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ORIGINAL ARTICLE

Artificial intelligence and knowledge research networks between Central Asia and the European Union: A bibliometric study using OpenAlex (2000-2025)

Alyona Dmitriyeva[1], Zhaslan Nurbayev[1,*], Ruslan Abdullin[2], Yerbolat Sergazin[1], Balaussa Seilkhan[1]

[1] L. N. Gumilyov Eurasian National University, Kazakhstan.
[2] Kostanai Social and Technical University named after Academician Zulkarnay Aldamzhar, Kazakhstan.
* Corresponding author
Email: zhaslannurbayev@gmail.com. **ORCID:** 0000-0003-4862-6152 (ORCID).

ABSTRACT

Objective. We examined the development of scientific collaboration in artificial intelligence (AI) between Central Asian countries and the European Union (EU) across three time periods (2000-2009, 2010-2016, and 2017-2024).

Design/Methodology/Approach. We conducted a bibliometric analysis using OpenAlex as the data source. We developed the search strategy to find scientific works published by authors affiliated with institutions in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) in the field of AI.

Results/Discussion. During the first period (2000-2009), the scientific collaboration network in the AI field shows an emerging structure. In the second period (2010-2016), the network experienced a significant expansion in both the number of participants and the density of connections. Scientific collaboration became more organized and widespread, with increased diversity of European countries collaborating with those in Central Asia. During the period 2017-2024, the collaboration network reached an unprecedented level of maturity and diversification. The structure of the network exhibited a substantial rise in the number of links and overall density, along with greater interconnectedness between European and Central Asian countries.

Conclusions. The analysis shows that AI collaboration between the EU and Central Asia has grown from early connections to a broader, more diverse network, with a steady rise in country involvement and relationship density. Kazakhstan remains a key and steady regional bridge to Europe, while Uzbekistan and Tajikistan have experienced consistent growth in their integration.

Keywords: artificial intelligence; European Union; Central Asia; country collaboration; bibliometric analysis; digital transformation.

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1. INTRODUCTION

Artificial intelligence (AI) is deeply embedded in our daily lives. It is increasingly used by citizens for tasks ranging from the simplest to the most complex. For this reason, governments are implementing projects, agendas, and regulations with a view not only to establishing legal frameworks but also to making use of AI to improve the quality of life of citizens.

In the case of Central Asian countries, recent analyses of their digitization efforts reveal that, although all nations in the region are implementing strategies to promote a digital economy and digital government as routes to sustainable growth, common structural challenges persist. These include inadequate legislative frameworks for digital security, limited internet coverage and speed, a shortage of skilled professionals, low levels of digital literacy, and insufficient regional collaboration. Moreover, the pace of digital transformation varies: while Kazakhstan, Uzbekistan, and Kyrgyzstan advance more quickly, Turkmenistan and Tajikistan are still in the early stages. The lack of effective policies to reduce the digital divide, enhance human capital, and boost investment in infrastructure and AI could worsen inequalities and hinder opportunities for inclusive economic and social development in the region (Kurmangali, Yeraliyeva & Beimisheva, 2024).

Younas (2020) offers a relevant overview of the progress of AI project implementation in these Central Asian countries. For example, in Kazakhstan, the modernization plan launched in 2017 included AI as a key component, encouraging its adoption alongside automation, robotics, and big data. In Tajikistan, the non-profit organization TajRupt established *TajRupt. AI,* the country's first AI research center, with programs in education, applied research, and technology entrepreneurship. Although Turkmenistan does not have a dedicated AI policy, it has participated in international forums and has an advanced intellectual property system, along with private sector-led projects. Kyrgyzstan has developed the Taza Koom 2040 initiative and the "Digital Kyrgyzstan 2019-2023" strategy, complemented by events like the "AI for Government" hackathon and international digital transformation conferences. Finally, in Uzbekistan, the 2018 Presidential Decree set the stage for integrating AI, blockchain, and supercomputing, with a recent draft of a national AI strategy (2021-2022) proposing a national research center and enhanced STEM education.

The fact that these countries have initiatives that are incipient, under implementation, or perhaps in the consolidation stage indirectly shows that the role of research is essential. It is not only a matter of producing local scientific literature on the subject, but also of establishing collaborative partnerships to attract experiences from other contexts and promote regional and local innovation. According to a study by Dwivedi & Elluri (2024), recent research on generative AI shows that, although this technology is still in its infancy, its applications have aroused considerable academic, media, and political interest. These authors identified two major themes in scientific production over the last decade: technical advances and developments in generative AI systems, and their applications in image processing, pattern recognition, and computer vision, with emerging topics such as ChatGPT, large-scale language models, and their use in health and education, as well as explorations in geosciences, remote sensing, the Internet of Things, and cybersecurity.

