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**SOCIO-ECONOMIC TRANSFORMATIONS IN UKRAINE: IMPACT OF  
THE DEMOGRAPHIC CRISIS ON THE DEVELOPMENT OF  
RAILWAY TRANSPORT ENTERPRISES**

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*The article examines the systemic impact of the demographic crisis in Ukraine on the functioning and strategic stability of railway transport enterprises. It is proven that demographic deformations have transformed into a determining macroeconomic factor, which determines a deep structural restructuring of the labor potential of the industry. It is established that in the conditions of a full-scale war in 2022–2026, demographic shifts have taken on the character of a multiplicative shock, which significantly exacerbated the shortage of human capital and necessitated the need for a radical revision of traditional models of economic value creation.*

*The key manifestations of demographic shifts have been identified and the main threats to the railway industry have been systematized, in particular: reduced availability of personnel, difficulty in staffing, deterioration of the age structure of personnel, risk of loss of experience, lack of innovative potential and digital competencies, imbalance in the provision of personnel to individual units. It has been established that under the conditions of a*

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*reduction in the number of employees by 65 thousand people during 2020–2025, the extensive management model, focused on the use of cheap labor, has lost its effectiveness. It is substantiated that the demographic crisis is not only a limiting factor, but also a driver of the technological transformation of the industry. It is argued that overcoming the personnel shortage requires accelerated digitalization, automation of production processes and comprehensive modernization of the personnel management system. It is concluded that to develop human capital, digital competencies, inclusiveness and organizational adaptability of personnel, railway transport enterprises need to implement a new model of supporting economic value, in which the intellectualization of business processes and the effective use of human potential will become key factors in the resilience of enterprises in the industry to demographic challenges.*

**Keywords:** *demographic crisis, railway transport enterprises, personnel, management, digitalization, personnel risks, economic value.*

## **СОЦІАЛЬНО-ЕКОНОМІЧНІ ТРАНСФОРМАЦІЇ В УКРАЇНІ: ВПЛИВ ДЕМОГРАФІЧНОЇ КРИЗИ НА РОЗВИТОК ПІДПРИЄМСТВ ЗАЛІЗНИЧНОГО ТРАНСПОРТУ**

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*У статті досліджено системний вплив демографічної кризи в Україні на функціонування та стратегічну стійкість підприємств залізничного транспорту. Доведено, що демографічні деформації трансформувалися у визначальний макроекономічний чинник, який зумовлює глибоку структурну перебудову трудового потенціалу галузі. Встановлено, що в умовах повномасштабної війни 2022–2026 рр. демографічні зрушення набули характеру мультиплікативного шоку, що суттєво загострив дефіцит людського капіталу та обумовив необхідність радикального перегляду традиційних моделей створення економічної цінності.*

*Ідентифіковано ключові прояви демографічних зсувів та систематизовано основні загрози для залізничної галузі, зокрема: зниження доступності персоналу, ускладнення комплектування штатів, погіршення вікової структури персоналу, ризик втрати досвіду, дефіцит інноваційного потенціалу та цифрових компетенцій, дисбаланс забезпечення кадрами окремих підрозділів. Встановлено, що за умов скорочення чисельності працівників на 65 тис. осіб упродовж 2020–2025 рр. екстенсивна модель управління, орієнтована на використання дешевої робочої сили, втратила свою ефективність. Обґрунтовано, що демографічна криза виступає не лише обмежувальним фактором, а й драйвером технологічної трансформації галузі. Аргументовано, що подолання кадрового дефіциту потребує прискореної цифровізації, автоматизації виробничих процесів та комплексної модернізації системи управління персоналом. Зроблено висновок, що для розвитку людського капіталу, цифрових компетенцій, інклюзивності та організаційної адаптивності персоналу підприємства залізничного транспорту потребують втілення нової моделі підтримки економічної цінності, в якій інтелектуалізація бізнес-процесів та ефективність використання людського потенціалу стануть ключовими факторами стійкості підприємств галузі до демографічних викликів.*

