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STRUCTURING "EDUCATION − MIGRATION − LABOUR MARKET" CHAIN

Purpose. This study aims at analysis of the research landscape with the current trends, gaps, and potential directions for future publications in education, migration, and labour markets in preventing "brain drain" in Ukraine during the war.

Methodology. The research method is based on analysis of chronological nature of educational, migration and labour markets and building geographical, interconnections maps and utilizing Scopus and Web of Science databases within VOSviewer software.

Findings. The comparison of subject areas demonstrated the interdisciplinary nature of the study, where "social sciences sector" (48.8 %), "economics, econometrics, and finance" (14.8 %) are leading in scientific literature. Four clusters and three clusters of scientific publications were determined in Scopus and Web of Science accordingly. The following trends were obtained: effect of migration on labour market outcome, economic opportunities of high-quality human capital, student professional development to avoid economic crisis were actively investigated by scientists, as well as crisis due to migration flow among young people at universities, positive effect of immigrants and connection with formal education. The highest number of relevant articles are in the United States, Germany, and the United Kingdom. The spatial analysis demonstrates intercontinental connection between researchers of six clusters (North American and Pacific countries, Countries of Northern Europe and the Middle East, Central European countries, island, and peninsular countries of the European contingent and the Gulf of Mexico, Central and Western European countries, Western European countries, and Intercontinental cluster). Ukrainian authors regularly collaborate with scientists from Poland, the Netherlands, France, Switzerland, and the United States.

Originality. For the first time, a comprehensive analysis covering all three aspects (education, migration and the labor market) was conducted in order to study the interrelationships and mutual influence of these sectors of the economy. The analysis was carried out on geographical-chronological maps built by the authors based on the Scopus and Web of Science databases.

Practical values. The results can be utilized to develop new strategies, policies, and legislative initiatives to ensure improve economical and organizational management of education at universities in a country.

Keywords: *higher education, emigration, labour market, VosViewer, science mapping*

Introduction. The importance of educational attainment is rapidly increased, both within the labour market context and for individuals and society at large. Statistics from the OECD group for 2021 indicate that trend of attainment in education are present with 47 % of younger people of 25- to 34-year-olds having obtained a tertiary qualification in the OECD countries, where the highest degree is a bachelor's qualification [1]. Moreover, in 2023, the European Union set a significant objective for the year in the realm of education: to facilitate change and enhance qualifications, enabling individuals to attain the necessary skills for meaningful employment in high-quality positions [2]. To achieve this goal, the role of universities in creation of an effective university model that ensures the quality of education and technology transfer is important [3]. However, Ukraine has been grappling with the noteworthy phenomenon of skilled professional emigration [4]. This phenomenon affects the country's economic advancement and overall progress [5, 6]. In early April 2023, 171 representatives of Ukrainian universities expressed concerns about higher education in the longer term and the problem of brain drain because of aggression, significant destruction and forced migration [7]. Additionally, the existing gap between education and the labor market can result in migration where individuals may possess skills that are undervalued or not in demand within the labor market of the host country, often leading to underemployment or unemployment. In contemporary economic development, the synergy between market-oriented objectives, entrepreneurship, and education has become increasingly intertwined. Constructing a meticulously crafted economic strategy that holistically encompasses education, migration, and the labor market can substantially contribute to a nation's development and well-being. That is why the issue of a direct correlation between education, migration flows and economic growth remains an ongoing subject of research and deliberation. As we navigate the intricate interplay between education, migration, and the labour market, it is imperative to recognize the complex dynamics at play and strive for comprehensive solutions that foster not only individual prosperity but also societal progress and economic advancement.

Literature review. The literature analysis reveals a coherent examination of the intricate interplay between higher education institutions, migration dynamics, and labour market considerations. The recognition of education substantial positive impact on local economies serves as an established model. The relevance of articles centred around education and migration has consistently maintained its significance.

Orduna-Malea E., Aytac S., and Tran C. (2019) conducted a comprehensive study evaluating the retroactive growth of research-focused universities via bibliographic analysis of Scopus, Web of Science, and Google Scholar [8]. The study explored the correlation of productivity as an effective tool for calculating institutional productivity in the national context [9].

Nguyen T. delved into the concerns of scientists regarding higher education, particularly in the years 2015−2019, using VosViewer and Citespaces tools [10]. This study unveiled a substantial body of knowledge concerning the role of higher education in national development, including its impact on human resources, economic growth, and other social aspects vital for addressing the challenges posed by the Fourth Industrial Revolution. Meanwhile Vasilyeva T. [11] assesses this impact from side of bifurcation transformations in the economy.

