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ROMANIA, GLOBAL LEADER IN LABOUR MOBILITY: A BIBLIOGRAPHIC REVIEW OF WORKFORCE MIGRATION AND RETURN TRENDS

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Abstract: *Romania has consistently ranked among the top countries worldwide in terms of skilled labor emigration, with more than 4 million citizens abroad. Romania is one of the few countries in the world where voluntary labor migration is comparable to the proportion of war- and crisis-affected countries. This article provides a critical bibliographic analysis of the migration of Romanian workers from 2017 to 2025. Although national discussions have focused increasingly on digitalization and automation, millions of citizens have continued to leave the country in search of better living and working conditions. This study combined the latest academic perspectives to highlight this paradox and argues for the restoration of the human dimension in public and organizational strategies related to labor.*
Key words: *Return migration, Romanian diaspora, labor mobility, brain drain, human resources management strategies, workforce reintegration.*

1. INTRODUCTION

Romania became the second largest country worldwide in terms of the share of its population living abroad, after Syria in 2017 [1]. Unlike conflict-driven migration, the Romanian exodus was mainly voluntary and was mainly composed of educated, experienced individuals. Currently, almost 30% of the skilled workforce and more than 20% of the country's population, or more than 4.3 million Romanians, are abroad [2]. The parallel Romanian policy debate has focused on digital transformation and the integration of artificial intelligence into public and commercial enterprises. This trend of mobility has made Romania both an important source of talent and a test case for the dynamics of brain flow and brain acquisition in Europe. Recent literature has documented not only the flow of professional refugees, but also the slow emergence of return migration, especially after the COVID-19 epidemic.

This bibliographic review is based on the paradox of technological acceleration combined with significant human displacement. Although artificial intelligence does not move, human ability does. And Romania is in trouble. By examining pertinent literature from the last five years on migration, return dynamics, and human resources management (HRM), this paper critically investigates this contradiction and suggests a reinterpretation of talent management beyond algorithmic zeal.

The study focusses on critical gaps in the literature by linking two areas that are often studied separately: Romania's labor migration and the rapid development of artificial intelligence in human resource management. Unlike existing research that focusses on digitalization or migration, this article contributes to a critical review of the literature, reinterpreting the debate on talent management by reintroducing human elements. The results highlight the paradox of simultaneous technological acceleration and human capital and point out that sustainable strategies must integrate both aspects.

2. METHODOLOGY

With the aim of synthesizing relevant academic and institutional work on Romanian

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labor migration and return dynamics from 2017 to 2025, this study follows a structured literature review technique. Especially in the framework of artificial intelligence, the review also includes insightful comments on the intersection between workforce mobility and digital transformation. The approach went through three different phases.

The targeted search terms Romanian migration, return migration, diaspora reintegration, brain drain, digitalization in HR and AI and workforce, were used to search academic databases including Scopus, Web of Science, Google Scholar and institutional repositories (European Commission, OECD, UNDP). Only publications between 2020 and 2025 were kept, guaranteeing relevance and topicality.

Five major themes: (i) motivations for emigration, (ii) profiles of returning people, (iii) obstacles to reintegration, (iv) HRM policies, and (v) the AI-human labor paradox, were used to group publications discovered. Other sources were organized according to newly developed subthemes, such as regional differences and sectoral vulnerabilities.

The review takes a critical stance, emphasizing inconsistencies, gaps, and neglected assumptions rather than descriptively compiling results, especially the disconnect between Romania's artificial intelligence policies and its ongoing loss of human resources.

This approach seeks to reframe the debate on digital transformation by placing the human element back in the centre of study, as well as to map existing knowledge.

Although this investigation uses a disciplined bibliographic methodology, some drawbacks must be recognized. First, the review is limited to sources published between 2020 and 2025, therefore, potentially missing significant earlier contributions. Second, the exclusion of empirical data, interviews, case studies, or surveys limits the depth of interpretation regarding individual and organizational experiences. Third, the convergence of artificial intelligence and migration is still a developing area with few peer-reviewed studies published. However, the integrative point of view and the goal of inspiring more research rooted in both technical and human dimensions help to balance these constraints. Another limitation comes from the time frame adopted. By restricting the analysis to studies published between 2020 and 2025, this review ensures currently but may have overlooked earlier contributions that remain relevant for understanding the long-term dynamics of Romanian migration.

3. CONCEPTUAL FRAMEWORK

Although artificial intelligence and automation have ruled the current HRM literature [3], they rarely intersect with the urgent reality of workforce mobility. Scholars often forget that human labor is still being replaced by social and economic conditions such as those found in Romania [4], not by robots. The digitalization of HRM is often associated with efficiency and automation but has a direct impact on labor mobility. In Romania, AI-driven transformations intensify the inconsistency between technology investment and the availability of skilled workers. This paradox must be considered when discussing the balance between brain waste and potential brain gain.

