only 7% of urban respondents and 6% of rural respondents gave a score of 5. Positive perception of state support is episodic and not mass. The average score for the country was 2.5, which indicates insufficient efforts of the state in the context of solving personnel problems. The impact of regional specifics on the personnel situation is disclosed in Figure 12.

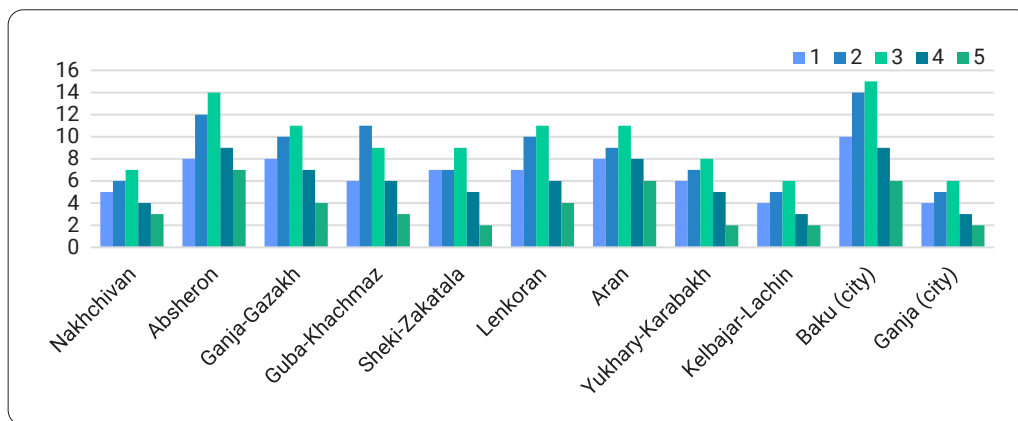


Figure 12. Distribution of experts' answers to the question about the influence of the specifics of the region on the personnel situation

Source: compiled by the authors

Assessment of the influence of regional specifics on the personnel situation showed that the majority of respondents perceive these specifics as a significant factor. The most frequent assessments (2 and 3 points) indicate a below average degree of influence. The greatest difficulties were identified in Sheki-Zakatala and Yukhary-Karabakh:

respondents from these regions indicated significant difficulties related to lack of infrastructure and limited opportunities for professional development. The highest scores were given by respondents from Absheron and Aran. The impact of regional characteristics on HR policy is illustrated in Figure 13.

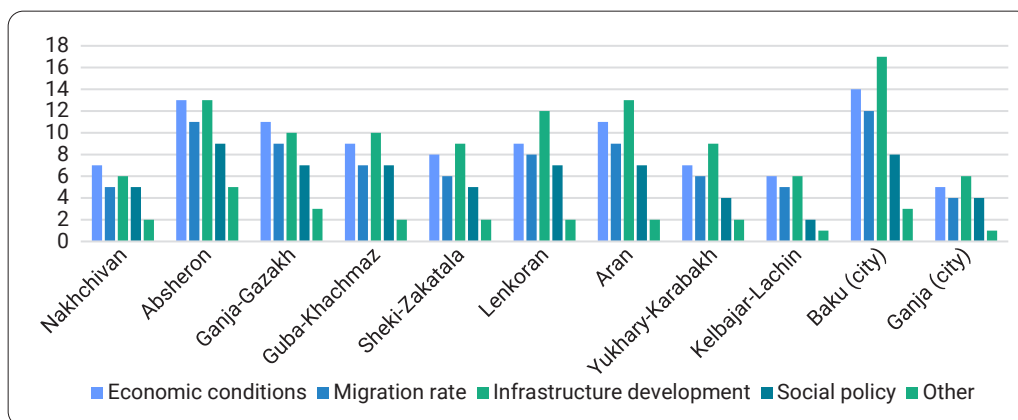


Figure 13. Distribution of expert responses to the question about the promising features of regions in the context of developing personnel policy

Source: compiled by the authors

Economic conditions, infrastructure development and migration level were the priority features that respondents consider important for the development of human resources policy. Economic conditions turned out to be the most significant for most regions, which confirmed the dependence of HR policy on the level of economic activity.