**Ключові слова:** *демографічна криза, підприємства залізничного транспорту,*

*персонал, управління, цифровізація, кадрові ризики, економічна цінність.*

**Problem statement.** The full-scale war in Ukraine significantly exacerbated the already existing demographic imbalances, causing large-scale migration processes, a reduction in the economically active population, a decrease in the birth rate and accelerated aging of the nation. As a result, a deep demographic crisis has formed, which is transforming from a social phenomenon into a key macroeconomic limiter of economic growth. These processes are particularly acute in strategically important industries, including railway transport enterprises, which perform a system-forming function in the country's economy and ensure the continuity of logistical, production and social ties in the country. The shortage of labor resources, structural imbalances in the labor market, the outflow of qualified personnel and the increase in the workload on personnel directly affect the efficiency of the functioning of railway transport enterprises, their ability to restore, modernize and introduce innovations. This necessitates the study of the impact of the demographic crisis on the development of Ukrainian railway transport enterprises, in particular in the context of the transformation of the model of their formation of economic value and increasing trust from personnel in conditions of manifestations of socio-economic anomie.

**Analysis of recent research and publications.** The study of the impact of transformation processes, including socio-demographic changes, on the activities of railway transport enterprises was devoted to the work of such authors as Dykan V.L., Zayachuk R.V., Koba V.G., Kalycheva N.E., Kompaniyets V.V., Mnykh O.B., Obruch G.V., Ovchinnikova V.O., Semenchuk T.B., Tokmakova I.V., Yanovska V.P. and others [1-8]. The works of these scientists consider certain aspects of reforming the industry, increasing management efficiency, developing human resources and adapting railway transport enterprises to the challenges of a turbulent environment. At the same time,

in the context of growing socio-economic disparities as a result of military actions and the deterioration of the economic situation of the state, there is a need to study the systemic impact of the demographic crisis on the formation of the economic value of railway transport enterprises and their long-term sustainability.

**The purpose of the article** is to study the manifestations of the demographic crisis in Ukraine and their impact on the development of railway transport enterprises.

**Presentation of the main material.** Human capital in economic theory is traditionally considered one of the key determinants of economic development. For Ukraine, as of 2026, the issue of preserving human resources has gone beyond the boundaries of classical scientific discussions or political slogans and programs, turning into an existential problem for national security and statehood. The full-scale war was an unprecedented shock, causing enormous damage not only to the material infrastructure, but also provoked the most acute demographic crisis in the entire history of the country. But despite the current state of affairs, an objective analysis forces us to admit that the prerequisites for this crisis have been forming since Ukraine gained independence in 1992. Negative demographic trends such as reduced population reproduction (depopulation), gradual aging of the nation, declining fertility, and permanent labor migration were stable long before the start of the full-scale war in Ukraine in 2022 and the hybrid war in 2014. However, 2022 acted as a tough catalyst that exponentially accelerated the processes of demographic decline. The mass outflow abroad of millions of citizens, mainly women of reproductive age and children, large-scale population displacement within the country (IDPs), as well as the withdrawal of a significant share of the economically active male population from the real sector for the needs of the Defense Forces of Ukraine led to a

catastrophic narrowing of the labor market supply [9]. The domestic economy faced not just a temporary shortage of personnel within the normal business cycle, but a profound long-term deformation of the structure of the labor economy.

According to international institutions, from a pre-war figure of 41.1 million people as of 2021, the actual population in the controlled territories stabilized at 33.38 million people by the beginning of 2026 [10-11]. The total demographic losses, which include external migration, the stay of citizens in temporarily occupied territories and direct losses from hostilities, are estimated at 8-10 million people [12].

