CHAPTER VI. THE ROLE OF ARTIFICIAL INTELLIGENCE IN STUDYING FORCED MIGRATION OF SCIENTISTS DURING THE FULL-SCALE WAR IN UKRAINE

DOI

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Abstract. The full-scale war in Ukraine has triggered a significant wave of forced migration among scientists, leading to brain drain and disruptions in research continuity. Understanding the dynamics of this migration is crucial for policymakers, academic institutions, and international organizations. Artificial Intelligence (AI) plays a significant role in analyzing large datasets, tracking migration trends, and predicting future developments. This paper explores how AI technologies can be leveraged to study the forced migration of scientists, assess its impact on global research, and propose strategies for mitigating negative consequences. In this paper presents AI solutions for supporting displaced scientists in forced migration, highlighting how AI-driven tools can facilitate scientific integration, career continuity, and knowledge retention in host countries.

Keywords: Artificial Intelligence, ukrainian researchers, russian-ukrainian war, brain drain, forced migration, AI Application.

Introduction. The Russian invasion of Ukraine in 2022 has triggered a massive wave of forced migration, significantly affecting the country's scientific community. Thousands of researchers and academics have been displaced, seeking refuge and opportunities to continue their work abroad. This large-scale exodus of intellectual talent not only disrupts individual careers but also poses long-term challenges for

Ukraine's research ecosystem, innovation potential, and global scientific collaborations. Artificial Intelligence (AI) presents powerful solutions to mitigate the negative impacts of this forced migration. AI-driven technologies can help track the movement of displaced scientists, analyze employment trends, and predict long-term consequences for research networks. Moreover, AI applications can provide direct support to displaced scholars, enabling them to integrate into new academic environments, maintain professional collaborations, and access funding opportunities. This paper analyzes AI solutions for supporting displaced scientists in forced migration, focusing on practical implementations that facilitate adaptation and knowledge retention. By identifying AI-driven strategies, this study contributes to a broader understanding of how technology can assist displaced researchers and sustain scientific progress despite geopolitical disruptions

Literature Analysis and Problem Statement. A wide range of issues related to the forced migration of Ukrainian scientists during the period of full-scale war are explored in the works of Ukrainian researchers. In a study conducted by O. Lytvynchuk (2023), aspects of the contemporary migration crisis arising from the Russian-Ukrainian war are examined. The researcher notes that the arrival of qualified immigrants contributes to increased labor productivity and does not require significant expenditures on their education in the host country. Additionally, this process helps reduce the nation's aging rate due to new immigrants. S. Fialka (2022) examines the consequences of the war for Ukrainian researchers and investigates the attitudes and motivations of Ukrainian scientists regarding their scientific activities and the publication of results in scientific journals. Y. Suchykova, N. Tsybuliak, and H. Lopatina (2023) explore how to prevent the loss of scientific potential due to the full-scale war. The authors establish a connection between the place of residence of Ukrainian researchers and their ability to engage in scientific activities. They also identify factors that reduced scientific effectiveness during the war. N. Harashchenko, L. Hladchenko, and N. Korytnykova (2022) focus on determining the needs of Ukrainian scientists, both those who have remained in Ukraine and those who have left due to the war. Among the most critical personal needs of Ukrainian scientists, the

authors highlight financial support, the creation of new social contacts, and stable access to the Internet. According to researchers, the most crucial needs in scientific activities include research projects, access to scientific literature, information and data, and mobility programs for scientists.

Ana Beduschi (2021) explores the impact of artificial intelligence on international migration management, analyzing its role in automating identity checks, border control, and processing visa and asylum applications. In her work, she examines how AI can deepen inequalities between countries, modernize migration processes, and contribute to a more data-driven approach to migration policy. Marie McAuliffe and Adam Sawyer (2021) explore the use of data science to understand patterns of international migration and human mobility. It discusses how new technologies have generated vast amounts of data, which can shape migration policies. However, the chapter warns that a focus on data-driven policy can distance policymakers from the true meaning behind the data variables, leading to ineffective or misinterpreted migration policies.

