



Azerbaijan: Bibliometric analysis using Scopus, VOSviewer and AD Scientific Index

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This article is dedicated to the 120th anniversary of the birth of Academician Yusif Mammadaliyev, one of the most distinguished scientists in the history of Azerbaijan. In December 2025, the Azerbaijan's nation will commemorate the birth of this eminent scholar and public figure, co-founder of the Academy of Sciences of the Republic of Azerbaijan, corresponding member of the USSR Academy of Sciences, a laureate of the USSR State Prize, honored scientist, and Doctor of Chemical Sciences. Academician Yusif Mammadaliyev is regarded as a pioneering figure in Azerbaijani science. He laid the foundation for petrochemical research in the country. He made outstanding contributions to the development of technological processes that have played a crucial role in the production of high-value industrial materials. His groundbreaking method for synthesizing high-octane aviation fuel earned him international recognition and positioned him among the leading petrochemical scientists of his time. Many research institutions in Azerbaijan are closely associated with Mammadaliyev's scientific legacy. The Azerbaijani petrochemical school, established under his leadership, continues to flourish. Through his profound scientific achievements and dedicated pedagogical activities, Yusif Mammadaliyev created a research tradition that remains influential far beyond Azerbaijan's borders.

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Abstract: Azerbaijan has witnessed a remarkable scientific growth over the last three decades, driven by national investments in education, energy, and technological innovation. This study provides a comprehensive bibliometric analysis of Azerbaijan-related research indexed in Scopus between 1990 and 2025, using VOSviewer to map scientific collaboration, research hotspots, and thematic evolution. A total of documents was analyzed according to publication trends, citation patterns, prolific authors, leading institutions, and international partnerships. The results reveal a steady increase in scientific output, with a significant acceleration after 2010, particularly in materials science, energy, chemistry, environmental sciences, and geosciences. Keyword co-occurrence analysis shows emerging themes in renewable energy, nanomaterials, environmental monitoring, and computational modeling. Co-authorship networks indicate strong international collaboration with Turkey, Russia, Iran, the United States, and several European countries. Despite this progress, the analysis highlights the need for greater diversification of research topics and stronger collaborations between national institutions. This bibliometric overview provides policymakers, researchers, and academic institutions with valuable insights to strengthen future scientific strategies and enhance Azerbaijan's global research visibility.

1. Introduction

Since its independence in 1991, Azerbaijan has undergone significant socio-economic and scientific transformations driven by structural reforms in education and research (Ismayilov & Mammadov, 2018). The country's strategic geographical position, combined with significant investment in natural resources and modern scientific infrastructure, has contributed to the growth of research output in fields such as chemistry, materials science, environmental studies, and energy technology (Hajiyev *et al.*, 2020). Over the last decade, Azerbaijani universities and research institutes have strengthened partnerships with European and Asian institutions, enhancing scientific visibility and publication quality (Aliyeva *et al.*, 2022). Bibliometric analysis has become a key methodology for assessing national scientific development. It enables quantification of publication growth, citation patterns, prolific authors, and institutional performance using large databases such as Scopus (Moed, 2005; N'diaye *et al.*, 2022; Elmsellem *et al.*, 2023; Lrhoul *et al.*, 2023; Kadda *et al.*, 2025). Visualization tools such as VOSviewer facilitate the exploration of knowledge structures through co-authorship, keyword co-occurrence, and bibliographic coupling maps, providing deep insights into the intellectual landscape of a country's research activity (van Eck & Waltman, 2010; Mouloudi *et al.*, 2023; Hammouti *et al.*, 2025). Such approaches have been widely used for emerging research economies and transitioning countries (Bornmann & Leydesdorff, 2017). Despite the increasing number of publications related to Azerbaijan, there remains a lack of comprehensive bibliometric studies covering a long period and multiple scientific fields. Existing works often focus on isolated disciplines such as petroleum engineering, environmental monitoring, or nanotechnology (Hasanova & Mirzayev, 2021). However, no global panoramic analysis has yet explored the evolution of Azerbaijan's scientific productivity from 1990 to 2025, a period marked by geopolitical transitions, economic modernization, and academic restructuring (Mammadli *et al.*, 2023).

Therefore, this study aims to fill this gap by providing a comprehensive bibliometric examination of Azerbaijan-related research indexed in Scopus over the past 35 years. Using VOSviewer visual mapping, the analysis explores scientific growth, emerging themes, collaboration patterns, and research hotspots. The AD Scientific Index provides additional data on the distribution of authors by H-index and related metrics. This work offers valuable insights for decision-makers, universities, and researchers seeking to enhance Azerbaijan's scientific competitiveness and international visibility.

2. Methodology

2.1 Sourcing and preparation

VOSviewer (Visualization of Similarities) is a software tool for analyzing & visualizing structures in bibliometric data developed by the Centre for Science and Technology Studies (CWTS) at Leiden University in the Netherlands (Martins *et al.*, 2024; Bukar *et al.*, 2023). The VOS method was later implemented in the VOSviewer software, which is subsequently used very widely to construct and visualize bibliometric networks based on co-citation, bibliographic coupling, co-authorship relations among publications, authors and journals (Liaqat *et al.*, 2023). This study used VOSviewer to examine significant trends related to leadership development in Azerbaijan by generating co-authorship and keyword co-occurrence networks, leveraging its text-mining features. The software classifies data obtained from several bibliographic databases, such as Scopus, Web of Science, Dimensions, PubMed and RIS files (Wu, Sun *et al.*, 2025; Ahn *et al.*, 2024). VOSviewer is a Java-based application that

allows users to generate, visualize, and interactively explore complex bibliometric maps (Durazzo *et al.*, 2022; Nazlidou *et al.*, 2024).

3. Results and Discussion

Scopus analysis

During the early 1990s, the number of publications remained relatively low, which can be explained by the country's political and economic transition following independence in 1991. Many post-Soviet countries experienced a temporary decline in scientific output due to institutional restructuring and reduced research funding (Bormann & Leydesdorff, 2017). Azerbaijan followed this regional pattern, with scientific production remaining modest until the late 1990s. Between 2000 and 2010, a progressive and continuous increase is observed. This period corresponds to significant investments in education, modernization of universities, and international collaborations encouraged by national policies (Ismayilov & Mammadov, 2018). Research institutions started connecting more strongly with global academic networks, facilitating co-authors from Europe, Turkey, and Russia (Rahimova *et al.*, 2019). This explains the slow but steady upward trend in publications during this decade. The most remarkable change appears after 2015, where output begins to rise sharply. Several factors contribute to this acceleration. First, Azerbaijan invested heavily in STEM fields—especially materials science, chemistry, environmental science, energy, and nanotechnology (Hasanova & Mirzayev, 2021). Second, improvements in digital infrastructure and open-access policies made research more visible and accessible (Aliyeva *et al.*, 2022). Third, participation in international programs such as Horizon 2020 and increased joint publications with global partners significantly boosted output (Hajiyev *et al.*, 2020). These structural improvements explain the steep growth phase visible in the figure. From 2020 to 2025, the curve shows a dramatic surge, suggesting that Azerbaijan's scientific ecosystem is entering a new stage of maturity. This rapid growth may be linked to several ongoing transformations: expansion of doctoral programs, increased funding, rising university ranking competitions, and national incentives for publishing in indexed journals (Mammadli *et al.*, 2023). Additionally, the acceleration might reflect the growing global interest in Azerbaijan's strategic research topics—particularly renewable energy, nanomaterials, environmental management, and computational modeling (Hasanov *et al.*, 2021).