Another significant finding was from Singh *et al.* (2024), who conducted a bibliometric study on AI applied to the Sustainable Development Goals (AI4SDG). These authors identified the United States, Western Europe, China, Japan, Australia, and India as the most active regions and countries. The analysis of country collaboration networks showed that the United States, the United Kingdom, and China form the closest core of cooperation, followed by strong links between the US and Canada, the UK and Germany, and Australia and China. They also observed that most European countries maintain close collaborative ties with each other in this field, reflecting both geographical proximity and thematic affinity in knowledge and technology transfer.

These results resemble those obtained by Gao *et al.* (2021), who, after mapping scientific collaboration in AI from 2008 to 2018, found that China, the United States, the United Kingdom, and Australia play central roles in the co-authorship network, with the China-United States partnership being the most prominent. The United States collaborates closely with several key partners, including the United Kingdom, Singapore, Australia, Germany, and Canada. This study revealed clear partner preferences: India, France, Germany, Italy, and South Korea tend to work with the United States, while the United Kingdom, Australia, Canada, Singapore, Saudi Arabia, and Japan have more co-authorship ties with China, reflecting different strategic alliances in global AI research production.

The bibliometric study of AI publications indexed in SCI-Expanded from 1991 to 2018, which reviewed 13,099 articles from 119 countries, found that 80% represented national output and 20% involved international collaborations. The United States led in both production and citation metrics, followed by China. The United Kingdom ranked second in international collaboration and average citations, while China experienced rapid growth during the last three years of the studied period. Among the countries showing the most recent momentum, India and Iran, despite ranking lower globally, rose to fourth and fifth place respectively in terms of annual publication volume in 2018. This indicates a geographical expansion of AI research toward emerging economies.

Meanwhile, the analysis of scientific collaboration networks in AI conducted by Hu, Wang & Deng (2020) showed that the United States, China, the United Kingdom, and Germany hold central roles, with particularly strong links between the United States and China. There are also notable collaborations between the United States and the United Kingdom, as well as between China and Germany. Most European countries frequently connect with each other, while Asian nations like Japan, South Korea, and Singapore tend to cooperate more with specific partners in Europe and North America. These findings indicate that, although AI research is global, international collaboration mainly occurs among a small group of countries with high capacity for producing and sharing technological knowledge.

Using bibliometric methods, which are ideal for describing research patterns based on scientific literature, many studies have examined AI research across various fields and sectors such as anesthesiology (Xie *et al.,* 2024), entrepreneurship (Siddiqui, Mumtaz, & Ahmad, 2024), economics (Jrad, 2023), finance (Goodell *et al.,* 2021; Bahoo *et al.,* 2024), medicine (Frasca *et al.,* 2024), digital marketing (Nalbant & Aydin, 2025), aviation (Lopes, Aparicio & Neves, 2025), neurosurgery (El-Hajj *et al.,* 2023), agriculture (Bhagat, Naz, & Magda, 2022), dentistry (Xie *et al.,* 2024), and the maritime industry (Munim *et al.,* 2020), among others. However, in this article, we analyze the evolution of scientific collaboration in AI between Central Asian countries and those of the European Union (EU) across three time periods (2000-2009, 2010-2016, and 2017-2024). Through this analysis, we will identify patterns, key players, and changes in these collaboration networks. Along these lines, we will attempt to answer the following research questions:

1. How has scientific production in AI in Central Asian countries evolved in collaboration with EU countries over the three periods analyzed?
2. Which countries occupy central positions in co-authorship networks, and how has their relevance varied between periods?
3. What changes can be observed in the density and structure of collaboration networks between the EU and Central Asia in the field of AI?

2. METHODOLOGY

We performed a bibliometric analysis focused on scientific collaboration networks. The goal was to explore how interactions between the EU and Central Asian countries in the field of AI have changed over time. To collect and analyze data, we used the open database OpenAlex, which provides extensive coverage of scientific publications and allows retrieval of metadata for bibliometric studies.