However, the most threatening to economic growth is not so much the overall reduction in the population, but the disproportionate loss of its economically active part. Over the four years of full-scale war, the national economy lost about 40% [13] of its working-age population. The main factor in the depletion of labor resources is external migration. As of 2026, the total number of Ukrainian refugees exceeds 5.6 million people [14]. European labor markets, also suffering from the aging of the nation, are actively recruiting Ukrainian workers for their needs. Given the demographic profile of the refugees, 45% of whom are women of reproductive and working age, and 30% are children, who are already deeply integrated into the Western education system, they are able to assimilate more easily with each passing year without any obstacles [15]. According to UN forecasts, after the end of the active phase of the war, from 3 to 3.5 million people could potentially return in the most optimistic scenario. These figures show the loss of millions of workers and intellects, which is destined to permanently undermine the potential for economic growth of Ukraine [16].

The second problem of labor losses is the withdrawal of some men for the needs of the Armed Forces of Ukraine, mainly from 25 to 50 years old, which provoked not just a

quantitative deficit, but a severe structural crisis in a number of critical industries, namely in construction, agro-industrial complex, metallurgy, energy, and transport logistics.

The third factor is the internal migration of the population to the safe regions of the west of the country. About 4 million internally displaced persons (IDPs) have formed a colossal but ineffective reserve of labor resources [17]. The problem of internal displacement has created paradoxes in local labor markets. On the one hand, there is an elocation of business to the safer western and central regions, which creates a demand for labor there. On the other hand, highly qualified specialists from the industrial eastern and southern macroregions often cannot find relevant applications for their skills in regions with a predominantly agricultural or tourist and recreational specificity. Faced with a housing crisis and the inability to confirm or adapt qualifications, human capital is degraded. Specialists are forced to accept low-skilled work in the service sector or trade, which leads to hidden unemployment and large losses of added value for the national economy.

The most tragic are the direct human losses resulting from hostilities on the front and beyond its borders, both among the military and the civilian population. In addition to direct depopulation, Ukrainian society is undergoing a test of adaptability due to the growth of veterans and civilians who have received disabilities. This category has a high level of motivation, but their full and barrier-free return to the labor market is significantly hampered by objective factors, namely the unfinished infrastructure of enterprises and the slow pace of institutional adaptation of the corporate sector to the new requirements of inclusiveness.

If the loss of working-age population due to migration and mobilization are direct and visible losses, then the processes occurring in the plane of natural population reproduction form a long-term threat to the

existence of the state. Ukraine has found itself in a demographic pit, the exit from which is impossible due to natural cycles of self-regulation, due to a complex of social, economic and political factors. For simple reproduction of generations, the basic indicator of the viability of the nation should be 2.1 children per family [18]. In Ukraine, this indicator is 0.8-1.0, which indicates a significant decline in the birth rate, which is due not only to the security factor, but also to the factor of family separation. The decline in the birth rate from 206 thousand children in 2022 to 168.8 thousand in 2025 indicates that the effect of the “demographic cross” has become established in Ukrainian society, in which mortality exceeds birth rate by almost three times [18].

Undoubtedly, the birth and upbringing of a child in the modern world is a long-term investment for a Ukrainian household. The war caused significant damage to the financial capacity of the Ukrainian middle class. The fall in real incomes, inflationary shocks, loss of savings and the permanent threat of losing their jobs turned parenthood into a financial risk. The rational behavior of families in conditions of economic turbulence dictates the refusal to expand the family in favor of basic survival. On the other hand, the problem of low birth rates is associated with the housing crisis and the inability of the majority of the population of Ukraine to purchase housing. In addition, the destruction of millions of square meters of housing stock and mass internal displacement have created an even larger housing crisis. About 4 million IDPs are often forced to live in rented apartments, modular towns or with relatives. In addition, the destruction of social infrastructure, the shortage of kindergartens with shelters, and the transition of schools to online learning shift the entire burden of childcare to parents, mainly mothers, which forces them to drop out of the labor market and further reduces the economic stability of the family.