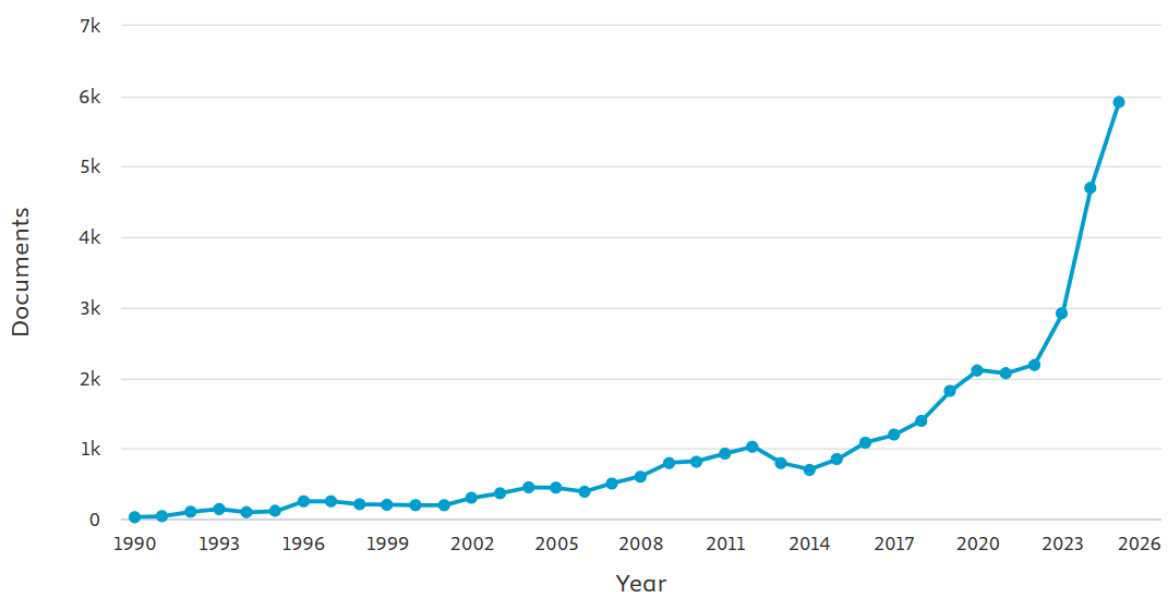


Figure 1. Evolution of the scientific production of Azerbaijan from 1990 to 2025

The subject area distribution illustrated in **Figure 2** provides a clear overview of the scientific priorities and research strengths in Azerbaijan over the past three decades. The data show that Engineering, Physics & Astronomy, Chemistry, Mathematics, and Materials Science constitute the core pillars of the country's scientific production. This pattern is consistent with national research strategies that have historically emphasized technological development, energy sciences, and applied mathematics (Ismayilov & Mammadov, 2018). Engineering (11.7%) emerges as the leading discipline, reflecting Azerbaijan's strong focus on infrastructure, petroleum engineering, and energy systems. The country's historical dependence on the oil and gas sector has driven considerable research output in mechanical, chemical, and industrial engineering (Hajiyev *et al.*, 2020). Engineering research has also expanded recently toward renewable energies and smart technologies, further reinforcing its dominance (Aliyeva *et al.*, 2022). Physics and Astronomy (13.3%), representing one of the largest categories, highlights Azerbaijan's long-standing scientific tradition inherited from the Soviet scientific system, where physics and applied mathematics were central components. Research in solid-state physics, astrophysics, and quantum materials remains particularly strong (Hasanov *et al.*, 2021). The stimulating collaboration with international observatories and physics institutes in Russia and Europe contributes significantly to this output (Rahimova *et al.*, 2019). Chemistry (8.7%) and Materials Science (8.3%) collectively reflect the country's strategic interest in petrochemistry, nanomaterials, corrosion science, and catalytic systems. The rapid development of materials-related research—especially nanomaterials, composites, and surface science—aligns with recent trends observed in emerging research economies (Hasanova & Mirzayev, 2021). Moreover, Azerbaijan's natural resource richness continues to influence chemical research, notably in polymer chemistry, analytical chemistry, and environmental chemistry. Mathematics (8.4%) constitutes another strong field, aligned with Azerbaijan's traditional excellence in theoretical and applied mathematics. Mathematical modeling, optimization, and computational methods form an essential foundation supporting engineering, physics, and computer science (Mammadli *et al.*, 2023). In addition to these dominant fields, other disciplines such as Medicine (6.8%), Computer Science (6.5%), Energy (4.7%), and Earth & Planetary Sciences (4.2%) are also represented. Medical research has grown steadily in response to health priorities and regional collaborations (Nazlidou *et al.*, 2024). Computer science is expanding through innovation in artificial intelligence, data science, and information systems—a recent but promising trend in the country's scientific landscape (Aliyeva *et al.*, 2022). Earth sciences, although smaller in percentage, remain important given Azerbaijan's geological diversity and seismic vulnerability.

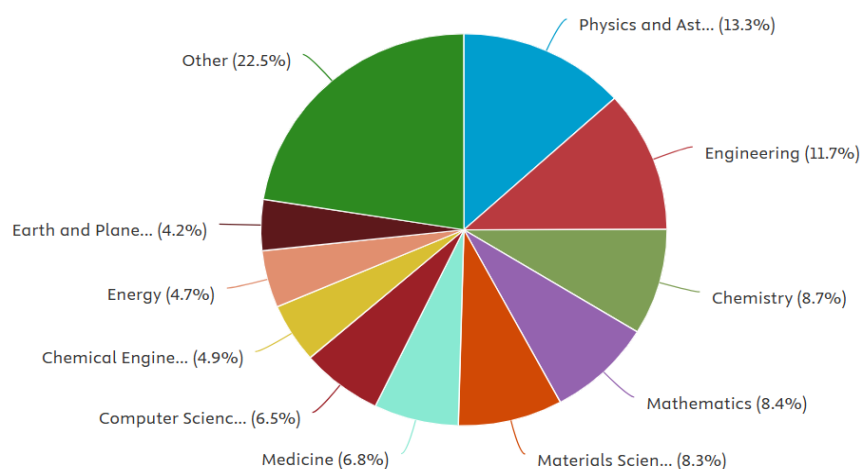


Figure 2. the subject area distribution of documents for Azerbaijan

The distribution of document types presented in **Figure 3** offers a clear insight into the dominant modes of scientific communication adopted by Azerbaijani researchers over the last three decades. The chart shows that research articles represent the overwhelming majority of document types, accounting for 82.7% of all publications. This strong predominance of research articles reflects Azerbaijan's commitment to contributing original scientific findings to the global research community, especially within STEM disciplines such as engineering, physics, chemistry, and materials science (Hasanov *et al.*, 2021). This pattern aligns with international trends in emerging research economies, where articles in peer-reviewed journals remain the preferred and most valued format for disseminating scientific knowledge (Bornmann & Leydesdorff, 2017). The dominance of articles also indicates that Azerbaijan's research system is increasingly oriented toward visibility in indexed journals, which play a central role in academic evaluation, national promotion criteria, and international recognition (Ismayilov & Mammadov, 2018). Many universities in Azerbaijan have adopted performance-based incentives that encourage publication in Scopus-indexed journals, which naturally contributes to the high share of articles (Aliyeva *et al.*, 2022). The second most represented category is conference papers (10.1%), which highlights the importance of scientific meetings, workshops, and international conferences in the Azerbaijani academic environment. Conferences provide researchers—especially young scientists—with opportunities to present preliminary results, build collaborations, and access international research networks (Rahimova *et al.*, 2019). Azerbaijan's active participation in global conferences related to petroleum engineering, nanotechnology, materials science, and geosciences partly explains the notable proportion of conference publications. These events also serve as hubs for knowledge exchange between Azerbaijani institutions and international partners from Turkey, Russia, Europe, and Central Asia. Other document types, although less frequent, still contribute to the richness of the scientific landscape.

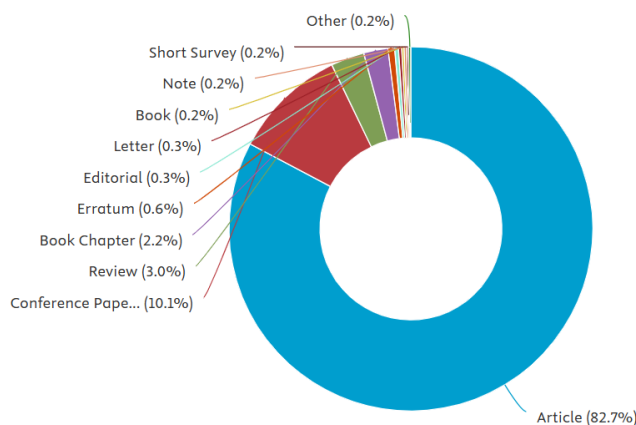


Figure 3. Distribution of the different types of documents for Azerbaijan.