We developed the search strategy to identify scientific works published by authors affiliated with institutions in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan) in the field of AI. To do this, we used the subfield identifier *subfields/1702 (Artificial Intelligence)* and filtered the documents by type. We only included articles, book chapters, and reviews to focus on the most significant academic contributions. Regarding the timeframe, we divided the analysis into three periods, which allowed us to observe structural changes in collaboration over more than two decades: period 1 (2000-2009), period 2 (2010-2016), and period 3 (2017-2024).

Each query to the OpenAlex API was formulated independently for each period, incorporating filters for country, year range, and document type. The complete data retrieved was then processed to include all relevant nodes and links in the network analysis. Once we extracted the metadata from the publications, we identified co-authorship relationships at the country level, considering as a collaborative link the joint presence of at least one author from a Central Asian country and one from an EU country in the same publication. The information from these interactions was structured in a table format of edges and nodes, which served as input for the construction and analysis of the networks.

We conducted visualization and analysis of the collaboration network using Gephi. In this software, we utilized network analysis metrics such as *degree* (number of direct connections per node), *weighted degree* (intensity of connections based on collaborations), *PageRank* (relevance of a node based on the importance of its connections), and *betweenness centrality* (the ability of a node to serve as an intermediary in the network). These metrics helped us identify not only the density and centrality of countries but also their relative role in overall network connectivity and how their influence evolved over time. The data analysis concentrated on highlighting EU-Central Asia interactions, excluding links with countries from other regions for comparative purposes.

3. RESULTS

3.1. Central Asia-EU scientific collaboration: first period (2000-2009)

During the first period analyzed (2000-2009), the scientific collaboration network in AI shows an initial, still developing structure, with sparsely connected nodes and a centralized distribution in a few countries that serve as collaboration hubs (Figure 1). Within the data set analyzed, only eight EU countries are identified (Bulgaria, the Czech Republic, Finland, France, Germany, Greece, Italy, and Poland) along with five Central Asian countries (Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan).

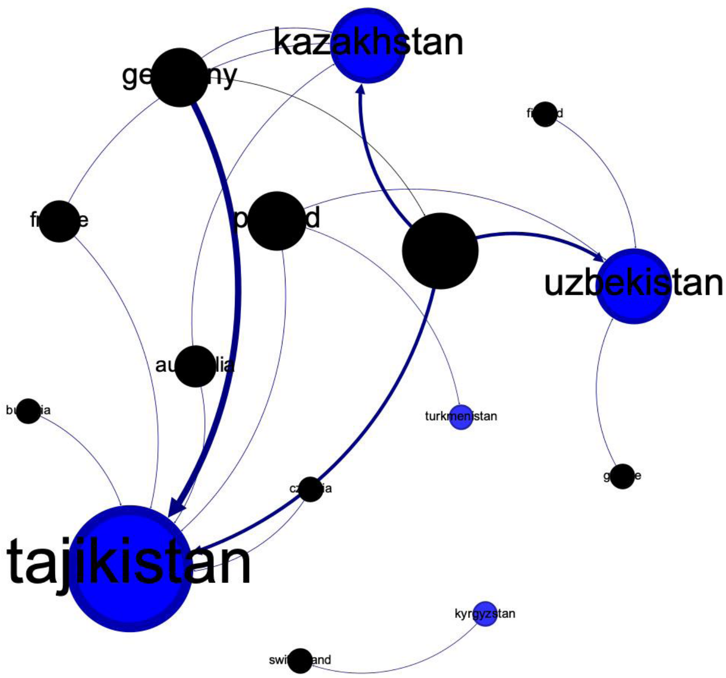

Figure 1. Central Asia-EU scientific collaboration network during the first period (2000-2009).

The level of collaboration between countries in both regions was limited at this stage, reflecting the uneven development of scientific capabilities and the weak institutionalization of bilateral or multilateral mechanisms for scientific cooperation in AI. Germany, France, and Italy served as the main sources of collaboration (outdegree ≥ 2), acting as active nodes that established publication links with various countries, including some in Central Asia. Meanwhile, Central Asian countries mainly played a receptive or peripheral role, with no nodes exhibiting prominent centrality and very low outdegree and weighted degree values. Kazakhstan was the Central Asian country with the highest relative involvement in the network, although it still had limited connections and lacked significant betweenness centrality indicators. Nevertheless, its presence during this period laid the groundwork for future growth in the coming decades. Additionally, it was observed that, despite the overall low clustering, some European countries formed links with more than one Central Asian country simultaneously.