Theoretical frameworks have changed from “brain drain” to “brain circulation”, emphasizing potential return and reintegration [5]. Although pilot projects such as Diaspora Start-Up or RePatriot [6] are abundant, Romania still lags behind in restoring its diaspora.

Return migration problems are related to human resources (HR), even if artificial intelligence changes the way HR is run. Returnees have tacit knowledge, intercultural awareness, and potential innovation assets that cannot be replaced by automation [7]. Migration-heavy settings call for a human-centered HRM approach.

Return migration is the process of resettling migrants in their home countries after a period of overseas stay. This process is temporary or permanent, voluntary or nonvoluntary, and depends on individual motivations and systemic factors. Romania's return migration includes professionals from western Europe and North America looking for employment, enterprise, or reintegration opportunities [8].

Migration studies have evolved from brain drain models to more nuanced frameworks such as brain circulation and brain gain [5]. These

frameworks emphasize the potential for knowledge transfer, innovation dissemination, and cross-border professional participation [9] when migrants return.

In HRM, refugees are considered strategic human capital, international skills, global exposure, and strong adaptability [9]. Potential contributions of people returning to the HR system include recruitment, enrolment, internal mobility, and leadership development [10]. However, challenges such as lack of recognition of qualifications, institutional rigidity, and cultural imbalances persist [4], [11].

4. FINDINGS AND DISCUSSION BASED ON BIBLIOGRAPHIC RESOURCES

This section synthesizes bibliographic insights into five dimensions: motivations, returnee profiles, barriers, policies, and critical contrasts between AI discourse and human capital realities. It argues that overlooking the emotional and professional drivers of migration while overfocusing on AI leads to misguided policy and practice.

4.1 Overview of the literature results

Scholarly interest in labor migration in Romania has increased over the past decade, particularly regarding socioeconomic effects, brain drain, and reintegration policies.

An examination of significant publications published between 2020 and 2025 reveals several common themes and gaps that need to be highlighted. Most research shows that the reasons for leaving Romanian professionals are mainly due to salary, professional growth, and institutional rigidity-related discontent [8], [2].

Beyond financial considerations, cultural and psychological aspects such as frustration with nepotism or underutilization of skills also become important. Return migrants are often urban, multilingual and globally educated, as Gherghina and Hein (2021) highlight [12]. Although they have promise, institutional obstacles impede their reinstatement: lack of diploma recognition, bureaucratic inertia, and limited employer flexibility remain common obstacles [11], [4].

Several projects aimed at drawing and retaining the Romanian diaspora include RePatriot, Diaspora Start-Up, and those supported by the National Recovery and Resilience Plan (PNRR) [13]. However, evaluations reveal that these initiatives are disjoint, underfunded or poorly aligned with the realities of the labor market [6].

Ionescu (2021) advocates modern HRM tactics, including adaptive onboarding programmes, experience equivalency frameworks, and mentoring systems to help reintegration that sees return migration as a chance [7].

Most studies approach migration and return separately from larger technological and organizational changes, despite the breadth of research. Particularly underexplored is the interaction between labor mobility and the rise of digital technologies, especially artificial intelligence. This vacuum allows the following part of this article to be addressed, which addresses the conflict between human capital decrease and artificial intelligence investment in Romania.

4.2 The paradox of AI and the human deficit: A sectoral and strategic analysis (2017-2025).

In motion contradiction, Romania finds itself at the crossroads of demographic erosion and digital transformation. Public and private players made significant investments in cloud infrastructure, digital platforms, and artificial intelligence systems between 2021 and 2025.

More than four million residents, many of them very talented, left the country in search of better life and work conditions despite these developments. Human systems deteriorate as digital technologies grow. Although national spending on AI-related technologies increased by 127% between 2020 and 2024, the nation lost thousands of workers in important industries, including construction, IT, and healthcare (Fig. 1). These conflicting forces have produced a developing contradiction: Romania is developing smart infrastructure without people being able to run, maintain, or profit from it. Regarding sectoral vulnerabilities and human drain, many industries demonstrate this contradiction.

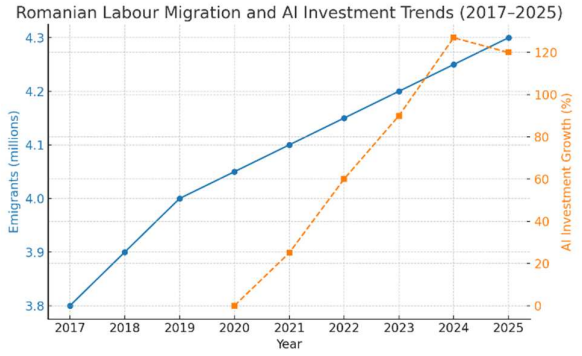

Fig. 1. Timeline of Romanian Labour Migration (2017-2025)

Source: Data on labour migration are drawn from the OECD (2023), UNDP (2020), and national policy briefs, reflecting cumulative estimates of Romanian citizens living abroad. The AI investment figures are based on the European Commission and national reports (2020–2024), showing a percentage growth compared to the 2020 levels. The figure illustrates the divergence between the erosion of human capital and the acceleration of digital investment in Romania.