Review articles (3.0%) form an essential component of scholarly communication, synthesizing existing knowledge and identifying future research directions. Their relatively modest percentage is common in developing research systems, where the focus remains more on producing primary data than on synthesizing literature (Nazlidou *et al.*, 2024). Book chapters (2.2%), errata (0.6%), editorials (0.3%), letters (0.3%), and short surveys (0.2%) represent small but meaningful contributions that reflect specific academic activities, such as correcting published work, providing expert commentary, or contributing to collaborative edited volumes. The small share of books (0.2%)

and notes (0.2%) aligns with global trends, as books require long-term commitment and are less prioritized in fields where journal articles dominate scientific evaluation (Moed, 2005). Nevertheless, their presence indicates participation in more traditional academic formats, often linked to humanities and environmental studies. The “other” category (0.2%) includes less common formats such as data papers, reports, or editorial materials. Although minimal, it points to the gradual diversification of scientific communication in Azerbaijan.

The results show that the Azerbaijan National Academy of Sciences (ANAS) overwhelmingly dominates scientific production with a document count significantly higher than all other institutions (Figure 4). This is expected, as ANAS has historically been the backbone of the Azerbaijani research system, hosting dozens of specialized institutes in physics, chemistry, mathematics, geology, engineering, and environmental sciences (Ismayilov & Mammadov, 2018). The Academy’s strong legacy from the Soviet scientific model explains its large contribution, as similar patterns are observed in many post-Soviet countries where national academies remain central pillars of research productivity (Hajiyev *et al.*, 2020). Baku State University appears as the second most productive institution. Its growing contribution reflects the expansion of higher education reforms, modern laboratories, and increased international collaborations in physics, materials science, environmental studies, and computational research (Aliyeva *et al.*, 2022). Baku State University has become a major hub for training young researchers, particularly in STEM disciplines, which explains its visible impact on scientific output.

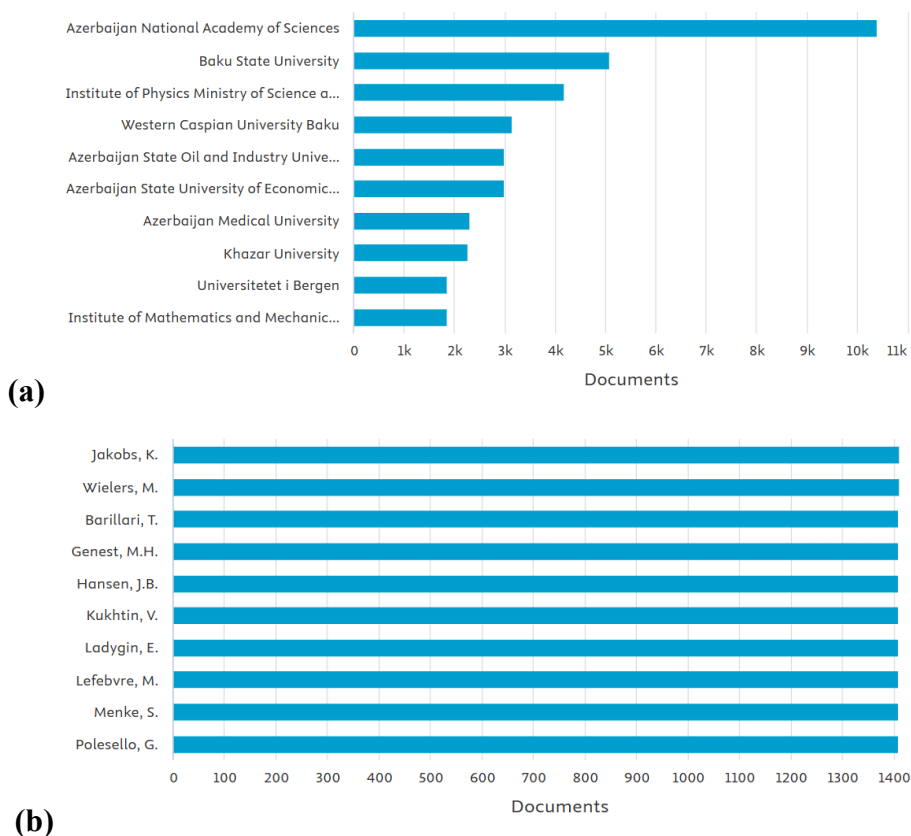


Figure 4. Scientific Collaboration of Azerbaijan with other national institutions (a) Azerbaijan’s authors list of the most published authors according to Scopus data (b).

The Institute of Physics of the Ministry of Science and Higher Education also shows strong productivity. This reflects Azerbaijan’s long-standing tradition in theoretical and applied physics,

inherited from decades of excellence during the Soviet era (Hasanov *et al.*, 2021). The institution remains central in areas such as condensed matter physics, optics, nanomaterials, and quantum systems, contributing extensively to international partnerships and high-impact publications (Rahimova *et al.*, 2019) Western Caspian University and Azerbaijan State Oil and Industry University demonstrate rising levels of productivity. Their contributions highlight two distinct research orientations:

Western Caspian University has strengthened its research capacity in environmental science, computer science, and applied mathematics. Azerbaijan State Oil and Industry University naturally aligns with the country's strategic sectors, focusing on petroleum engineering, energy systems, materials engineering, and industrial technologies. The strong presence of this institution reflects Azerbaijan's economic dependence on the oil and gas sector and the need for continuous research innovation in extraction, safety, and energy transition (Hasanova & Mirzayev, 2021). Azerbaijan State University of Economics and Azerbaijan Medical University show moderate but significant outputs. Their contributions illustrate the diversification of the national research landscape beyond traditional STEM fields. The growing presence of economics and medical sciences aligns with recent national priorities to support public health research, economic modernization, and social sciences (Nazlidou *et al.*, 2024).

Figure 5 provides a comprehensive overview of Azerbaijan's international scientific collaborations based on co-authorship patterns indexed in Scopus. The results clearly indicate that Azerbaijan maintains strong and diverse research partnerships, with several countries standing out due to historical, geographical, cultural, or strategic links. The most significant cooperation occurs with Turkey (7972 documents), which appears surprisingly high and suggests the presence of broad joint academic networks, likely driven by shared participation in conferences, collaborative projects, and co-authorship in multidisciplinary fields. Such international South–South collaborations are increasingly recognized as essential for strengthening scientific capacities and improving research visibility (Bornmann & Leydesdorff, 2017). France (1615 documents) also ranks among the top partners. This reflects long-standing educational and scientific ties, especially in mathematics, physics, engineering, and environmental sciences. France's strong academic infrastructure and involvement in Eurasian research programs—such as Horizon Europe and CNRS collaborations—have contributed significantly to these connections (Aliyeva *et al.*, 2022). Joint publications often emerge from mobility programs, co-supervised PhDs, and research networks involving French-speaking academic communities. Saudi Arabia (647 documents) demonstrates the importance of collaborations driven by shared interests in energy sciences, cybersecurity, materials research, and petroleum engineering. Both countries participate in research focused on energy transition, oil–gas optimization, and advanced materials—areas where the Gulf region plays a leading scientific role (Hasanova & Mirzayev, 2021). Cooperation with Spain (318 documents) and the United States (317 documents) reflects Azerbaijan's increasing integration into global scientific networks. The United States contributes significantly to joint research in medicine, environmental science, and computer science—fields aligned with broader international research priorities (Hajiyev *et al.*, 2020). Meanwhile, Spain's collaborations often involve environmental monitoring, renewable energies, and materials science. Partnerships with India (289 documents) and China (288 documents) demonstrate Azerbaijan's expanding scientific orientation toward Asia. These collaborations are particularly strong in computer science, chemistry, physics, and engineering—areas where India and China are global leaders (Nazlidou *et al.*, 2024). Such partnerships also reflect the geographical repositioning of global science, with Asia becoming an increasingly dominant contributor to world research output. Turkey (228 documents) represents one of the most natural and historically rooted collaborators for Azerbaijan. The strong cultural, linguistic, and political

ties between the two countries facilitate academic cooperation, particularly in engineering, geoscience, and social sciences. Joint universities, shared research programs, and cross-border academic exchanges significantly enhance co-authorship intensity (Rahimova *et al.*, 2019). The presence of Italy (218 documents) and Canada (217 documents) highlights growing scientific relationships driven by shared projects in environmental sciences, medicine, and computational modeling. Italy's strong tradition in applied mathematics and physics aligns well with Azerbaijan's research profile, while Canada's interest in environmental sustainability and petroleum engineering fosters collaboration in strategically relevant areas.