Investigations probing the relationship between education and employment emerge prominently. Liu S. analysed student employment within the context of popularized higher education and quality career guidance [12]. The findings emphasizing graduate employability and the necessity for strategies that enhance successful graduate employment in the labour market [13–15]. Ralph A. & Arora A. (2022) highlighted the problematic of youth unemployment for economic development, while also acknowledging trends linking education and employment [16]. Dinh N., Dinh H., Pham H. explored the antecedents of employability and the role of work-integrated learning [17]. Additionally, the positive effects stemming from interactions between students' skills during internships and employability were demonstrated in research studies, utilizing bibliometric analysis and publication data from Web of Science and Scopus to be defined by investigation timeframe [18–20].

The relationships between of education, migration, and the labour market garnered attention in recent years. The authors also examined the influence of education on a migration flow and a labour market, indicating graduation serves as an indicator in institutional and government policies, incentivizing integration into host labour market countries [21–23].

Unsolved aspects of the problem. Despite the recent surge in interest in the education-migration-labour market nexus, a comprehensive bibliometric analysis encompassing all three facets remains essential due to their interconnected and mutually influential nature. Such an analysis could be effectively executed using Scopus, alongside validation through Web of Science datasets.

The purpose of the paper is to investigation the scientific landscape of the "education − migration − labour market" chain for improvement of economical and organizational management of education system patterns.

The object of the research is to develop a network of keywords "education", "migration" and "labour market", interconnections, chronological and geographical maps within the Scopus and Web of Science database.

Methodology. The methodological foundation is based on quantitative and qualitative data analysis of scientific publications with the in-built tools of Scopus by Elsevier (SciVal) and Web of Science by Clarivate Analytics, including VOSviewer 1.6.19 software. The study explored publishing patterns throughout 1977 to 2023 (Scopus) and 1992 to 2023 (Web of Science). A group of scientific studies was selected based on the keywords such as "education", "migration" and "bour market" which were used to provide a comprehensive range of scholarly relevant articles and publications. Each search query within the bibliometric analysis was formulated using the logical operator AND. The results of quantitative and qualitative analyses are presented as graphics and bibliometric maps ratio publications by years, subject areas, field of studies and author countries.

Results. This study is based on the construction of a complete and dynamic landscape about the mutual influence and interdependence of a higher educational institution with migration flows and employment, in particular, the impact of human capital on the state economy.

The bibliographic analysis in the Scopus database disclosed that 2,544,390 articles were found under the keyword "education", 838,253 scientific documents were found under the keyword "migration", and 76,668 scientific publications were found under the keyword "labour market". This demonstrates high trends in "education − migration − labour market" chain. For a more reliable results, the quantitative analysis was arranged for the number of articles for the relevant keywords (Fig. 1).

In Fig. 1, the first mentions of education in relation with migration and labour market appeared in 1977, with the growth began in 1993, and the increasing trends in the number of scientific works in this field continue in current years. The number of articles analysis showed amount of 1,031 docu-
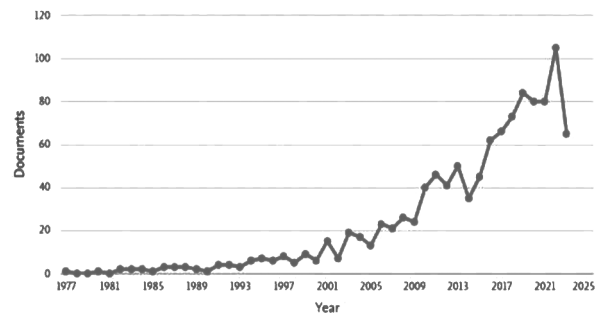

Fig. 1. The trend of the number of scientific publications by keywords "education" AND "migration" AND "labour market" by year

ments during 1977 and 8 months 2023 years in total. According to Scopus database, the three key peaks of publications occur in 2019 (84 articles, 8 % of all publications) and 2022 (105 articles, 9 %). The peak of publications in 2019 is caused by the period of Covid-19, which led to a forced increase in the distance mode in education and at the workplace, as well as a decrease in migration flows, which directly affected the investigated chain.

In addition, "higher education" category was analysed in combination of categories "migration" and "labour market" for the number of publications (Figs. 2 and 3).