Manifestations of the “delayed life syndrome” are also growing in Ukrainian

society. In conditions of chronic stress and air anxieties, the planning horizon of the average Ukrainian has narrowed from years to weeks or even days. Making a decision to have a child is a commitment for the next two decades. Without a basic guarantee of physical safety and faith in the predicted future, it is psychologically impossible to take on such responsibility, which generates the phenomenon of mass delayed parenthood and refusal to have children, especially among the younger generation.

The synthesis of low birth rates, extremely high mortality and youth migration is generating a transformation of the age structure. Ukraine has become a rapidly aging country. The share of people aged 60+ is growing hypertrophied against the background of a narrowing of the taxpayer base. This structural imbalance forms the so-called “pension trap” [19]. The demographic burden coefficient has increased to critical values: the number of payers of the single social contribution (SSC) has actually equaled the number of pensioners, and in some regions there have been even more pensioners. The solidarity pension system has lost its ability to be self-sufficient, and in such conditions the state is forced to cover the deficit of the Pension Fund at the expense of external macro-financial injections or internal borrowings, which critically limits the possibilities for investing in development and recovery programs.

Thus, it can be stated that socio-economic factors create a vicious macroeconomic circle: poverty, loss of housing and security risks block the birth rate, and the catastrophic aging of the nation, in turn, deprives the economy of the workers necessary to overcome this same poverty.

As of 2026, the shortage of qualified labor in Ukraine has transformed from an operational problem of individual enterprises into a key systemic risk for the national economy. The final disappearance of the “employer’s market” is observed: today, it is not companies that choose their personnel, but scarce human resources that dictate the

conditions for the functioning of entire industries. According to market surveys, about 74% of business entities identify the lack of personnel as the main determinant limiting production volumes and the pace of recovery [21].

The deficit is of a pronounced structural nature, concentrated in sectors with high added value and critical infrastructure. In the energy sector, the demand for specialists for the implementation of “major reconstruction” projects has increased 2.5–3 times compared to the pre-war period. At the same time, the supply on the labor market has decreased due to mobilization restrictions and the physical departure of men. This creates a “bottleneck”: the availability of funding from international donors does not guarantee the implementation of work due to the lack of linear engineering staff and qualified workers. In the transport complex, the demand for specialists for the implementation of “major reconstruction” projects has increased 2.5–3 times compared to the pre-war period. High-tech sectors such as IT and R&D are also suffering from the outflow of personnel, especially “senior specialists”, i.e. high-quality IT workers.

The most radical change in 2024–2026 was the accelerated integration of women into professions that were traditionally considered exclusively “male,” which became a key strategy for business survival. In industrial regions, there is a massive retraining of women as heavy equipment operators, electricians, welders, and machinists. Companies are also forced to invest in workplace ergonomics, revising occupational safety standards and shift schedules to take into account the needs of women, who often combine work with sole care for children or elderly relatives. In addition to the above, a deep gap has been recorded in the labor market between the existing competencies of job seekers and the real needs of the economy. Highly educated specialists from temporarily occupied or front-line territories, moving to agricultural or service-oriented communities, are often