Iulia Cristina Iuga and Adela Socol (2024) examine the relationship between brain drain and government readiness for AI implementation in European Union countries. The study explores how factors such as macroeconomic conditions, governance quality, educational levels, and R&D efforts influence AI adoption by governments, with a particular focus on the impact of brain drain. Using data from 2022, the research employs regression techniques and spatial analysis to identify patterns and interdependencies between countries. The findings suggest that brain drain negatively affects government AI preparedness and emphasize the need for strategic policy-making and institutional reforms to strengthen AI capabilities in the public sector.

Thijs Broekhuizen, Henri Dekker, Pedro de Faria, Sebastian Firk, Dinh Khoi Nguyen, and Wolfgang Sofka (2023) propose a conceptual 3x3 matrix for using artificial intelligence in managing open innovation, which helps identify how various AI applications can enhance or automate human intelligence at different stages of the open innovation process.

Romael Haque and Sabirat Rubya (2023) explore the use of chatbots in mobile applications for mental health. The authors examine the features of popular chatbot-enabled apps that provide support and treatment for mental disorders, as well as analyze user reviews. They emphasize that chatbots have great potential, offering access to therapy anytime and anywhere, but incorrect responses can lead to a loss of interest from users.

Sarah M. Blackmore (2024) discusses the impact of artificial intelligence (AI) on migration processes and systems. She examines current examples of AI being used in immigration systems and discusses how companies and governments can prepare for its implementation, as well as the challenges and issues that may arise in the process. She provides examples, such as the iris scanner introduced at Dubai Airport in the United Arab Emirates to verify identity, which speeds up the passport control process while maintaining security measures. In Portugal, AI is used to verify the authenticity of documents submitted with online citizenship applications

Although the migration of Ukrainian scientists has been explored by several scholars, and the impact of AI on migrants and migration policies has been discussed, there is a lack of research specifically addressing the influence of AI on forced migrants, particularly Ukrainian scientists during the ongoing war with Russia.

Research Results. Due to Russia's aggression, a large number of Ukrainian scientists were compelled to leave their positions in the scientific community. Some chose to join the defense forces, while many others decided to migrate abroad, contributing to an estimated six million documented departures from the country. While it is difficult to determine exact numbers amidst the ongoing conflict, reports from the Council of Young Scientists under Ukraine's Ministry of Education and Science, as of April 4, 2022, indicated that between four and six thousand scientists had left Ukraine due to the invasion. Recent estimates suggest this number could reach 22,000, representing approximately a quarter of the country's researchers (The Future of Science in Ukraine, 2022). The forced displacement and emigration of Ukrainian scientists have had a devastating impact on the country's scientific community and research landscape. The loss of such a significant portion of talented individuals

threatens the continuity and future development of scientific activities in Ukraine. For many countries that welcome a significant number of Ukrainian migrants each year, having efficient entry processing systems, effective support for displaced individuals, and well-structured adaptation programs is crucial. The ability to integrate forced migrants into the host country plays a key role in ensuring both social stability and economic contributions. Current AI-driven initiatives build upon the trends of the past decade, leveraging big data management approaches to enhance migration policies, streamline administrative processes, and improve the overall experience of migrants and refugees. Additionally, AI solutions can directly support displaced scientists by facilitating employment matching, improving access to academic resources, and enabling professional networking.

Below, presents a table of AI applications that can simplify the lives of forced migrant scientists (Table 1). These solutions cover key areas such as automated language translation, research collaboration platforms, AI-driven job matching, digital credential verification, and funding recommendation systems. By leveraging these technologies, displaced scientists can better navigate their professional transitions, maintain research continuity, and integrate more effectively into new academic and professional environments.

Table 1.

AI Solutions for Supporting Displaced Scientists in Forced Migration

AI Application	Description
AI-Powered Talent Matching Platforms	Several established solutions offer valuable features for talent matching: Workable – AI-driven recruiting, automated resume screening, and candidate evaluation; HireVue – Video interviews with speech and facial analysis; LinkedIn Recruiter – AI-based candidate filtering; Pymetrics – Soft skills assessment through neuropsychological testing. By integrating these technologies, organizations can effectively match displaced scientists with job opportunities, research grants, and academic positions, ensuring that expertise is utilized where it is needed most.
Language Translation Tools	AI-powered translation services can assist displaced scientists in overcoming language barriers, ensuring clear and accessible communication in academic and professional settings. Tools like DeepL and other real-time translation technologies facilitate the translation of research papers, conference presentations, and institutional correspondence, helping scientists integrate more effectively into their new environments.