According to the Scopus database, a total of 1,720 documents were identified spanning the period from 1977 to the first eight months of 2023 (Fig 2). A significant increase in publication after 2014 was observed. Furthermore, a rapid surge in the number of scientific works was observed in specific years, notably in 2014 (90 articles, representing a remarkable 27 % increase compared to the previous year). Similarly, significant spikes were evident in 2020 (147 articles, accounting for a noteworthy 22 % growth) and in 2022 (203 articles, reflecting a substantial 12 % increment).

According to the Scopus database, a total of 3,728 documents were identified spanning the period from 1977 to the first eight months of 2023. Notably, a rapid surge in the num-
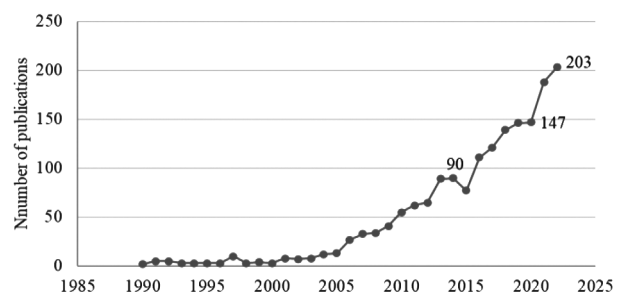

Fig. 2. The trend of the number of scientific works by the keyword "higher education" AND "migration" during 1990−2022
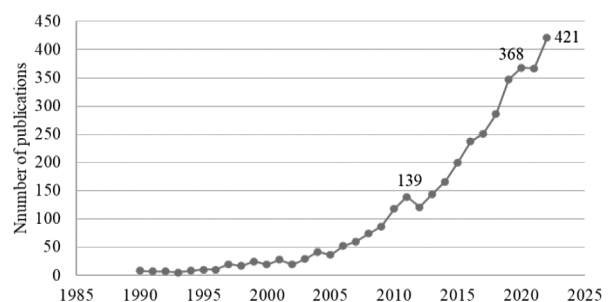

Fig. 3. The trend of the number of scientific works by the keyword "higher education" AND "labour market" during 1990−2022

ber of scientific works was observed in specific years, notably in 2014 (90 articles, representing a remarkable 27 % increase compared to the previous year). Similarly, significant spikes were evident in 2020 (147 articles, accounting for a noteworthy 22 % growth) and in 2022 (203 articles, reflecting a substantial 12 % increment). A comparison of the analysis of Figs. 2 and 3 shows that in the studies, more attention was paid to the context of employment (higher education and the labour market) than migration in connection with education.

For the analysis of scientific research within the framework of the "education-migration-labour market" chain, a study was conducted on the Scopus database using the keywords presented in Table 1. The study was divided into 2 vectors, as the results differ by keyword and combinations. The most popular topics in the investigated chain are "education", including "higher education", combinations of "education" "migration" with" labour market" each. "Educational migration" and "labour market" keywords pair is less published among research studies.

The sector analysis of field of study to first study of quality analysis of "education – migration – labour market" chain to identify investigated field of studies.

According to analysis by subject areas (Figs. 4 and 5), a lot of research about connection between education, migration and labour markets is devoted to literacy social and economic sciences. The initial data from Scopus and Web of Science showed that the topic of higher education, migration, and labour market chain focused majority on the Social Sciences (48.8 %) and Demography (17 %) relatively, which indicates a one-sided attention to this issue in the academic literature on higher education, migration, and labour market. Based on Scopus database, 14.9 % of publications are in Economics, Econometrics and Finance (258 articles). In the field of Business, Management and Accounting, there were 111 scientific papers, which stand for 6.4 % in sources of Web of Science.

In Fig. 7, there is arranged the document counts across the spectrum of 15 leading publisher countries. A meticulous examination of the Scopus database reveals that the foremost contributors in terms of published output are rooted in a global array of locations. According to Scopus database, the highest among of published countries are in the United States (183 papers, 16.4 %), Germany (122 documents, 10.9 %) and the United Kingdom (108 articles, 9.7 %). Canada takes 10th place with 48 documents per investigated period. Poland closes the top fifteen (23 papers, 2.0 %). The similar tendency is evidenced for Web of Science database with some differences. Switzerland is present only in top 15 Scopus publishers and Romania is present only in Web of Science top 15 ranking.