Demographic changes in Azerbaijan had a significant impact on the state of human capital in the regional economy: the reduction in the number of young people and the increase in the share of the elderly population transformed the structure of the able-bodied population, which created new challenges for the labour market. In developed regions, such as Baku and Absheron, growing competition for skilled labour has led to higher requirements for education and training, forcing employers to reconsider the approaches to human resource management.

Migration processes both within and outside the country have increased the imbalance between urban and rural areas. The study has shown that limited employment opportunities, low level of infrastructure and uneven distribution of educational resources contribute to the outflow of able-bodied population from rural areas. As a result of these processes, the economic potential of rural areas continues to decline, which aggravates the problems of population ageing and lack of qualified personnel.

To overcome these challenges, respondents pointed to the need to modernise approaches to human capital management by adapting jobs for older employees, developing infrastructure in rural areas and introducing educational programmes that could meet the current demands of the labour market. These measures can be considered as a basis for reducing the negative impact of the demographic crisis and increasing the efficiency of labour resources use in the future.

The analysis of answers also revealed that the level of state support in solving personnel issues remains insufficient. The survey participants noted that the existing measures do not meet the needs of the regions, especially in rural areas, which indicates the need to revise state policy to create equal opportunities in the development of human capital throughout the country.

Discussion

The study analysed the current situation of human capital and demographic processes affecting different age groups, and assessed the role of infrastructural and economic factors in the formation of human resources in Azerbaijan. The analysis of structural changes in the labour market and the barriers that hinder the effective use of workers' potential and reduce the attractiveness of certain regions has shown that if the current trends persist, without comprehensive measures to improve the level of qualifications and working conditions, the uneven distribution of human resources and the burden on the social sphere may increase.

The situation with human capital in rural areas of Azerbaijan can be characterised as follows: the lack of qualified labour force here is closely linked to low wages, poor infrastructure and limited opportunities for training and

professional development (Ismayilov *et al.*, 2024a). As a result, young people prefer to leave for cities or abroad, while the remaining population faces difficulties in adapting to the changing requirements of the labour market. Such dynamics leads to an unsolvable situation when the shortage of personnel complicates the economic development of rural regions, and the lack of effective mechanisms of state support makes it difficult to overcome this outflow (Rexhepi & Murtezaj, 2024). This imbalance leads not only to the decline of traditionally "rural" industries, but also to limited prospects for innovative endeavours. The low attractiveness of rural life has led to an outflow of young people, resulting in demographic shifts and a growing proportion of the elderly population requiring special adaptation programmes (Hasani *et al.*, 2023). The cumulative impact of these problems hinders the formation of a sustainable model of economic growth, as rural areas lose the development potential and cannot compete effectively with cities for investment and human resources. A comparison with the study by K.R. Schneider *et al.* (2024) on rural transformation in sub-Saharan Africa under conditions of climatic, demographic and social change showed a similar need to strengthen rural economies through education, infrastructure upgrading and social programmes. However, in the context of Africa, the authors of the reviewed study revealed the role of climate challenges and the need to balance traditional economy and innovation, while for Azerbaijan, it is socio-economic aspects that are crucial: insufficient state support, low wages and limited opportunities for vocational training hinder the effective use of human capital in rural areas.

Due to the fact that the most mobile and educated part of the youth leaves for the cities, rural areas remain without the necessary share of qualified labour force (Adilov, 2025). The reduction in the number of specialists is also aggravated by the fact that older generations have difficulties in mastering new technologies, and the labour market itself does not provide sufficient incentives for upgrading qualifications. The result can be an imbalance in which some local enterprises cannot find the right skills and potential employees do not see the point in investing in the own education, which undermines the economic sustainability of peripheral areas, preventing greater innovation and regional competitiveness. According to N. Sitohang (2022), successfully overcoming demographic challenges is possible if companies realise the value of human capital and invest in its development, including through corporate training programmes. Similarly, in the work of S. Bawono (2021) on how human capital and technological development affect economic growth in Indonesia, the author pointed out the importance of combining new technologies with a skilled labour force to strengthen the economy in the long term. For rural areas in Azerbaijan, conditions should also be created where education and professional development become accessible and in demand, and the development and application of innovative solutions are not limited to cities and large private enterprises.