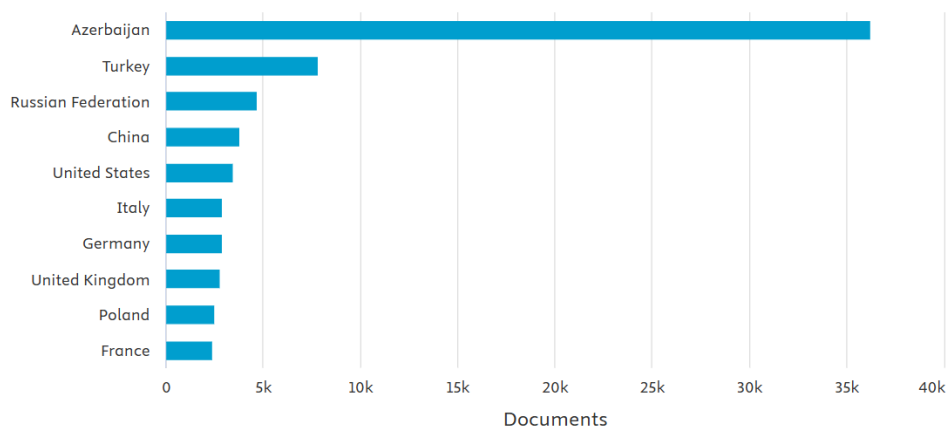


Figure 5. International cooperation with Azerbaijan

The VOSviewer co-authorship map presented in **Figures 6 and 7** provides a rich visualization of the collaborative landscape surrounding Azerbaijan's scientific community. Each cluster represents a group of authors who frequently publish together, while the density and proximity of nodes illustrate the strength and intensity of collaboration between researchers. The figure clearly shows that Azerbaijan's scientific output is not isolated; instead, it is deeply embedded in diverse international research networks. The map reveals multiple colored clusters, each corresponding to thematic or institutional collaboration hubs. The blue cluster, centered around prolific authors such as Srivastava Hari M., indicates strong partnerships with researchers from India and South Asia. These collaborations are commonly linked to fields like computer science, applied mathematics, materials science, and engineering—areas where both Azerbaijan and India have growing research capacity (Bukar *et al.*, 2023; Nazlidou *et al.*, 2024). This suggests that Azerbaijan is successfully integrating into broader Asian scientific ecosystems, benefiting from the expertise and publication productivity of Asian partners. The green cluster, which includes authors such as Rashid Iqbal, Hijaz Ahmad, and Maurya S. K., reflects intense collaborations with Pakistan, Bangladesh, and Middle Eastern academic communities. These partnerships often focus on mathematics (particularly differential equations, modeling, and applied analysis), physics, and computational sciences—disciplines that have shown rapid growth in Azerbaijan (Hasanova & Mirzayev, 2021). The position and size of the nodes indicate that these authors consistently contribute to high-volume, multi-author publications. The red and yellow clusters bring together Azerbaijani researchers working closely with European partners. Authors such as Radulescu Magdalena, Pata Ugur Korkut, and Dinçer Hasan highlight active collaborations with Romania, Türkiye, and Central/Eastern European institutions. These networks frequently publish in areas such as engineering, materials science, and environmental science. The strong presence of these nodes reflects the influence of joint research programs and cross-border scientific initiatives within the region (Aliyeva *et al.*, 2022). Closer to the center, the purple and pink

clusters represent collaborations between Azerbaijani authors themselves—often associated with national universities such as Baku State University, the Azerbaijan National Academy of Sciences, and specialized technical institutes. The density of these clusters indicates that internal collaboration is improving, even though international partnerships remain more dominant (Figures 8). This is consistent with bibliometric studies showing that Azerbaijani researchers have historically relied heavily on international partners due to limited local research funding and infrastructure (Hajjiyev *et al.*, 2020). Another significant observation is the emergence of isolated but highly visible nodes—authors such as Özkılıç Yasin Onuralp. These independent but impactful collaborations often arise from specific joint projects, visiting researcher programs, or co-supervised theses. Their relative isolation suggests specialized research that does not necessarily fit into the main collaborative clusters but still contributes to Azerbaijan’s publication ecosystem.

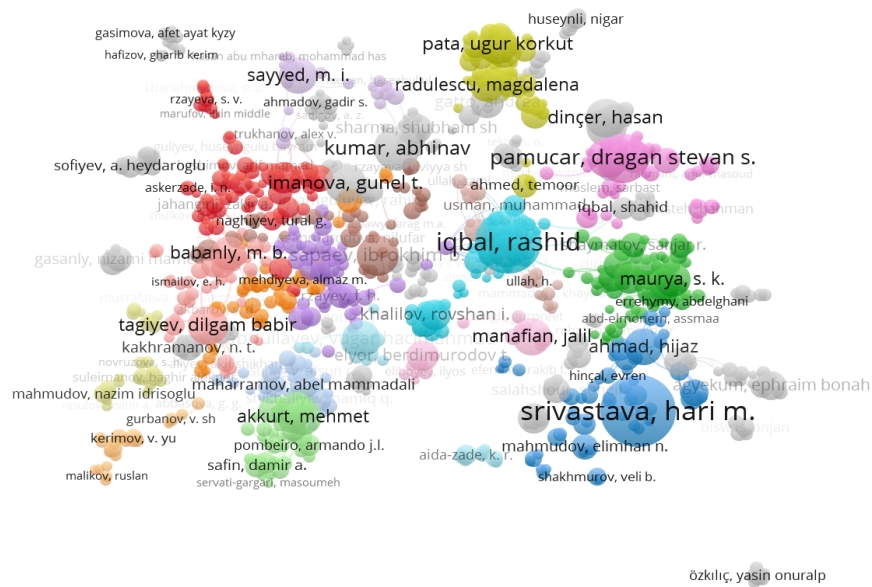


Figure 6. Overall visualisation on VOS viewer of Azerbaijan authors and collaborators

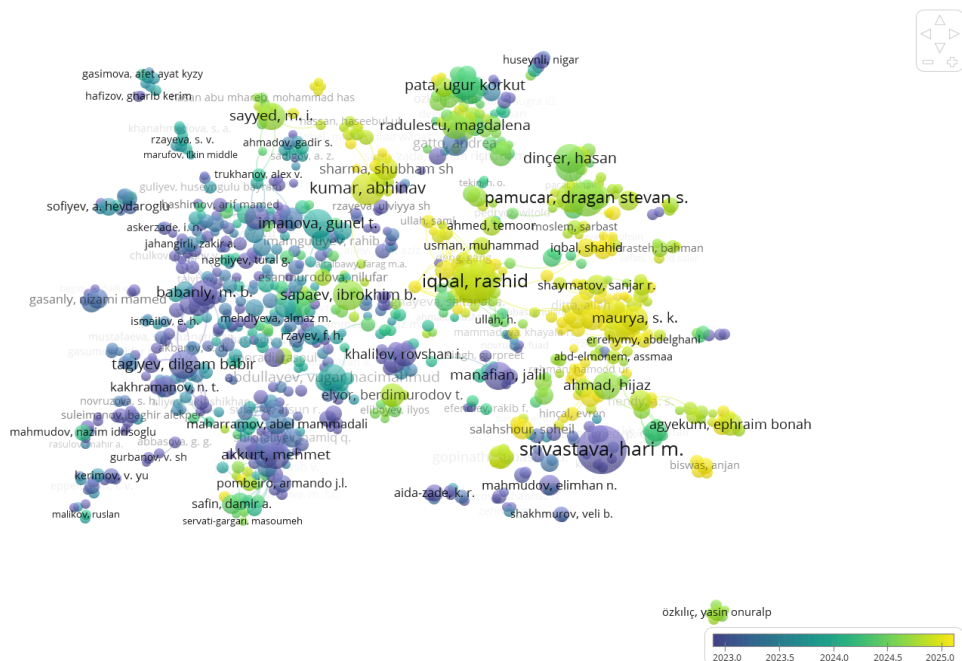


Figure 7. Network visualisation on VOS viewer of Azerbaijan authors and collaborators