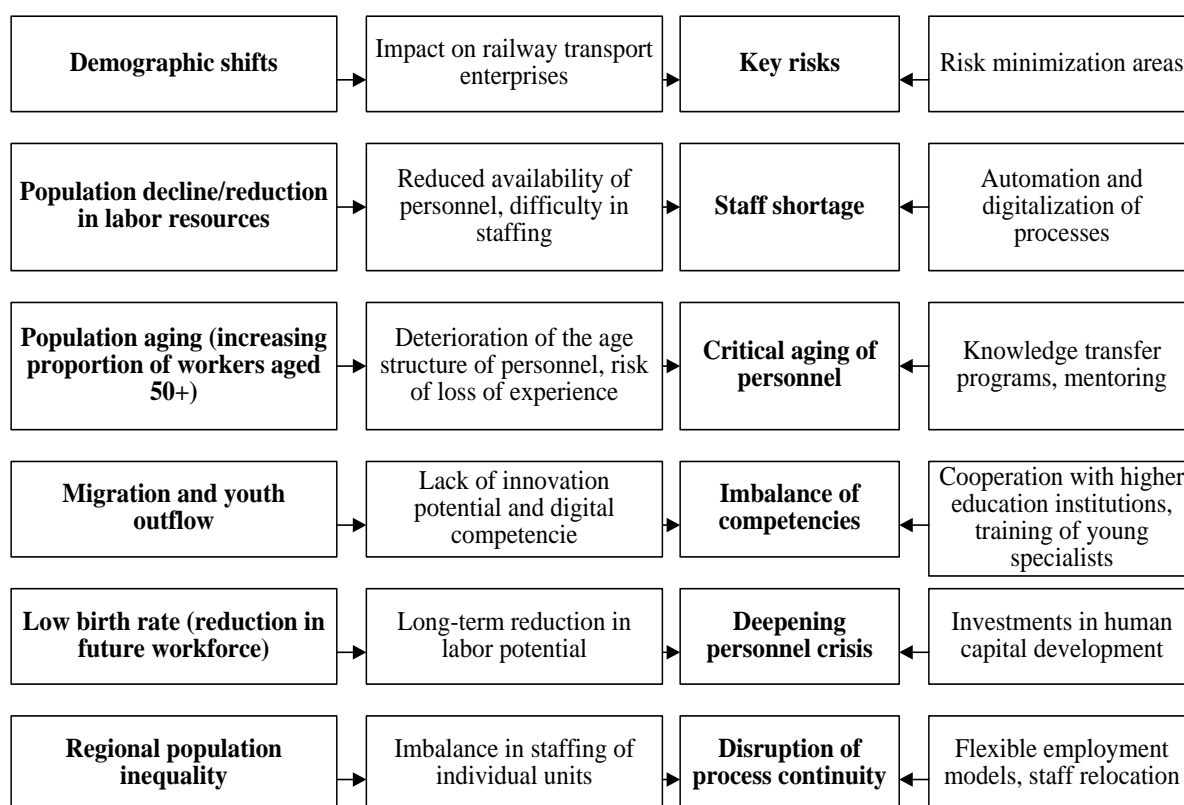
forced to engage in low-skilled work, which leads to the gradual loss of unique professional skills that will be critically needed in the restoration of industry. Since the formal vocational education system is not keeping up with the pace of change, the market is switching to a “fast learning” model. The state and business are introducing short-term intensives (1–3 months) to train personnel “here and now”, which allows filling vacancies, but often harms the depth of expertise. It is also worth noting the key challenges to corporate culture that arose in 2026 in connection with the return of veterans to the labor market. Veterans have unique “soft skills” - stress resistance, crisis management skills and high adaptability, despite this, their successful reintegration requires businesses to create an inclusive environment, namely the implementation of mental health programs and psychological support, physical adaptation of workplaces for people with limited mobility, flexible work schedules and gradual entry into the work rhythm.

It is also worth noting that due to the acute shortage of personnel, an atypical macroeconomic effect is observed: the growth of nominal wages is outpacing the growth of labor productivity. Business is forced to increase remuneration only in order to prevent staff turnover. This creates the risk of an inflationary spiral and reduces the investment attractiveness of enterprises, since the share of personnel costs in the cost structure becomes disproportionately high. It should be noted that the personnel shortage forces us to rethink basic economic categories, business operating models and the very principles of assessing the effectiveness of key industries. These processes are most openly taking place in the transport and logistics industry, namely at railway transport enterprises. For a long time, added value in transportation was generated mainly in an extensive way due to access to relatively cheap labor and a uniform influx of personnel. However, in the conditions of the personnel famine of 2022–2026, when the

industry faced a critical shortage of personnel, a radical paradigm shift took place towards the formation of a value-based concept of personnel management. Over the period 2020-2025, the number of personnel in railway transport enterprises decreased by 65 thousand people: from 245 thousand in 2020 to 180 thousand people in 2025 [22]. It is worth noting that the reduction in the number is partly the result of an optimization policy that involves the transformation of the

management structure and the elimination of a certain list of positions. Only in 2025 were the positions reduced to 500, which led to the release of almost 25% of administrative and managerial personnel [23].