In conformity with the results of the survey, there is heterogeneity in the quality of human capital in cities: despite a higher level of educational infrastructure compared to rural areas, a gap was found between necessary skills and actual competences. In particular, respondents pointed to the lack of practical training for young professionals and the lack of technology skills among older workers. At the same time, respondents noted low satisfaction with continuous learning opportunities: retraining and professional development programmes are not adapted to the rapidly changing requirements of the labour market in large cities. A study of the long-term impact of human capital on innovative development and economic growth in Europe by C. Diebolt & R. Hippe (2022) showed that sustainable economic growth is largely determined by the ability of regions to accumulate quality human capital that promotes innovation. In the context of Azerbaijani cities, this means that with proper investment in education and practice-oriented training programmes, it is possible to increase innovation and reduce skill imbalances. In turn, A. Grigorescu *et al.* (2021) studied the development of the digital economy in Central and Eastern European countries that are part of the European Union and found that in these countries, advanced IT competences and developed infrastructure are key success factors. Thus, increasing access to quality educational resources and improving digital learning practices will improve the adaptation of employees to technological change and enable the competitiveness and economic development of urban regions.

Over the period 2019-2024, the share of older people (60+) in the total population structure of Azerbaijan increased from 11.5% to 14.9%, which may lead to a rebalancing of the labour market as the number in the most economically active age groups decreases and the burden on the social services system increases (Ismayilov *et al.*, 2024b). That is, under conditions of limited financial and infrastructural resources, this may lead to a shortage of staff in the spheres of health care and social support. At the same time, some older citizens with valuable knowledge and experience could potentially remain economically active, but face a lack of retraining programmes and flexible employment options. Thus, the growing number of older people not only affects the social and economic situation, but also raises the question of the need to develop new mechanisms for integrating age groups into the economic life of society. N. Bairoliya & R. Miller (2021) studied the demographic transition in China and noted that declining fertility and an ageing society have turned the initial demographic dividend (an increase in the proportion of the working-age population) into potential ballast for the economy. The impact of this process is largely determined by the level of human capital: the higher the quality of education and training, the easier it is to overcome the negative effects of ageing and maintain sustainable economic growth. Similar results were shown by the study of S. Purohit (2023). The author studied demographic change in India and concluded that without proper investment in

human capital and job creation, the demographic transition can lead to unemployment and increased social inequality. In the context of the data presented on the growing number of older people in Azerbaijan, it can be concluded that comprehensive policies are needed to mitigate demographic risks: investing in lifelong learning programmes, promoting flexible employment and creating incentives to keep older age groups healthy. This approach will increase the economic activity of older people and retain the expertise in production and services.

The role of government support in the development and management of human capital, including by funding educational programmes and skills development initiatives, should be aimed at ensuring access to training for different population groups and adapting training courses to the changing needs of the labour market. Some respondents in the survey pointed to the possibility of closer coordination between different agencies and educational structures in order to strengthen the practice-oriented approach to training. The findings suggest that expanding the range of educational opportunities and further strengthening the links between government and employers can contribute to improving the quality of human capital. M. O'Neill & S. Bagchi-Sen (2023) revealed how public educational institutions in the United States have a significant impact on human capital formation by making education more accessible to the general population. The results of the study showed that stable funding and support of universities contribute to the training of in-demand specialists and reduce social inequality. Thus, the interaction of public educational institutions with real sectors of the economy, as well as regular updating of educational programmes will help graduates to adapt more quickly to the requirements of the labour market in Azerbaijan and contribute to the overall economic and social development of the country.

The reviewed studies have highlighted general trends in the formation of human capital and the impact of demographic changes on economic development. The authors agreed that it is difficult to ensure long-term growth and innovation activity without expanding educational programmes, improving the retraining system and considering regional specifics. At the same time, there are still gaps related to the mechanisms of retaining qualified specialists in remote areas, the formation of flexible forms of employment for the elderly population and overcoming the digital divide. These aspects require further research and more detailed analysis in order to improve the effectiveness of practical measures and strengthen socio-economic stability.