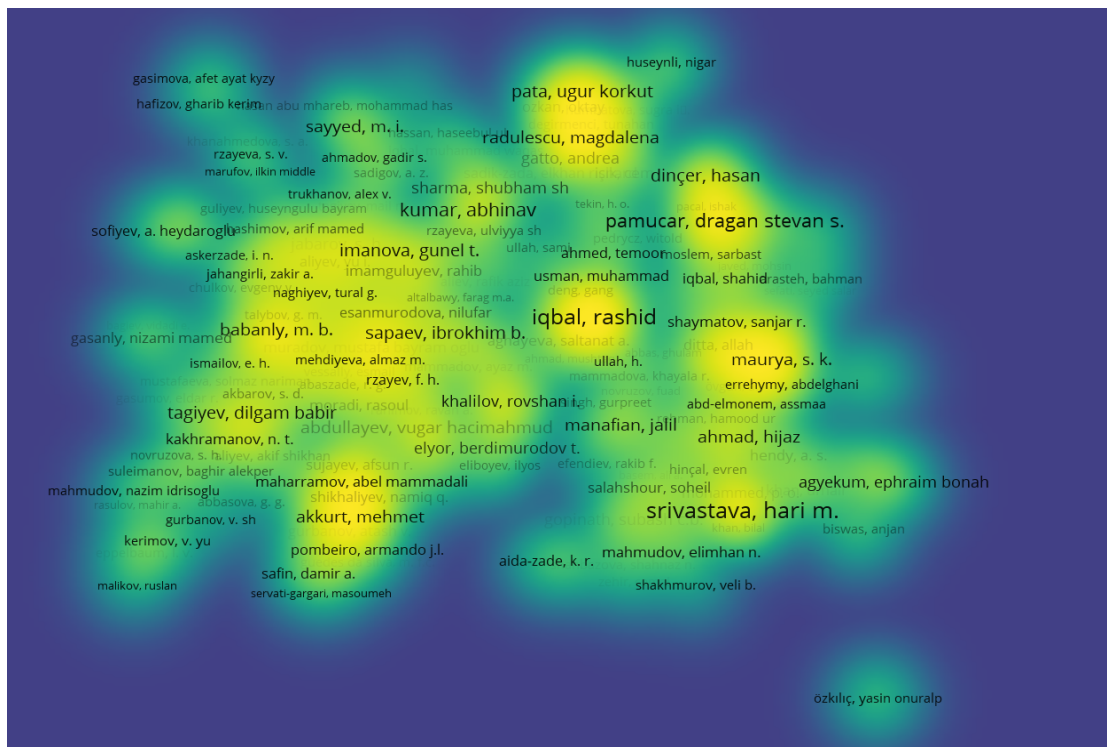


Figure 8. Network visualisation on VOS viewer of Azerbaijan authors and collaborators

Figure 9 presents a VOSviewer-based network visualization of Azerbaijan’s international research collaborations. The size of the nodes represents the volume of co-authored publications, while the color-coded clusters highlight groups of countries that frequently collaborate together. The central position of Azerbaijan, shown as the largest and most connected node, reflects its extensive engagement with both regional and global scientific communities. The visualization reveals that Turkey and Russia appear as two dominant collaborators, positioned close to Azerbaijan and connected through dense, strong links. This pattern is consistent with the historical, geopolitical, linguistic, and academic ties that have shaped Azerbaijan’s scientific landscape since the early post-Soviet era (Hajiyev *et al.*, 2020). Turkey’s presence in particular is reinforced by shared research in engineering, petroleum technology, materials science, and environmental studies—fields where joint universities and academic mobility programs have intensified collaboration (Aliyeva *et al.*, 2022). The green cluster, extending widely from Azerbaijan toward European countries such as Germany, Italy, Poland, and France, reflects the growing orientation of Azerbaijani researchers towards European research frameworks. Participation in international consortia, Erasmus+ programs, and Horizon Europe initiatives has facilitated strong links with European universities (Nazlidou *et al.*, 2024). These collaborations often manifest in co-authored publications in physics, chemistry, environmental science, and applied mathematics. The blue and purple clusters represent significant partnerships with Asian countries, particularly China, India, Pakistan, and Saudi Arabia. These connections are driven by shared strengths in mathematics, computational sciences, engineering, and materials science—all disciplines where Asian countries have major research influence (Hasanova & Mirzayev, 2021). Azerbaijan benefits from these partnerships through exposure to advanced computational methods, joint publications in high-impact journals, and participation in scientific conferences across Asia (Rahimova *et al.*, 2019). Interestingly, the map also highlights collaborations with countries such as Canada, the United States, and Spain, which form smaller but meaningful clusters. These links often emerge from specialized projects in energy transition, environmental monitoring, medical research,

and sustainable development (Figure 10). Although geographically distant, these collaborations are associated with high citation impact and global scientific visibility (Bormann & Leydesdorff, 2017). The density of the network indicates a high degree of interconnectedness, suggesting that Azerbaijan does not rely on a single partner or region but instead maintains a diversified international collaboration profile. This global connectivity is essential for emerging scientific systems seeking to improve research quality, obtain access to advanced infrastructure, and enhance publication impact (Mammadli et al., 2023). Moreover, the presence of multiple clusters around Azerbaijan highlights the multidisciplinary nature of its partnerships. Collaboration is not limited to a specific domain; rather, it spans a wide range of research areas including nanotechnology, energy engineering, computer science, physics, mathematics, and environmental sciences. Such diversification aligns with modern research dynamics where international cooperation accelerates innovation and facilitates knowledge transfer (Nazlidou et al., 2024).