Between 2017 and 2023, more than 43,000 medical professionals fled Romania. Due to externalization of training expenditure and the importation of short-term medical labor, economic losses are estimated at 2.3 billion euros. Almost 38% of countries have access to healthcare than the average in the EU. Although among the best-paid industries in the nation, information technology has experienced an annual shortfall of 15,700 professionals. For better dynamic career paths and stability, several Romanian programmers relocate to North America or Western Europe. Over 800 million in human capital losses occur annually in engineering and construction, therefore impacting strategic infrastructure projects. Due to labor shortages, the railway, hospital, and school buildings have become regular.

AI without people is a strategic gap. The dominant narrative implies that technology will compensate for human deficiencies. However, the literature and practical application reveal this to be an illusion. AI needs domain knowledge, ethical control, and local adaptation, all of which depend on competent people [14]. AI systems risk becoming costly, underused, or poorly integrated without a strong and driven human workforce. Furthermore, automation lacking a socioeconomic foundation could produce new disparities: between rural and urban people, digital elites, and the working class, or between those who go and those left behind.

We think of dual transformation abilities, and recent strategic plans stress the necessity of dual transformation: coordinated growth of human capital and digital systems. Popescu & Dumitrescu (2024) have proposed the idea that a coherent strategy for talent development, mental health, and lifelong learning is necessary for any digital transformation to be sustainable [15].

The impact of artificial intelligence on labor migration has not yet been adequately addressed in current research. AI could accelerate the demand for advanced digital skills, thus increasing the influx of highly qualified workers looking for competitive salaries abroad. On the other hand, lack of human capital undermines the implementation of artificial intelligence systems that depend on local expertise to adapt and maintain them. This double pressure deepens the paradox between technological investment and demographic erosion.

Table 1

Sector vulnerabilities and human drain

Sector	Human Losses / Migration	Estimated Economic Impact	Digital Invest-ment Response
Healthcare	43,000 professionals lost	€2.3 billion/year	E-health systems, pilot AI triage
IT	15,700 specialists/ year deficit	€1 billion productivity gap	Coding schools, cloud platforms
Construction	~€800 million/ year in delays	Infrastructur e blockages	BIM platforms, AI project managers

Table 2

Expected Frequencies

Education Level	Expected Migrated	Expected Stayed
Primary	955.56	1044.44
Secondary	1672.22	1827.78
Tertiary	1672.22	1827.78

Case studies provide evidence for this opinion. Higher retention than national averages results from the combination of high salaries with life benefits (green areas, bilingual schools, startup culture) in Cluj. Such ecosystems reflect a deliberate investment in both technology and people, not one at the expense of the other. To analyze the dependence between migration and education level, we used the chi-square test. We defined the two hypotheses (null hypothesis and alternative hypothesis).

(H_0): Education level and migration are independent.

(H_1): There is a relationship between education and migration.

Chi-Square Statistic: $\chi^2 = 205.49$
Degrees of freedom (df): Df=2
p-value = $\sim 2.40 \times 10^{-45}$ (essentially 0)

When applying this test, the expected frequencies represent the number of people we would expect to see in each category if there were no relationship between the variables, in our case, education level and migration. The expected frequencies refer to the number of people we would not expect to migrate for each level of education if there were no relationship between the level of education and migration, Table 2. Since the p-value is less than 0.05, we reject the null hypothesis. This means that there is a statistically significant relationship between education level and workforce migration in Romania between 2017 and 2025.

A strategic advice is rehumanizing HRM and the authors suggest a three-tiered strategy to meet the human shortfall in Romania's digital transition in short-term (2024-2025) include reintegration scholarships and retention bonuses in healthcare and IT; offer diaspora professionals more flexible and distant working opportunities. In medium-term (2026-2027) there should be create regional talent centres with colleges, regional businesses, and government agencies; create national platforms for the certification of international experience and credentials. Fo the case of long-term (2028–2030) there is a need for modifying the government sector to allow faster access for returnees; include human sustainability indicators in digital projects that evaluate workforce inclusion and well-being, as well as outcomes.

5. CONCLUSION

This article contributes to a new bibliographic perspective by critically arguing the dominant discourse on AI in HRM with the unexplored human crisis of labor migration. In Romania, mind migration has been largely ignored in favors of digital innovation. The authors argue that HRM must rehumanize its priorities by integrating the flow of real talent into strategic planning.