In terms of prestige metrics like PageRank, EU countries led the network, highlighting their central role in scientific collaboration. No Central Asian countries showed relevant indicators in these metrics during this period, emphasizing their marginal role in this early stage of the collaboration network.

3.2. Central Asia-EU scientific collaboration: Second period (2010-2016)

During the second period (2010-2016), the scientific collaboration network experienced a significant expansion in both the number of participants and the density of connections (Figure 2). We identified 15 EU countries and five Central Asian countries actively involved in the network, showing notable growth compared to the previous period. At this stage, scientific collaboration became more organized and widespread, with increased diversification among European countries engaging with those in Central Asia. Countries such as Germany, France, Italy, Poland, and Spain solidified their roles as central nodes, distinguished by a high degree and page rank. These countries not only maintained high scientific output but also broadened their collaborative networks, establishing multiple links with authors and institutions in Central Asia.

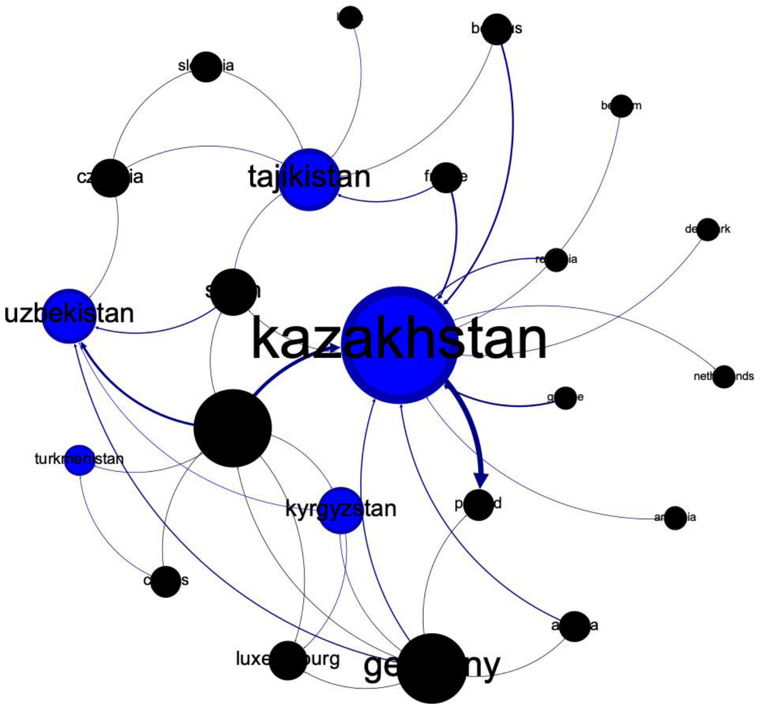

Figure 2. Central Asia-EU scientific collaboration network during the second period (2010-2016).

On the Central Asian side, Kazakhstan continued to lead in terms of integration and visibility within the collaborative network, followed by Uzbekistan and Tajikistan, which showed growth in their indicators of centrality and influence within the network. Although Central Asian countries still occupy peripheral positions in terms of betweenness centrality, we observe increased interregional connectivity, indicating ongoing institutional strengthening. The network also shows a slight increase in clustering, suggesting a trend toward forming more stable collaborative subgroups with multiple connections. This increased cohesion may be related to emerging thematic networks or educational cooperation in the context of technological innovation and digital development.

3.3. Central Asia-EU scientific collaboration during the third period (2017-2024)

In the most recent period (2017-2024), the scientific collaboration network reached an unprecedented level of maturity and diversification (Figure 3). Twenty-four EU countries and five Central Asian countries were identified as participants in the network, representing the widest coverage across the three periods analyzed. The network structure shows a significant increase in the number of connections and overall density, along with greater interconnection between European and Central Asian countries. Germany, France, Italy, Spain, Poland, and the Netherlands continue to hold key positions in terms of degree and page rank, confirming their roles as leaders in scientific cooperation and key nodes for knowledge sharing. Additionally, other EU countries, such as Austria, Bulgaria, and Finland, have increased their importance in connectivity measures, expanding the geographical diversity of collaboration.

In Central Asia, Kazakhstan strengthens its role as a key scientific partner of the EU, achieving higher weighted scores and connectivity compared to previous periods and forming denser links with multiple European countries. Uzbekistan and Tajikistan continue to show steady growth in their integration metrics, while Kyrgyzstan and Turkmenistan, with lesser relative influence, maintain a consistent presence in the network. Average clustering has increased from earlier periods, indicating the development of more cohesive collaborative communities, possibly focused on specific AI themes.