In Figs. 8 and 9, a high density of research connections is observed in two groups of clusters of migration and education, which are connected by labour relations. The effect of migration is one of the most relevant topics in the research analysis.
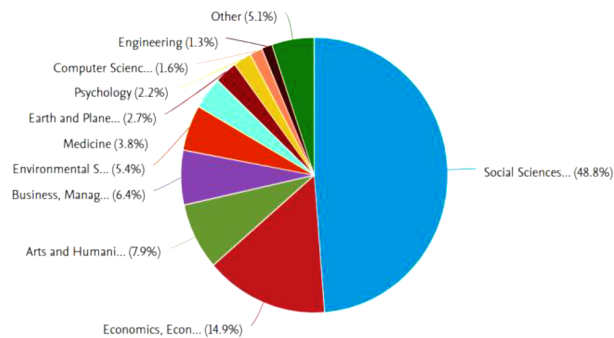

Fig. 4. Subject areas of publication on the "education − migration − labour market" chain in Scopus
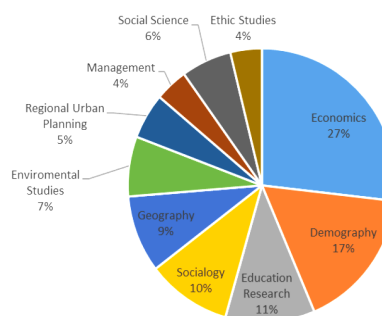

Fig. 5. Subject areas of publication on the "education − migration − labour market" chain in Web of Science

For example, it is defined that migration effect is more significant than university effect on manufacturing in local labour markets (Faggian, A., 2005). The connection of student development at universities to form high quality human capital, crisis due to migration flow among young people at universities, positive effect of immigrants and connection with formal education were dynamically investigated by scientists.

According to Fig. 10, the following four clusters in Scopus dataset are identified: migration of labour force due to financial reasons (green), academic mobility for increasing qualification and refugees among student (red), teaching technologies (yellow) and management for innovation (blue).

The Web of Science resources are presented in Fig. 11, the three main groups were discovered: effect of wage on labour market and migration process (red), immigration of skilled workers for economic integration (blue), and student development for employment.

Key topics of publications are preventing "brain drain", the problem of employment of graduates, activation of migra-

Number of scientific publications by keywords in Scopus and Web of Science

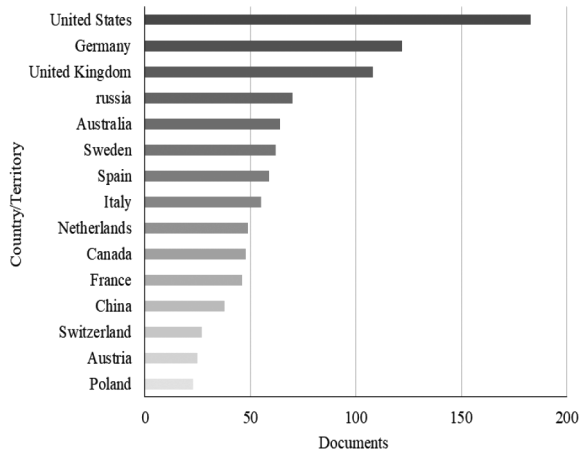| Keyword combination	Number of publications, Scopus/WOS	Key word combination	Number of publications, Scopus/WOS
"Education"	2,544,390/1,353,745	"Education" AND "Migration" AND "Labour Market"	1,116/1,194
"Higher Education"	196,039/156,858	"Education" AND "Labour Migration"	834/440
"Education" AND "Migration"	18,830/11,722	"University" AND "Migration" AND "Employment"	540/263
"Education" AND "Labour Market"	16,531/15,065	"University" AND «Migration" AND "Labour Market"	353/248
"Higher Education" AND "Labour Market"	4,051/4,044	"Higher Education" AND "Migration" AND "Labour Market"	178/214
"Higher Education" AND "Migration"	1,866/1,664	"Educational Migration" AND "Labour Market"	17/16

Fig. 6. Top 15 countries by the number of articles on "education − migration − labour market" chain by country based on Scopus database
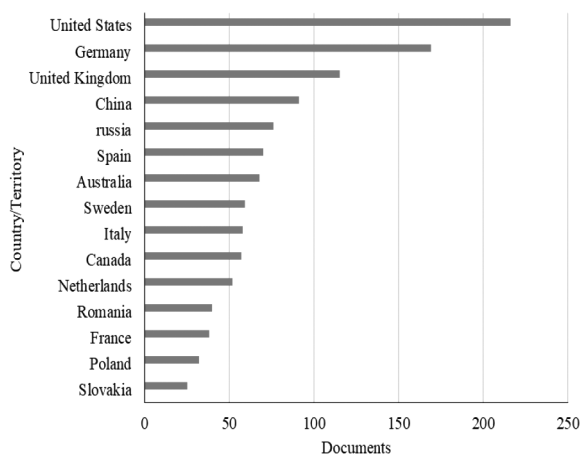

Fig. 7. Top 15 countries by the number of articles on "education − migration − labour market" chain by country based on Web of Science database

tion processes, improvement of the ability of foreign students to integrate into the labour market of the host country and promotion of a favourable environment for families of foreign students, more than graduation, will lead to higher rates of stay of foreign students.