Research Collaboration Platforms	AI-powered networking tools can connect displaced scientists with international research institutions, facilitating collaboration and knowledge exchange. Currently, no dedicated platform exists for this purpose. However, existing technologies could serve as a foundation—for example, LinkedIn, which allows professionals to connect within similar fields, or ResearchGate, where researchers can find peers working on related topics. These platforms analyze researcher profiles and suggest potential collaborators based on shared academic interests.
AI-Powered Resettlement Optimization System	A solution like GeoMatch uses machine learning and predictive analytics to process migration data and determine the optimal relocation areas, based on historical data of successful integration. Developed in 2020, it analyzes refugee data and historical employment outcomes to recommend the best placement options. The tool is already in use in the U.S. and Switzerland, improving administrative processes and enhancing migrants' self-sufficiency. Through close collaboration with government agencies, GeoMatch adapts to different migration policies, with plans for expansion to additional countries in the future.
Grant and Funding Assistance	AI-powered systems can identify and recommend suitable grant and funding opportunities for displaced scientists by analyzing vast datasets from various research institutions. By processing large volumes of data, these tools optimize the application process and expand access to scientific resources. Granter.ai helps match and apply for the right grants, but it has a more commercial context, whereas Grantsfinder allows you to discover EU funding calls in an easier and faster way.
Psychological Support Systems	AI-based chatbots and digital mental health services provide emotional support, crisis intervention, and coping strategies tailored to the needs of scholars who have lost their jobs. These tools use natural language processing to detect emotional distress and provide appropriate recommendations. Among the popular AI platforms for psychological assistance today is ELIZA. The "Doctor" scenario of this chatbot successfully imitates the famous psychologist Carl Rogers. The chatbot for Ukrainians, "Friend. First Aid," created with the support of the Charité clinic, helps reduce stress levels with its recommendations. Wysa is an app that offers a chatbot therapist, numerous exercises to improve mental health, and even the ability to communicate via voice messages.
Legal and Immigration Guidance	AI applications can greatly assist Ukrainian scholars with Legal and Immigration Guidance. The Ministry of Foreign Affairs of Ukraine has introduced an AI spokesperson to enhance communication and provide consular information. Additionally, AI-driven chatbots are being developed by both government authorities and private sector service providers, such as migration agents and visa centers, to support individuals seeking to migrate for work, study, or family reasons. These chatbots can offer personalized advice, assist with visa applications, and guide users through legal requirements, providing 24/7 support and reducing waiting times.

The table includes not all applications, chatbots, and other AI solutions, as there are countless options available. The main point to highlight is the opportunities they offer for temporarily displaced Ukrainian scientists. Each of these applications is a small piece of a vast sea, where most Ukrainian researchers are seeking support. If we focus on this target group and allow them to benefit from AI advancements, it will

demonstrate the government's interest and the opportunities that have emerged for them, thanks to, rather than in spite of, these technologies.

The integration of AI into support mechanisms for displaced scientists enhances efficiency, accessibility, and accuracy in addressing their complex challenges. However, reliance on AI must be complemented by human oversight to ensure ethical considerations, fairness, and adaptability to individual circumstances.

Conclusions. AI can play a vital role in understanding, managing, and supporting the migration of Ukrainian scientists during the ongoing war. It can help by improving data collection, predicting trends, aiding in resource allocation, and providing logistical support, which would make it easier to address the challenges faced by displaced scientists and reduce the long-term impact on scientific progress. While AI today can mimic certain aspects of human thinking and intelligence, it still lacks the ability to effectively manage the large-scale relocation of displaced scientists. Relying solely on AI to determine the future of refugee scientists may lead to decisions that are inaccurate and unfair, as these situations require careful analysis, human empathy, and the consideration of many factors that AI alone cannot fully grasp.

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