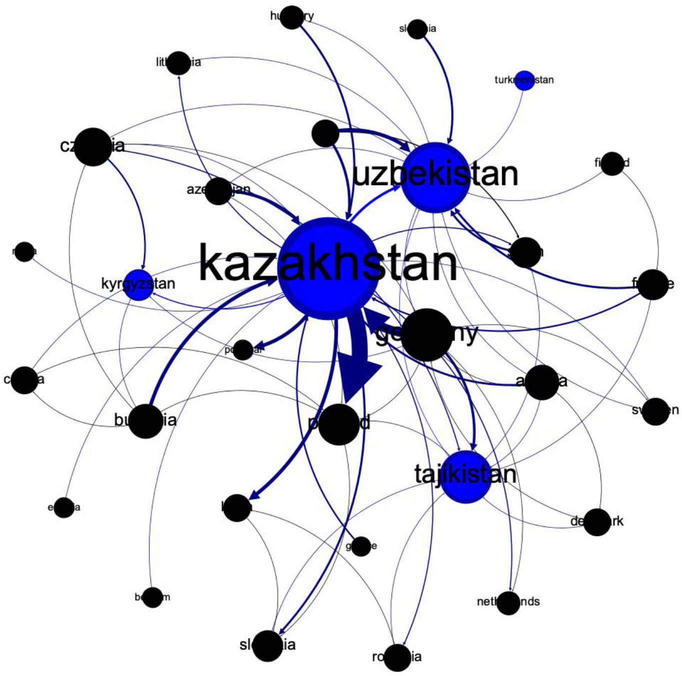

Figure 3. Central Asia-EU scientific collaboration network during the third period (2017-2024).

Region	Country	Degree 2000-2009	PageRank 2000-2009	Degree 2010-2016	PageRank 2010-2016	Degree 2017-2024	PageRank 2017-2024
Central Asia	Kazakhstan	4.0	0.105156	11.0	0.124759	24.0	0.088889
	Kyrgyzstan	1.0	0.042136	4.0	0.036984	4.0	0.029138
	Tajikistan	7.0	0.188645	5.0	0.118993	10.0	0.125595
	Turkmenistan	1.0	0.054063	2.0	0.042744	1.0	0.014316
	Uzbekistan	4.0	0.140937	5.0	0.084796	15.0	0.234588
UE	Austria			2.0	0.025821	5.0	0.014316
	Belgium			1.0	0.025821	1.0	0.014316
	Bulgaria	1.0	0.042136			5.0	0.014316
	Croatia					3.0	0.01675
	Cyprus			2.0	0.025821		
	Czechia	1.0	0.042136	3.0	0.025821	6.0	0.01675
	Denmark			1.0	0.025821	3.0	0.01675
	Estonia					1.0	0.014316
	Finland	1.0	0.042136			2.0	0.014316
	France	2.0	0.042136	2.0	0.025821	4.0	0.020401
	Germany	3.0	0.042136	7.0	0.036793	10.0	0.026718
	Greece	1.0	0.042136	1.0	0.025821	1.0	0.014316
	Hungary					2.0	0.014316
	Italy	4.0	0.054063	8.0	0.042005	3.0	0.014316
	Latvia			1.0	0.025821	3.0	0.020612
	Lithuania					2.0	0.020612
	Luxembourg			3.0	0.052702		
	Malta					1.0	0.020612
	Netherlands			1.0	0.05234	2.0	0.023856
	Poland	3.0	0.042136	2.0	0.057552	7.0	0.037467
	Portugal					1.0	0.020612
	Romania			1.0	0.05234	3.0	0.029368
	Slovakia			2.0	0.033135	4.0	0.045285
	Slovenia					1.0	0.014316
	Spain			4.0	0.058291	4.0	0.024669
	Sweden					3.0	0.023856

Table 1. Data derived from social network analysis of the maps for the three periods.

4. DISCUSSION

The longitudinal analysis of scientific collaboration in AI between EU countries and Central Asia shows patterns that, although developing within a specific geographical and thematic context, share certain similarities with global trends identified in previous studies. In the first period analyzed, collaboration was marked by the involvement of a limited number of countries, with Kazakhstan serving as the main central partner in Central Asia and EU scientific leaders like Germany, France, and the United Kingdom. This initial setup, although less dense than the global networks described in the literature, already indicated the presence of strategic nodes that act as bridges between the two regions.