According to the Scopus database, the results of the evolutionary and temporal analysis of scientific research demonstrate distinct shifts in focus over time in combating education, migration, and labour flows (Fig. 12). Before 2017,
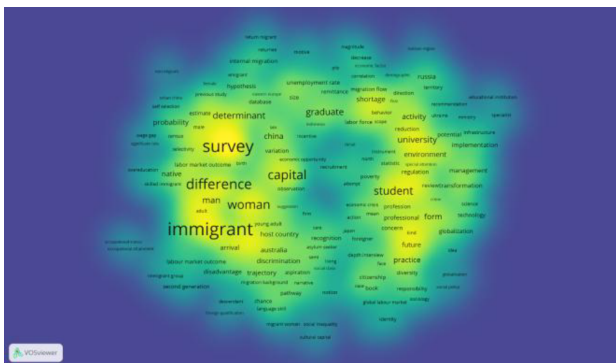

Fig. 8. Map of interconnections between "education", "migration" and "labour market" concepts with other concepts by title and abstract based on Scopus database
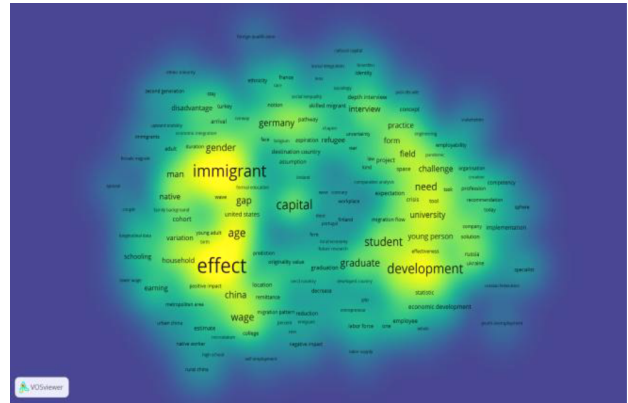

Fig. 9. Map of interconnections between "education", "migration" and "labour market" concepts with other concepts by title and abstract based on Web of Science database
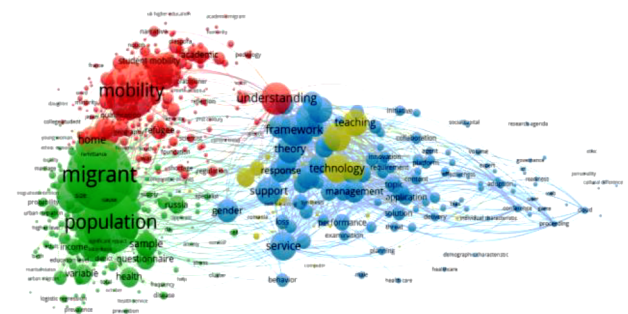

Fig. 10. Network map between the keywords of articles published on the "education − migration − labour market" chain by title and abstract (Scopus)
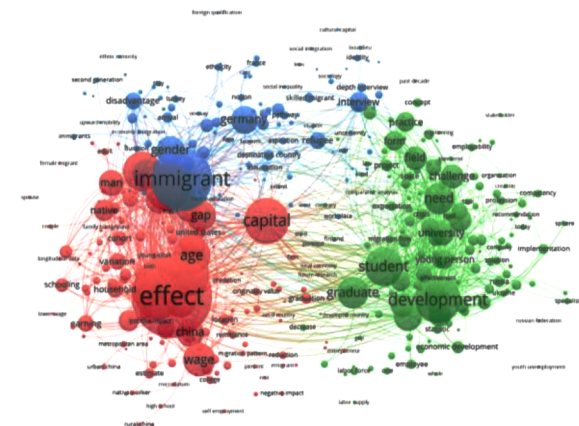

Fig. 11. Network map between the keywords of articles published on the "education − migration − labour market" chain by title and abstract (Web of Science)

scholars primarily emphasized the pattern of economic development. From 2017 to 2018, attention shifted toward human capital for economic development, the impact of international migration on economic growth. Since 2019 and continuing to the present, researchers have been primarily engaged in exploring an importance of universities and international students' methods and countermeasures against migration and labour market.