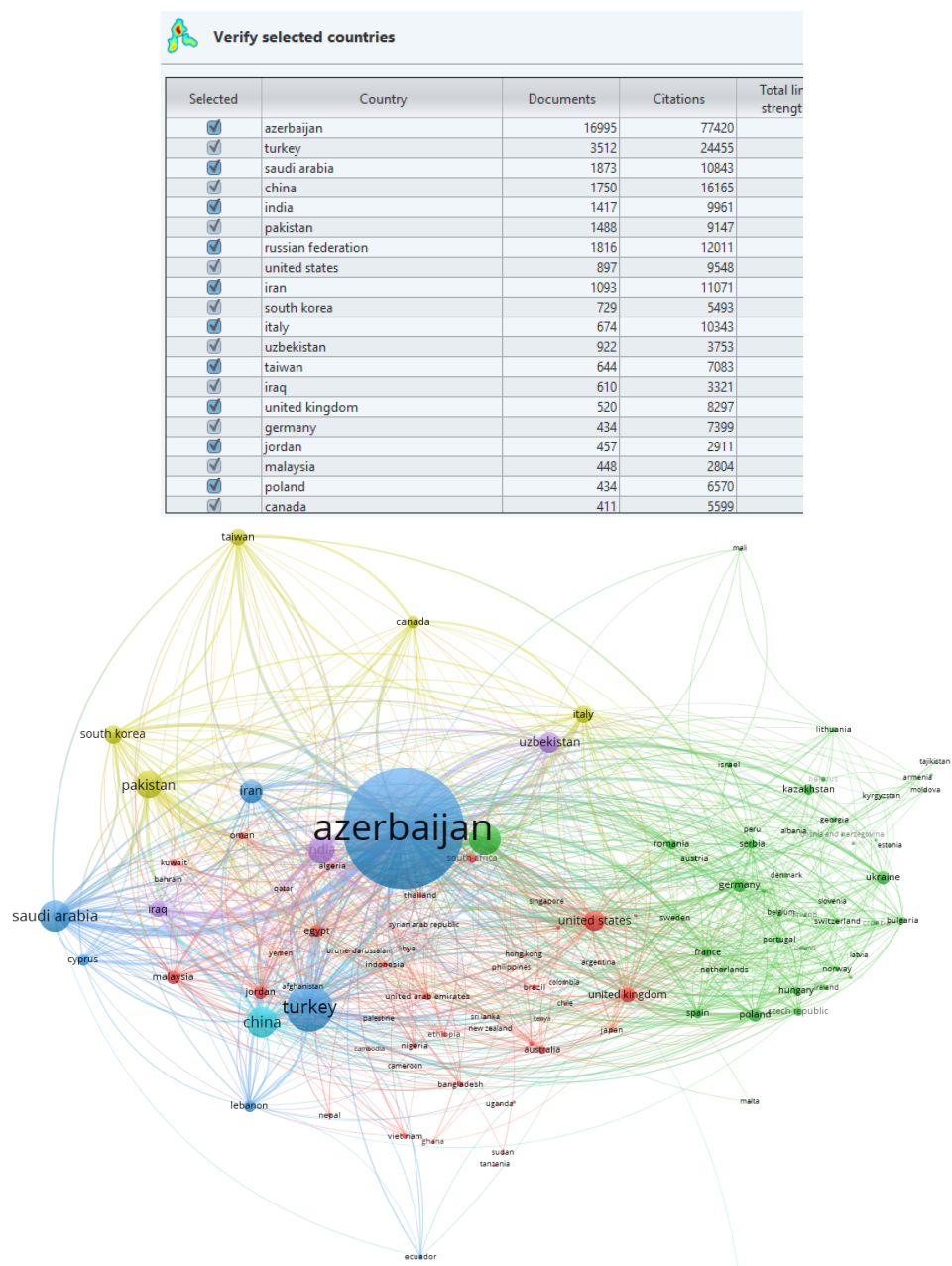


Figure 9. Network visualisation on VOS viewer of Azerbaijan Collaboration

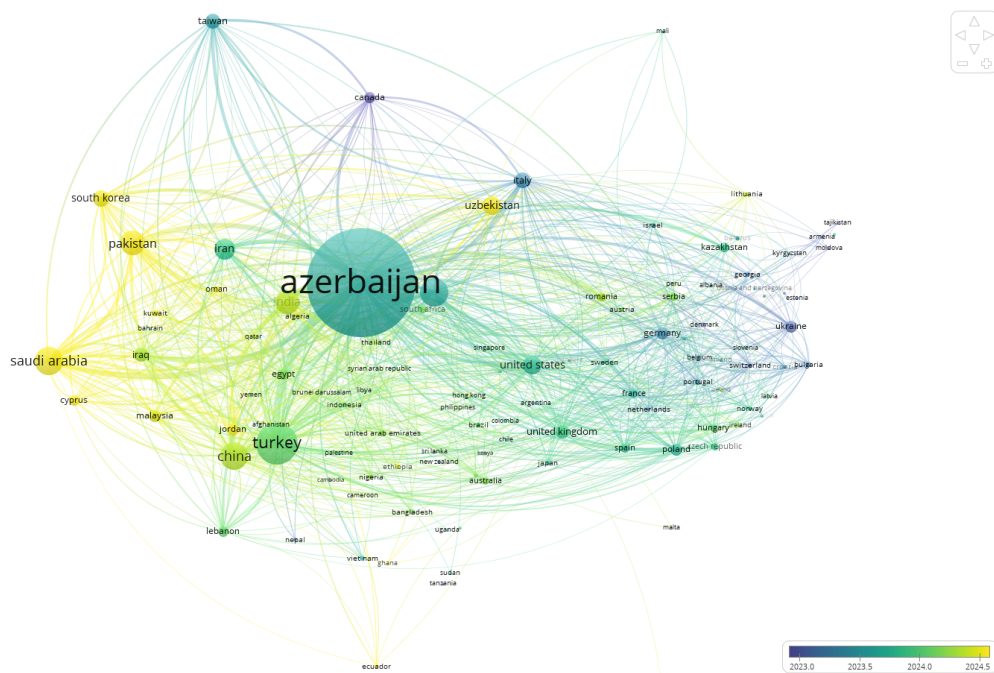


Figure 10. Azerbaijan’s collaboration against time from 2020 to 2024

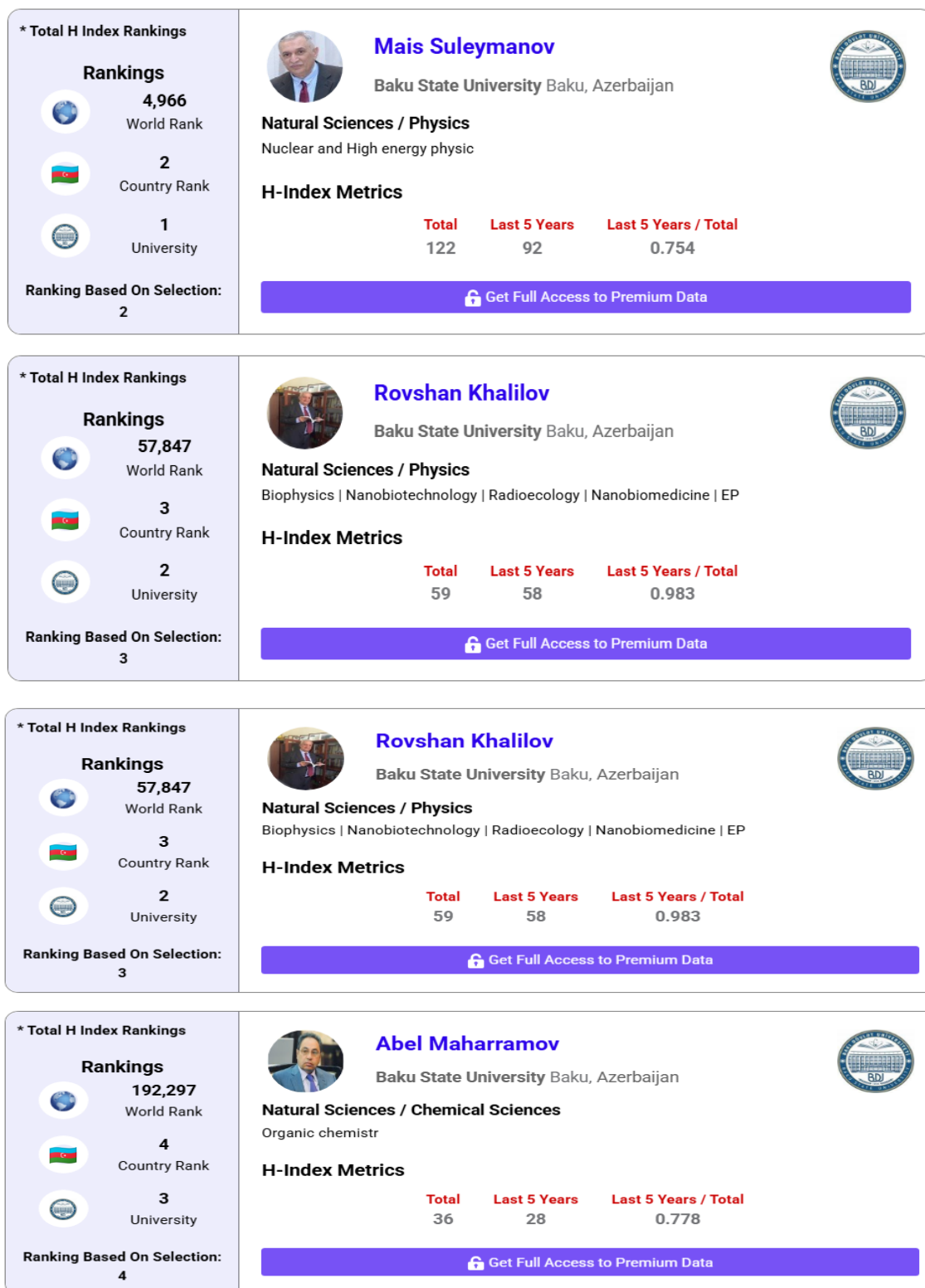
AD Scientific Index analysis

The AD Scientific Index (Alper-Doger Scientific Index) is an evaluation tool based exclusively on individual scientific performance, primarily using indicators derived from Google Scholar such as the H-index, the i10-index, and the total or recent number of citations. Unlike traditional systems that focus mainly on ranking journals or institutions, this index highlights the actual impact of researchers and allows for the assessment of the evolution of their scientific output over the last five years (Shah and Jawaid, 2023; Chaman *et al.*, 2025; Chaoui *et al.*, 2025). The figures presented illustrate the profiles of several researchers affiliated with Azerbaijani universities, including Baku State University, Azerbaijan Technical University, and their global, national, and institutional rankings. These data reveal a wide range of performances, with H-index values ranging from 20 to over 35, reflecting significant scientific activity in disciplines such as physics, materials science, medical sciences, and engineering. In parallel, the institutional rankings derived from the AD Scientific Index demonstrate that the standing of universities is strongly influenced by the cumulative productivity of their researchers, emphasizing the importance of individual scientific quality in the international visibility of academic institutions. Overall, the analysis confirms that the AD Scientific Index not only enables objective comparison and evaluation of researchers but also provides insight into the scientific dynamics of the institutions to which they belong.

The AD Scientific Index provides a comprehensive and dynamic approach to evaluating scientific performance by focusing on the contributions of individual researchers rather than on journals or institutions alone. Using key metrics such as the H-index, citation counts, and recent publication impact, the index offers a nuanced understanding of both long-term productivity and short-term research activity. A total of 2311 researchers from 55 institutions leading to ranking according to H-Index.

The profiles displayed in the figures highlight the scientific achievements of researchers from leading Azerbaijani institutions, showing variations in citation impact and ranking positions at the global, national, and university levels (Figure 11). These differences reflect the diversity of research