Compared to global studies, such as the one by Singh *et al.* (2024), which identified the United States, China, and the United Kingdom as the closest core of cooperation in AI4SDG, our analysis shows that, in the specific case of EU-Central Asia collaboration, alliances are more concentrated in European countries with high research capacity and a tradition of international cooperation, while the role of Central Asia is unevenly distributed, with Kazakhstan and Uzbekistan as the main actors. This difference is probably due to the lower critical mass of scientific production in AI in the Central Asian region, compared to the large global hubs.

During the second period, there was an increase in network density and diversification of links, with more countries from both the EU and Central Asia being included (see Table 1). This trend mirrors the findings of Gao *et al.* (2021), who reported that global collaboration in AI between 2008 and 2018 saw the formation of distinct strategic alliances, such as China-United States and United Kingdom-Australia, with clear partner preferences. In our case, although the volume of publications and the diversity of partners are more limited, a certain preference is also evident: countries like Germany, France, and the United Kingdom maintain recurring links with Kazakhstan and Uzbekistan, while other EU countries, such as Poland and Spain, establish *ad hoc* collaborations, reflecting a pattern of selectivity similar to that observed in global networks.

In the third period, the steady growth of collaborations and the emergence of new links between EU and Central Asian countries strengthen the trend toward increased regional integration. This trend partly aligns with the findings of Hu, Wang & Deng (2020), who demonstrated that in global AI networks, there is a core group of countries with especially strong connections, surrounded by a network of secondary collaborations. However, in the EU-Central Asia context, this core mainly consists of European countries (Germany, France, Italy, and the United Kingdom), with one or two central partners from Central Asia. This makes the network more reliant on individual nodes and less balanced than the global network.

Finally, it should be noted that, unlike the findings of Dwivedi and Elluri (2024) and the bibliometric study based on SCI-Expanded (1991-2018), where leadership in collaboration consistently favors powers like the United States and China, our analysis shows that, in a bilateral framework such as that of the EU and Central Asia, the sway of collaboration is more influenced by regional, historical, and linguistic factors than by global scientific dominance. This indicates that, although some general patterns of centrality and preference in AI collaboration are partially shared, the geographical and political context creates unique configurations that cannot be directly inferred from global networks.

5 CONCLUSIONS

The analysis shows that AI collaboration between the EU and Central Asia has expanded from initial connections to a broader, more varied network, with a steady rise in country participation and relationship density. Kazakhstan has played a crucial and stable role, acting as the main regional link to Europe, while Uzbekistan and Tajikistan have shown consistent growth in their integration. In the EU, countries like Germany, France, and Italy have maintained steady leadership, along with the increasing importance of others such as Spain, Poland, and the Netherlands. Despite progress, the collaboration network still relies heavily on a few key nodes, suggesting that future efforts should focus on diversifying partners and enhancing capacity across all Central Asian nations to create a more balanced cooperation network.

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Conflict of interest

The authors declare that there are no potential conflicts of interest.

Contribution statement

Conceptualization, formal analysis, writing-original draft: Zhaslan Nurbayev.

Supervision: Balaussa Seilkhan.

Methodology, software, validation: Alyona Dmitriyeva, Yerbolat Sergazin.

Writing-review & editing: Ruslan Abdullin, Zhaslan Nurbayev.

Statement of data consent

The data generated during the development of this study have been presented in the manuscript.

REFERENCES

Bahoo, S., Cucculelli, M., Goga, X., & Mondolo, J. (2024). Artificial intelligence in Finance: a comprehensive review through bibliometric and content analysis. *SN Business & Economics, 4*(2), 23. https://doi.org/10.1007/s43546-023-00618-x

Bhagat, P. R., Naz, F., & Magda, R. (2022). Artificial intelligence solutions enabling sustainable agriculture: A bibliometric analysis. *PloS one, 17*(6), e0268989. https://doi.org/10.1371/journal.pone.0268989

Dwivedi, R., & Elluri, L. (2024). Exploring Generative Artificial Intelligence Research: A Bibliometric Analysis Approach. *IEEE Access,* vol. 12, pp. 119884-119902. DOI: 10.1109/ACCESS.2024.3450629.