Future studies should investigate the long-term consequences of reintegration programmes, especially in relation to human-centered digital transformation and organizational flexibility. By combining bibliographic analysis with qualitative interviews and industry case studies, mixed-method investigations would improve our understanding of how returnees shape and are shaped by institutional change.

This article demonstrated that Romania's digital transformation strategy could not be separated from its labor migration crisis. The political implications are clear: Talent retention and reintegration programmes must be integrated into digital investment plans. Short-term incentives, such as retention bonuses, medium-term solutions, such as national verification platforms for returning students, and long-term pathways to embedding human sustainability indicators into digital projects are necessary to balance AI growth and the resilience of the workforce.

Future research should go beyond bibliographic analysis and include qualitative interviews, case studies, or surveys of returnees. Such empirical evidence would capture individual and organizational real experiences and provide a richer basis for policy recommendations. Comparison studies with other EU countries facing similar challenges may also improve understanding of how to reconcile technological ambitions and the development of sustainable human capital.

6. REFERENCES

[1] United Nations, Department of Economic and Social Affairs, "International Migration Report." UN DESA, 2018.

[2] OECD, "Talent Abroad: A Review of Romanian Emigrants." OECD Publishing, 2023.

[3] E. Brynjolfsson and A. McAfee, *The Second Machine Age*. W. W. Norton & Company, 2021.

[4] M. Suciu, "Brain gain versus brain waste in Romania," *J. Hum. Resour. Manag.*, 2023.

[5] Z. L. Kone and Ç. Özden, "Brain Drain, Gain, and Circulation," 2020.

[6] European Commission, "Youth and Talent Mobility in the EU." European Commission, Brussels, 2024.

[7] L. Ionescu, "Strategic human resource practices in post-return reintegration," *Rom. Rev. Manag. HR*, 2021.

[8] A. Croitoru, "Stimulating return migration to Romania," *SAGE Open*, 2020.

[9] N. Mirea, D. Fatol, and C. F. Bogdea, "A Study on Human Capital as a New Factor of Production in Reshaping the Entrepreneurial Education," in *11th International Conference on Information Science and Information Literacy*, 2021, pp. 247–260. doi: 10.2478/9788395815065-027.

[10] M. Sarfraz, L. Ivascu, M. I. Abdullah, I. Ozturk, and J. Tariq, "Exploring a Pathway to Sustainable Performance in Manufacturing Firms: The Interplay between Innovation Capabilities, Green Process, Product Innovations and Digital Leadership," *Sustain. 2022, Vol. 14, Page 5945*, vol. 14, no. 10, p. 5945, May 2022, doi: 10.3390/SU14105945.

[11] UNDP Romania, "Policy brief on the return migration of the Romanian diaspora," 2020.

[12] S. Gherghina and M. Hein, "Diaspora return and democratic engagement," *East Eur. Polit.*, vol. 37, no. 2, pp. 256–275, 2021.

[13] "Innotech Repatriot 2020: program de fonduri nerambursabile pentru diaspora - CEPU." https://cepu.ro/innotech-repatriot-2020-program-de-fonduri-nerambursabile-pentru-diaspora/ (accessed Jul. 13, 2025).

[14] N. Mirea, M. Palade, and A. Gaureanu, "STEM Education, Artificial Intelligence, and Ethical Challenges," in *Artificial Intelligence for Human-TechnologiesEconomy Sustainable Development*, 2024, pp. 251–260. Accessed: Jul. 30, 2024. [Online]. Available: https://eng.bigai.ai/

[15] "Dynamics of Industrialization, Energy Transition, Population, and Ecological Footprint: Energy, Sustainability, and Environment in Balkan Countries," *Econ. Manag. Financ. Mark.*, vol. 19, no. 3, p. 76, 2024, doi: 10.22381/emfm19320244.

România, lider global în mobilitatea forței de muncă: O analiză bibliografică a tendințelor de migrație și întoarcere a lucrătorilor (2017–2025)

România se află constant în topul țărilor cu cea mai mare rată de emigrare a forței de muncă înalt calificate, cu peste 4 milioane de cetățeni stabiliți în afara granițelor. Este una dintre puținele țări din lume unde migrația economică voluntară atinge proporții comparabile cu cele din state afectate de război sau crize majore. Acest articol oferă o analiză bibliografică critică a fenomenului migrației muncii în România în perioada 2017–2025. Deși discursul public național s-a concentrat tot mai mult asupra digitalizării și automatizării, milioane de cetățeni au continuat să părăsească țara în căutarea unor condiții mai bune de viață și de muncă. Studiul valorifică cele mai recente perspective academice pentru a evidenția acest paradox și susține necesitatea reconectării politicilor publice și organizaționale la dimensiunea umană a muncii.

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