It is worth noting that the impact of the demographic crisis in the country on the activities of railway transport enterprises goes far beyond the quantitative shortage of labor (Fig. 1).



*Fig. 1. Manifestations of demographic shifts and threats to the development of railway transport enterprises (authors' development)*

The difficult demographic situation determines the transition from the model of exploitation of cheap labor to the model of management of knowledge capitalization. In conditions when the physical volume of labor resources of railway transport enterprises has decreased by 26.5% in five years, their economic value begins to depend on the pace of technological replacement of routine operations and the ability to ensure the continuity of critical business processes under conditions of critical aging of the personnel

core. Accordingly, it should be noted that in the realities of Ukraine, the demographic challenge is becoming the main driver of the transformation of railway transport enterprises from the industrial giant of the past to a high-tech logistics platform, where sustainability is determined not by the number of employees, but by the intellectual density of processes.

It is also worth noting that the demographic crisis transforms the structure of personnel competencies, the level of

institutional memory and the ability to reproduce critically important knowledge. The outflow of experienced employees combined with an insufficient influx of young personnel creates risks of a break in technological continuity and a decrease in the level of operational safety. This also provokes an increase in asymmetries between the real needs of railway enterprises in highly qualified personnel and the opportunities and supply of the national labor market, which increases the importance of forming mechanisms for the development of internal competencies, corporate training, and digital skills of personnel.

To compensate for the shortage of labor resources, it is extremely important to rethink organizational models of management of railway transport enterprises, in particular, the transition to flexible, network and platform forms of organization of activity, which are based on large-scale automation, digitalization and integration of business processes. In turn, the digital transformation of railway transport enterprises requires a change in approaches to assessing the effectiveness of their activities, which will combine traditional production indicators with parameters that reflect the level of intellectualization of labor, digital maturity, innovative activity and the ability to reproduce human capital.

So, in general, it is worth stating that the demographic crisis in Ukraine has a destabilizing effect on the activities of railway transport enterprises, creating a need for their structural restructuring by increasing adaptability, technological capacity and long-term sustainability. The ultimate vector of such restructuring is the formation of a new model of economic value, where the market value and efficiency of the enterprise are determined not by the scale of the personnel involved, but by the quality of synergy between high-tech assets and intellectual capital. In this model, economic value is generated by minimizing dependence on scarce low-skilled labor and maximizing returns on investment in employees' digital

competencies, which transforms human resources from an operating cost factor into the main driver of capitalization and competitiveness in the face of global instability.

**Conclusion.** Thus, the demographic crisis in Ukraine has become systemic and transformed into a determining macroeconomic factor that directly affects the functioning and development of railway transport enterprises, causing deep structural deformations of the labor potential. It is argued that in the conditions of a full-scale war, demographic shifts have taken on the character of a multiplicative shock, which has intensified existing negative trends and led to the formation of a long-term deficit of human capital. The manifestations of demographic shifts and threats to the development of railway transport enterprises are revealed. It is determined that for railway transport enterprises, the key consequences of the demographic crisis were not only a decrease in operational efficiency, an increase in security risks, disruption of business process continuity and an increase in personnel costs, but also an urgent need for the urgent implementation of digital changes, a comprehensive transformation of the personnel management system, which should combine tools for the development of knowledge, digital skills, inclusiveness and adaptability to changes in the external environment. In this context, the demographic crisis is not only a limiting factor, but also a powerful driver of the industry's transition to a high-tech development model, where the determining factor of economic value is not the number of personnel, but the efficiency of using intellectual potential.

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