strengths across fields, including physics, materials science, biotechnology, and medical sciences. At the institutional scale, the AD Scientific Index shows how the collective performance of affiliated researchers shapes the each university's overall ranking, revealing a direct correlation between individual scientific excellence and institutional visibility. This analytical framework is therefore valuable for identifying influential researchers, understanding research trends within institutions, and assessing the scientific competitiveness of universities on an international scale (Figure 12).




*** Total H Index Rankings**

Rankings


- 203,351**
World Rank
- 5**
Country Rank
- 1**
University

Ranking Based On Selection:
5



Ziya S Aliev | Ziya Aliyev, Ziya Sakhavaddin Aliev

Azerbaijan State University of Oil and Industry Baku, Azerbaijan



Engineering & Technology / Metallurgical & Materials Engineering
Materials Science | Quantum Materials | Topological Insulators | Crystal Growth | Superconductor

H-Index Metrics

Total	Last 5 Years	Last 5 Years / Total
35	28	0.800

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*** Total H Index Rankings**

Rankings

- 211,384**
World Rank
- 6**
Country Rank
- 1**
University

Ranking Based On Selection:
6



Elshan G. Hashimov | Гашимов Э.Г., Həşimov E.Q., Hashimov E.Q.

Azerbaijan Technical University Baku, Azerbaijan



Others
military science | GIS | modelling | mechanics

H-Index Metrics

Total	Last 5 Years	Last 5 Years / Total
34	33	0.971


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*** Total H Index Rankings**

Rankings


- 236,987**
World Rank
- 7**
Country Rank
- 4**
University

Ranking Based On Selection:
7



Khudaverdi Ganbarov

Baku State University Baku, Azerbaijan



Medical and Health Sciences / Virology
Microbiology | Micology and Biotechnology

H-Index Metrics

Total	Last 5 Years	Last 5 Years / Total
32	32	1.000


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*** Total H Index Rankings**

Rankings


- 253,790**
World Rank
- 8**
Country Rank
- 5**
University

Ranking Based On Selection:
8



Shahin S Agaev

Baku State University Baku, Azerbaijan



Others
Institute for Physical Problems | Baku State Universit

H-Index Metrics

Total	Last 5 Years	Last 5 Years / Total
31	27	0.871

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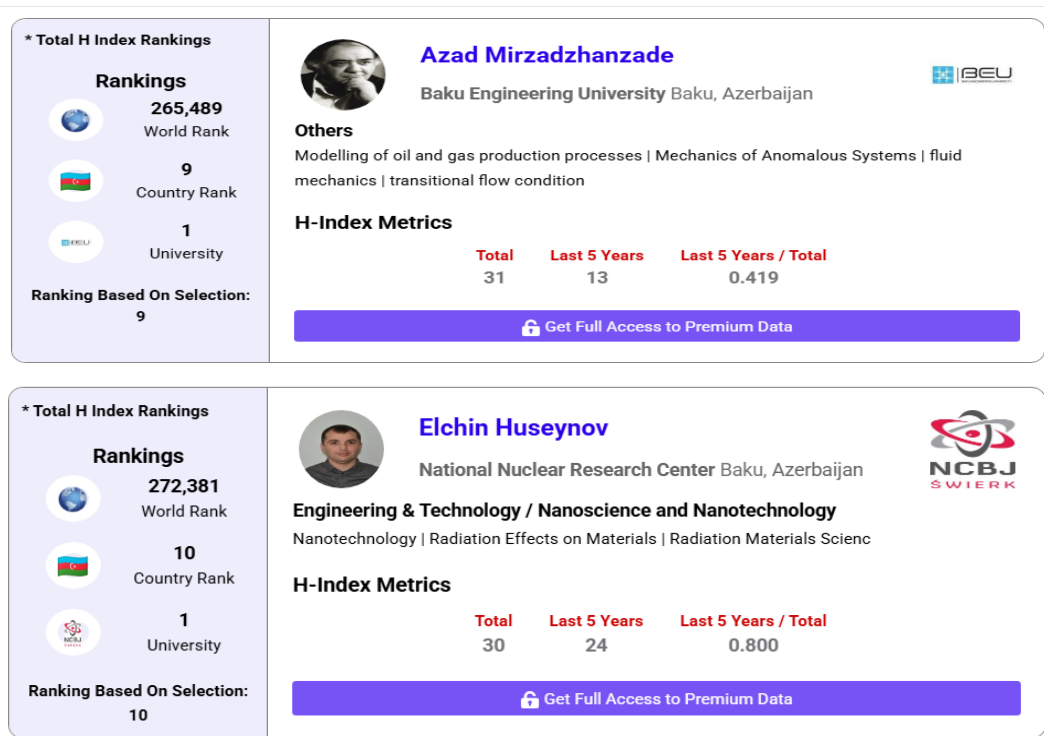
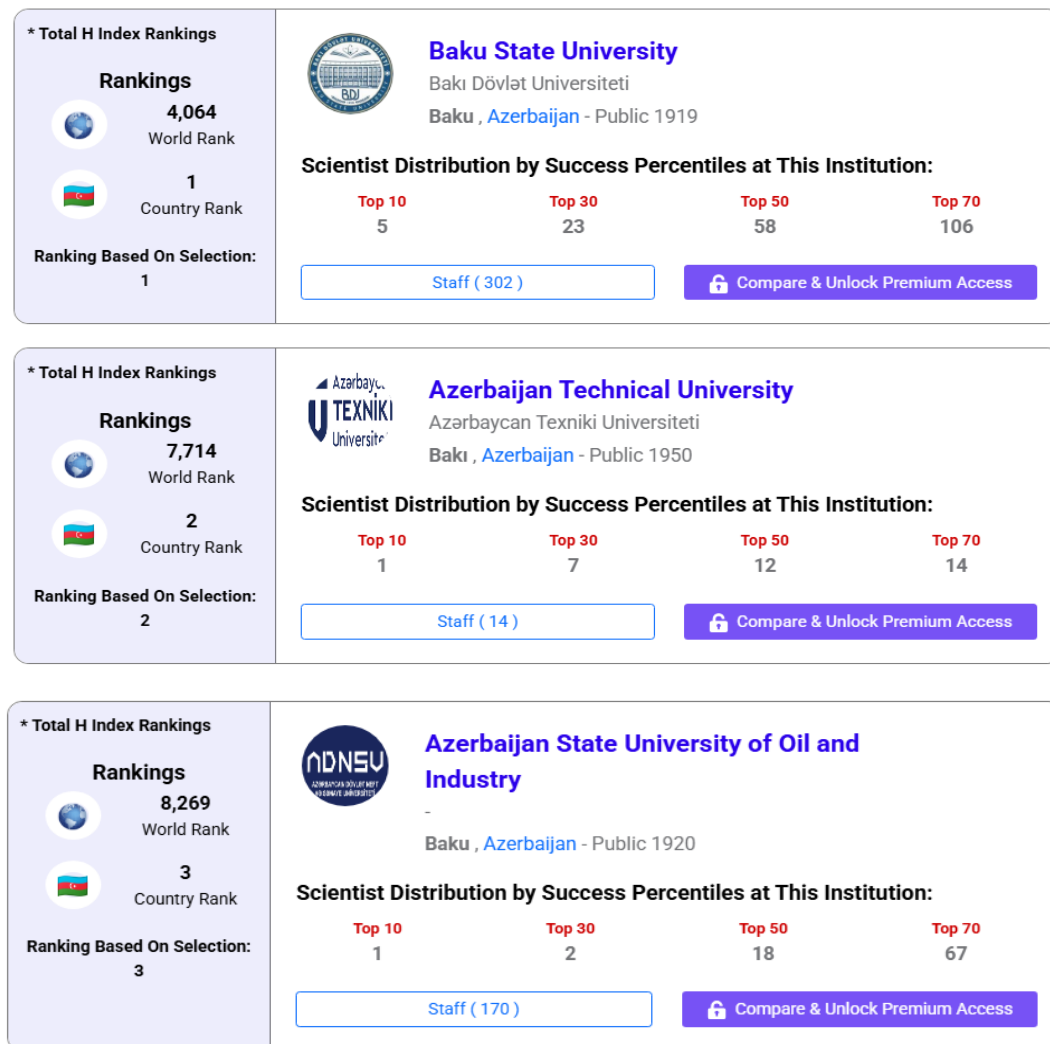