The chronological analysis in Fig. 13 as well as the evolutionary and temporal analysis of scientific research showed that before 2014, scholars focused on the employment after graduation, especially in European international students; after 2018 − on the impact of young people's immigration on
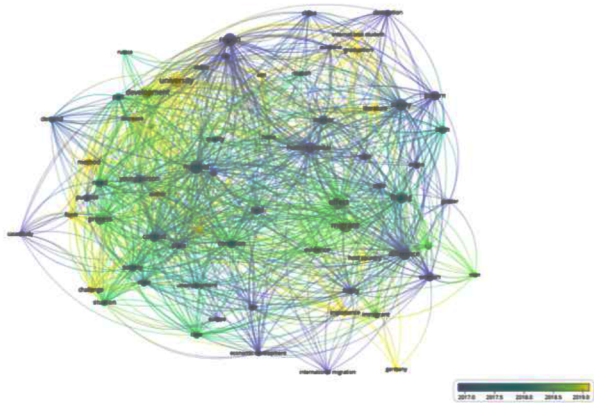
Fig. 12. Chronological map of published articles on the "higher education − migration − labour market" chain by title and abstract (Scopus)
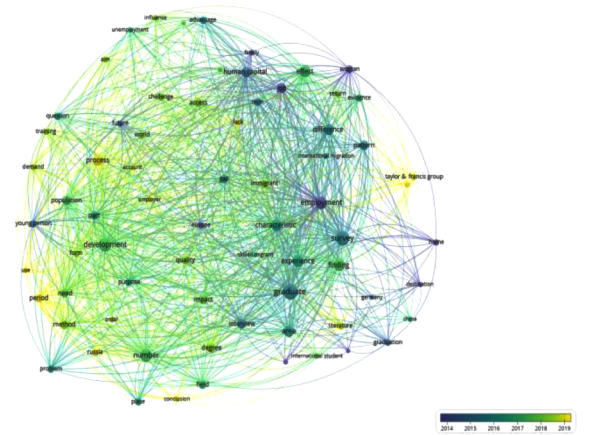

Fig. 13. Chronological map of published articles on the "higher education − migration − labour market" chain by title and abstract (Web of Science)

economic growth; from 2019 to the present, on the search for methods and tools to find ways of avoiding lack of employees.

To provide more relevant structuration of the chain, the visualization of collaboration networks provides a visual representation between countries we developed. The results of this analysis presented in Figs. 14−18.

The spectral analysis demonstrates categorization, which will help to distinguish and visualize the distribution of countries according to their contribution to the study on the "education chain − migration − labour market" problems more effectively (Fig. 14):

1. North American and Pacific countries: the USA, Canada, Japan, Australia, Singapore, Vietnam, Taiwan (blue).
2. Countries of Northern Europe and the Middle East: Sweden, Israel, Finland (orange).

3. Central European countries, island, and peninsular countries of the European contingent and the Gulf of Mexico: Great Britain, Portugal, the Netherlands, Austria, Hungary, Slovakia, Denmark, Mexico (red).
4. Central and Western European countries: Italy, France, Norway, the Czech Republic, Poland, Switzerland, Greece (green).
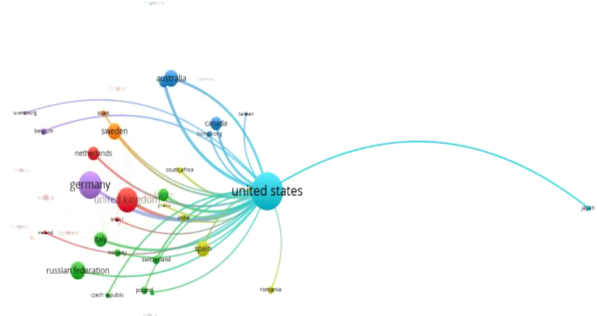5. Western European countries: Germany, Belgium, Luxembourg (purple).