El-Hajj, V. G., Gharios, M., Edström, E., & Elmi-Terander, A. (2023). Artificial intelligence in neurosurgery: a bibliometric analysis. *World Neurosurgery, 171,* 152-158. https://doi.org/10.1016/j.wneu.2022.12.087

Frasca, M., La Torre, D., Pravettoni, G., & Cutica, I. (2024). Explainable and interpretable artificial intelligence in medicine: a systematic bibliometric review. *Discover Artificial Intelligence, 4*(1), 15. https://doi.org/10.1007/s44163-024-00114-7

Gao, F., Jia, X., Zhao, Z., Chen, C. C., Xu, F., Geng, Z., & Song, X. (2021). Bibliometric analysis on tendency and topics of artificial intelligence over last decade. *Microsystem Technologies, 27*(4), 1545-1557. https://doi.org/10.1007/s00542-019-04426-y

Goodell, J. W., Kumar, S., Lim, W. M., & Pattnaik, D. (2021). Artificial intelligence and machine learning in finance: Identifying foundations, themes, and research clusters from bibliometric analysis. *Journal of Behavioral and Experimental Finance, 32,* 100577. https://doi.org/10.1016/j.jbef.2021.100577

Ho, Y. S., & Wang, M. H. (2020). A bibliometric analysis of artificial intelligence publications from 1991 to 2018. *COLLNET Journal of Scientometrics and Information Management, 14*(2), 369-392. https://doi.org/10.1080/09737766.2021.1918032

Hu, H., Wang, D., & Deng, S. (2020). Global Collaboration in Artificial Intelligence: Bibliometrics and Network Analysis from 1985 to 2019. *J. Data Inf. Sci., 5*(4), 86-115. https://doi.org/10.2478/jdis-2020-0027

Jrad, M. (2023). A role of artificial intelligence in the context of economy: Bibliometric analysis and systematic literature review. *International Journal of Membrane Science and Technology, 10*(3), 1563-1586.

Kurmangali, M., Yeraliyeva, Y., & Beimisheva, A. (2024). Digitalization and Artificial Intelligence in Central Asia: Governmental Responses and Further Implications. *Public Policy and Administration, 23*(2), 146-159. DOI: 10.13165/VPA-24-23-2-03.

Lopes, N. M., Aparicio, M., & Neves, F. T. (2025). Challenges and prospects of artificial intelligence in aviation: a bibliometric study. *Data Science and Management, 8*(2), 207-223. https://doi.org/10.1016/j.dsm.2024.11.001

Munim, Z. H., Dushenko, M., Jimenez, V. J., Shakil, M. H., & Imset, M. (2020). Big data and artificial intelligence in the maritime industry: a bibliometric review and future research directions. *Maritime Policy & Management, 47*(5), 577-597. https://doi.org/10.1080/03088839.2020.1788731

Nalbant, K. G., & Aydin, S. (2025). A bibliometric approach to the evolution of artificial intelligence in digital marketing. *International Marketing Review.* https://doi.org/10.1108/IMR-04-2024-0132

Siddiqui, D., Mumtaz, U., & Ahmad, N. (2024). Artificial intelligence in entrepreneurship: A bibliometric analysis of the literature. *Journal of Global Entrepreneurship Research, 14*(1), 13. https://doi.org/10.1007/s40497-024-00385-5

Singh, A., Kanaujia, A., Singh, V. K., & Vinuesa, R. (2024). Artificial intelligence for Sustainable Development Goals: Bibliometric patterns and concept evolution trajectories. *Sustainable Development, 32*(1), 724-754. https://doi.org/10.1002/sd.2706

Xie, B. H., Li, T. T., Ma, F. T., Li, Q. J., Xiao, Q. X., Xiong, L. L., & Liu, F. (2024). Artificial intelligence in anesthesiology: a bibliometric analysis. *Perioperative Medicine, 13*(1), 121. https://doi.org/10.1186/s13741-024-00480-x

Xie, B., Xu, D., Zou, X. Q., Lu, M. J., Peng, X. L., & Wen, X. J. (2024). Artificial intelligence in dentistry: a bibliometric analysis from 2000 to 2023. *Journal of Dental Sciences,* *19*(3), 1722-1733. https://doi.org/10.1016/j.jds.2023.10.025

Younas, A. (2020). Recent Policies, Regulations and Laws Related to Artificial Intelligence Across the Central Asia (August 1, 2020). Ai Mo Innovation Consultants. Available at https://ssrn.com/abstract=3664983