Conclusions

The study revealed the impact of demographic processes on human capital in Azerbaijan, its trends and challenges, considered changes in the age structure of the population, migration processes, as well as the impact of these factors on the economic and social stability of the regions. The revealed reduction in the number of infants and

young children in the 0-4 and 5-9 age groups against the background of an increase in the share of the elderly population has demonstrated a tendency towards population ageing, which in the future may lead to a decrease in the number of able-bodied population and create additional pressure on economically active age groups.

It was also revealed that internal migration from rural areas and emigration of qualified specialists abroad have significantly exacerbated the problem of economic instability of the state: the decline in the population of rural areas has undermined its economic activity, while the outflow of young people and skilled workers has limited the opportunities for innovation and competitiveness in the international arena.

The survey of experts in the field of human resources allowed drawing conclusions about the current situation with human resources and the impact of demographic changes on the regional economy of Azerbaijan. According to the results, 39% of all respondents named lack of qualified personnel as the most widespread problem. Respondents from Baku (46%) and Absheron region (40%) were most affected by this problem. Limited access to educational and professional resources was mentioned by 24% of respondents, and in rural areas this problem is aggravated by poor infrastructure and insufficient support from government programmes.

When asked about problems with labour resources, 42% of all respondents noted an acute shortage of qualified specialists. The lack of modern retraining and professional development programmes was noted by 14%, while 28% of respondents from urban areas and 34% from rural areas highlighted the need to create conditions for retraining

and adaptation of older age groups, due to the increasing proportion of the elderly population and the need for integration into the labour market.

The state policy aimed at supporting human capital, according to the survey participants, does not meet the current challenges. Insufficient efforts to develop infrastructure, launch targeted educational initiatives and stimulate the attraction of personnel to rural areas limit the effectiveness of labour resource management, which has a particularly acute impact on rural areas against the background of population ageing.

This study has highlighted the need to revise human capital management strategies in Azerbaijan through a comprehensive approach that includes adapting educational programmes to demographic changes, expanding state support measures, stimulating rural development and creating conditions for retaining qualified specialists.

It is recommended that further research should be devoted to studying the relationship between digital skills and the level of professional mobility of workers of different generations, which in the future will allow developing strategies to adapt human resources to technological changes and increase the sustainability of the regional economy.

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Conflict of Interest

None.

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Вплив демографічних процесів на формування та ефективне використання людського капіталу в умовах регіональної економіки

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Анотація. Метою цього дослідження стало виявлення наявних проблем у використанні людського капіталу в міських і сільських регіонах Азербайджану. Для цього було проаналізовано демографічні дані за 2000-2024 роки та проведено опитування експертів у сфері управління людськими ресурсами та розвитку людського капіталу. У рамках проведеного дослідження було здійснено комплексний аналіз людського капіталу і демографічних процесів в Азербайджані. Було розглянуто концепції, пов'язані з демографічним переходом і накопиченням людського капіталу, що дало змогу розкрити значущість якісних освітніх програм, гідної оплати та привабливих умов у періоди зміни вікової структури населення. Згідно з даними проведеного опитування, 30 % респондентів із сільської місцевості вказали на брак кваліфікованої робочої сили, що може позначитися на технологічному оновленні та темпах економічного зростання регіонів. Опитані з міст також підтвердили цю тенденцію: 35 % зазначили труднощі в пошуку фахівців, які повною мірою володіють необхідними навичками. Крім того, було виявлено, що частка літніх людей (старше 60 років) у структурі населення прагне до 15 %, що ставить нові завдання перед системою соціального захисту. Для подолання негативних наслідків старіння населення було обґрунтовано необхідність розроблення механізмів, що дають змогу залучати старше покоління до економічної активності. Було проаналізовано, яким чином інфраструктурні обмеження, державна політика та урбанізація впливають на професійну мобільність і конкурентоспроможність працівників; результати засвідчили, що за умови грамотної підтримки з боку державних інституцій і роботодавців, а також за умови залучення освітніх закладів до постійного оновлення навчальних планів, можна пом'якшити негативні ефекти старіння населення та нестачі кваліфікованих фахівців. Проведене дослідження засвідчило, що максимізація економічного потенціалу регіонів в умовах прискореного старіння населення та міграційних процесів потребує взаємодії державних інститутів, бізнесу та освітніх організацій

Ключові слова: старіння населення; міграція; державна політика; інфраструктурні обмеження; підвищення кваліфікації; урбанізація