Figure 11. Evolution of the author's ranking on the AD Scientific Index



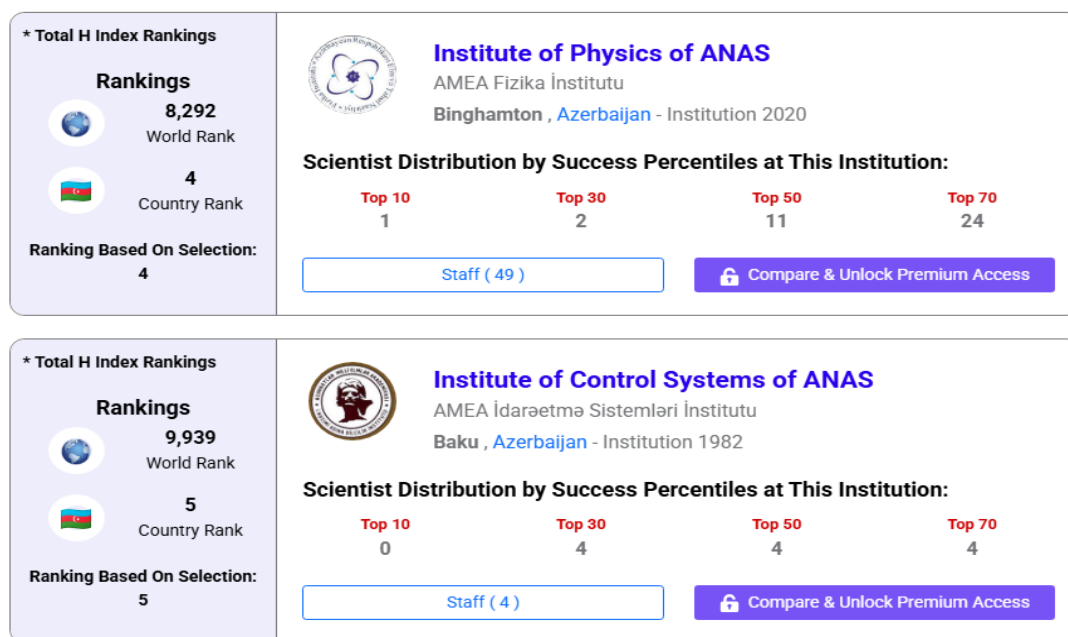


Figure 11. Top Institutions of Azerbaijan on the AD Scientific Index

Policymakers in Azerbaijan can be inspired by the three OIC leaders (Turkey, Iran and Saudi Arabia), who are increasingly making efforts in research. Turkey and Iran exceeded one million articles on Scopus according to data collected at the first december, 2025. Turkey has been ranked the top OIC country since 2024.

	Turkey	Iran	Saudi
2025	85216	70582	74257
2024	78517	76978	72824
2023	75344	76008	62665
Total	1111,901	1059,325	590,243

Data Scopus (Dec. 1st, 2025)

Conclusion

This bibliometric study provides a comprehensive long-term overview of Azerbaijan’s scientific production from 1990 to 2025, offering valuable insights into the evolution, structure, and dynamics of the country’s research landscape. The analysis of Scopus-indexed documents, combined with VOSviewer visualization, reveals a research system that has undergone a profound transformation over the past three decades. The results show a clear upward trajectory in scientific output, with a remarkable acceleration after 2015. This growth reflects the combined effects of national investment in research infrastructure, increased participation in international collaborations, and the expansion of higher education institutions. Subject-area analysis demonstrates that Azerbaijan remains firmly anchored in STEM disciplines—especially engineering, physics, chemistry, materials science, and mathematics—while simultaneously expanding into medicine, computer science, environmental sciences, and economics. This diversification indicates a gradual transition toward a more balanced and

multidisciplinary research ecosystem. The distribution of document types confirms that peer-reviewed articles dominate Azerbaijan's scientific communication, illustrating the country's commitment to global scientific visibility. At the institutional level, the Azerbaijan National Academy of Sciences remains the leading contributor, supported by major universities such as Baku State University, the Institute of Physics, and Western Caspian University. Emerging contributions from medical, economic, and technical universities further highlight the strengthening and diversification of the national academic system. International collaboration emerges as a core driver of Azerbaijan's scientific progress. Strong connections with Turkey, Saudi Arabia, China, India, Pakistan, Russia, USA, Iran, and several European countries illustrate the country's strategic geographic and scientific positioning between Asia and Europe. Co-authorship and country-level network visualizations show a dynamic and highly interconnected research environment, where Azerbaijani scholars benefit from global partnerships spanning multiple disciplines. These collaborations contribute not only to increased publication volume but also to higher citation impact, access to advanced technologies, and integration into global scientific networks, this study demonstrates that Azerbaijan has evolved from a modest scientific contributor in the early 1990s into an increasingly active and internationally engaged research player. The country's scientific landscape is now characterized by rapid growth, strong international partnerships, and widening thematic diversity. Moving forward, strengthening intra-national collaboration, improving research quality, and supporting interdisciplinary initiatives will be essential to consolidating Azerbaijan's scientific visibility and competitiveness. By providing a data-driven and multidimensional overview of Azerbaijan's research performance, this bibliometric analysis offers valuable guidance for policymakers, funding agencies, academic institutions, and researchers. It highlights both achievements and areas for future improvement, ultimately contributing to a deeper understanding of the country's current scientific trajectory and its potential for continued development in the global research arena.

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