Fig. 15. Visualization map of co-authorship of scientists in "education − migration − labour market" chain in the United States (criterion − country indicated in the affiliation)

Fig. 16. Visualization map of co-authorship of scientists in "education − migration − labour market" chain in Germany (criterion − country indicated in the affiliation)

Fig. 14. Visualization geographical map of co-authorship of scientists in "education − migration − labour market" chain (criterion − country indicated in the affiliation)

Fig. 17. Visualization map of co-authorship of scientists in "education − migration − labour market" chain in the United Kingdom (criterion − country indicated in the affiliation)
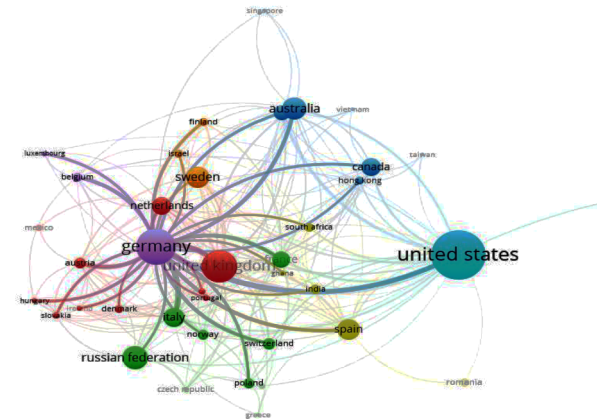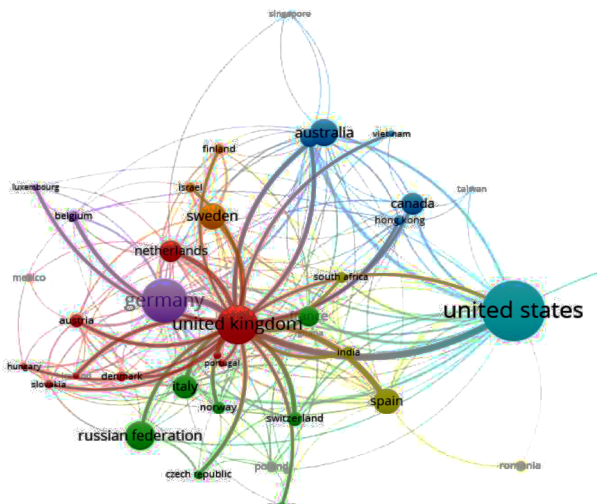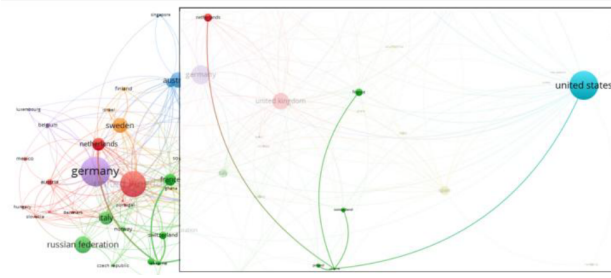
Fig. 18. Visualization map of co-authorship of scientists in "education − migration − labour market" chain in Ukraine (criterion − country indicated in the affiliation)

6. Intercontinental cluster: Spain, Romania, India, South Africa (green).

The group of countries "Japan and the USA" is an alliance of technologically advanced and influential countries with different cultural heritages, but a mutual space for the exchange of knowledge, innovation, and research, both education and work opportunities for citizens of both countries.

Most of the publications related to research in the fields of educational, migration and labour relations were published in the publications of the USA, Germany, and Great Britain, which are leader recipient-countries of immigrants according to OECD 2019 (1.03 million, 0.61 million and 0.35 million, respectively) [2, 24]. In 2021, there were over 45 million people in the US (estimates as a 13.6 % of the US population) according to the Census. In the United Kingdom, there were 1.2 million people in 2022 according to Government website of the UK.

The interconnectedness of countries for the United States in Scopus dataset is shown in Fig. 15. Clusters within the network highlight collaborative groups focusing on skilled migrants in the context of "education − migration − labour market" chain. According to structuration of author countries publication analysis, the co-author countries of the United States are Australia, Canada, German, Italy, Canada, Japan, and Sweden. These strategic collaborations underscore the global nature of research pursuits and emphasize the collective endeavour to comprehensively explore and address the intricate relationships that underlie the nexus of education, migration, and the labour market.

Fig. 16 offers a visual representation that vividly portrays the intricate interconnections between countries within the Scopus dataset, specifically pertaining to Germany with the United States, Australia, Italy, Canada, Poland, Switzerland, Sweden, the Netherlands, and Spain in collaboration. Within this network, distinct clusters emerge, each illuminating collaborative groups that centre their efforts on the dynamic discourse surrounding skilled migration within the broader framework of the "education − migration − labour market" chain.

The visualization maps of co-author countries associated with the United Kingdom has revealed a constellation of collaborative relationships that are driving knowledge exchange and research synergy in the "education − migration − labour market" chain within the United Kingdom, which has yielded illuminating insights (Fig. 17). Remarkably, the co-authors of the United Kingdom exhibit a dynamic connection with a range of countries. Notable partners in this collaborative network include the United States, Australia, Canada, Sweden, the Netherlands, and Spain. These intercontinental ties underscore the transnational nature of research pursuits, highlighting how scientists from diverse corners of the world are collectively contributing to the discourse surrounding the intricate interplay of education, migration, and the labour market within the context of the United Kingdom.

The visualization map is presented in Fig. 18, showcasing the co-authorship network among scientists engaged in the "education − migration − labour market" domain within Ukraine, where the criterion of affiliation country was considered, yielded intriguing findings. The results of this analysis unveil robust scientific connections that Ukraine maintains with several countries such as Poland, the Netherlands, France, Switzerland, and the United States. These connections are indicative of collaborative efforts and knowledge exchange between researchers across borders, underscoring the global nature of research endeavours addressing the intricate interplay of education, migration, and the labour market.

Conclusions. The purpose of the article was to evaluate the literature on the function of in the "education − migration − labour market" chain through a bibliometric analysis and extract significant insights using the Scopus and Web of Science dataset. The analysis allowed identifying key concepts and themes in the existing literature, providing valuable insights for higher education authorities and researchers in this field. The analysis revealed that the developing relationships of education, migration, and labour markets are crucial in economics growth. The identification of the interconnection between key concepts "education," "migration," and "labour market" resulting in the identification of four clusters (Scopus)of scientific publications and three clusters (WOS) clusters related to the researched topic. Through bibliometric analysis, the study identified several key concepts that emerged as significant in the existing literature. The identified concepts include the student development at universities to form high quality human capital, crisis due to migration flow among young people at universities, positive effect of immigrants and connection with formal education were dynamically investigated by scientists. These concepts represent critical aspects of the chain and reflect the focus of researchers and scholars in this field.

The comparison of subject areas demonstrated a predominance of "social science" and "economics, econometrics, and finance", which is logical considering the social-economic nature of problems in this chain. The researcher results revealed that leading countries are US, Germany, and UK, where the number of labour and academic immigrants is the highest. The perspectives are for further research to develop effective strategies and policies to combat education and labour market with re-emigration approach. The results demonstrate necessity to encourage scholarly authors to increase investigating interconnection between education, migration, and labour market as one symbiosis.

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Структуризація ланцюга "освіта — міграція — ринок праці"

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Мета. Це дослідження спрямоване на аналіз дослідницького середовища з поточними тенденціями, прогалинами й потенційними напрямами для майбутніх публікацій про міграцію та ринки праці в Україні під час війни.

Методика. Метод дослідження базується на аналізі хронологічної природи ринків освіти, міграції та праці, побудові географічних карт взаємозв'язків і використанні баз даних Scopus і Web of Science у програмному забезпеченні VOSviewer.

Результати. Порівняння предметних галузей продемонструвало міждисциплінарний характер дослідження, де в науковій літературі лідирують «Соціальні наук» (48,8 %), «Економіка, економетрика та фінанси» (14,8 %). У Scopus та Web of Science визначені чотири кластери та три кластери наукових публікацій відповідно. Отримані такі тенденції в дослідженнях: вплив міграції на результати функціонування ринку праці, економічні можливості якісного людського капіталу, професійний розвиток студентів для уникнення економічної кризи активно досліджувалися науковцями, а також — криза через міграційний потік серед молоді в університетах, позитивний вплив іммігрантів і зв'язок із формальною освітою. Найбільше відповідних статей у США, Німеччині й Великобританії. Просторовий аналіз демонструє міжконтинентальний зв'язок між дослідниками шести кластерів (країни Північної Америки та Тихого океану, країни Північної Європи та Близького Сходу, країни Центральної Європи, острівні й півострівні країни європейського континенту та Мексиканської затоки, країни Центральної та Західної Європи, країни Західної Європи й міжконтинентальний кластер). Українські автори регулярно співпрацюють з ученими Польщі, Нідерландів, Франції, Швейцарії та США.

Наукова новизна. Уперше був проведений комплексний аналіз, що охоплює всі три аспекти досліджень (освіту, міграцію та ринок праці), з метою вивчення взаємозв'язків і взаємовпливу даних секторів економіки. Аналіз здійснювався на побудованих авторами географічно-хронологічних картах на основі баз даних Scopus та Web of Science.

Практична значимість. Результати можуть бути використані для розробки нових стратегій, політики й законодавчих ініціатив для забезпечення покращення економічного та організаційного управління освітою в університетах.

Ключові слова: *вища освіта, еміграція, ринок праці, VosViewer, наукове картографування*