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Scientific Landscape in the South Caucasus: A Comparative Analysis of Armenia, Azerbaijan, and Georgia (2012–2024)

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Abstract

This article presents a comparative analysis of the scientific output of Armenia, Azerbaijan, and Georgia over the period from 2012 to 2024. Using data from the Web of Science international database, the study will examine the research productivity and impact of these countries, highlighting trends, policies, and developments that have influenced their scientific landscapes. Special attention will be given to journal indexing policies, particularly those related to the inclusion of national and local journals in the Web of Science (WoS) and their impact on the number of publications form the perspective states.

The analysis begins by situating the scientific efforts of these republics within their historical context, reflecting on their roles around 33 years after regaining independence from the Soviet Union. It then focuses on the post-independence period, with a particular emphasis on the past decade. The article evaluates key indicators such as publication volume, citation metrics, and international collaborations. Special attention is given to recent policies and strategies implemented in Armenia, Azerbaijan, and Georgia to foster research and development, and their outcomes in terms of scientific progress.

This study aims to provide a comprehensive understanding of the similarities and differences in the scientific trajectories of these nations and their positions in the global scientific community during the specified timeframe of 2012-2024.

Introduction

The South Caucasus region, encompassing Armenia, Azerbaijan, and Georgia, has a complex scientific landscape shaped by historical legacies, political developments, and economic transformations. During the Soviet era, these three republics played distinct yet interconnected roles in the USSR's centralized scientific system. Research institutions, academies of sciences, and universities in the region benefited from substantial state funding and integration into the broader Soviet knowledge production framework. However, the dissolution of the Soviet Union in 1991 led to a period of economic and institutional decline, significantly affecting the scientific and technological capacities of these newly independent states (Chankseliani et all.2018; Chankseliani et. all, 2021).

Over the past three decades, Armenia, Azerbaijan, and Georgia have pursued different paths in revitalizing their research sectors, influenced by national policies, international collaborations, and economic constraints. Armenia has increasingly positioned itself as a hub for information technology and innovation, leveraging its strong diaspora connections and historical scientific expertise (Abramo et al., 2025; Gzoyan et al., 2023). Azerbaijan, with its resource-rich economy, has prioritized

applied research in energy and technology, seeking to integrate scientific advancements into its economic diversification efforts (Humbatova, 2021). Georgia, meanwhile, has focused on strengthening ties with European research institutions, aiming to modernize its academic infrastructure and increase participation in international projects (Chagelishvili, 2025).

Scientometric analysis provides a valuable tool for understanding the evolution and impact of research output in these countries. By examining publication trends, citation metrics, and international collaborations, this study aims to assess the scientific performance of Armenia, Azerbaijan, and Georgia within the broader global and regional contexts. Through this approach, we seek to identify key trends, challenges, and opportunities that shape the research landscapes of these nations, contributing to a deeper understanding of their scientific trajectories in the post-Soviet era.

This research builds upon the findings of our study "Comparative Analysis of the Scientific Output of Armenia, Azerbaijan, and Georgia," which examined the research productivity and collaboration patterns of these three South Caucasus countries up until 2013 (Gzoyan et al., 2015). While that study provided a foundational understanding of the region's scientific landscape, significant developments have occurred over the past decade, necessitating an updated analysis. Since 2013, Armenia, Azerbaijan, and Georgia have implemented various policy reforms, expanded international collaborations, and witnessed shifts in research funding and institutional priorities. This study aims to assess these changes by employing a scientometric approach to evaluate publication trends, citation impact, and regional as well as global integration in scientific research. By analyzing the latest data, this research seeks to provide a comprehensive overview of the evolving scientific output in the South Caucasus, identifying both progress and persistent challenges in the region's research landscape.

After seventy years of Soviet rule, Armenia, Azerbaijan and Georgia—along with twelve other post-Soviet states—regained their independence in 1991. However, independence came with significant political, social, and economic challenges, including crucial decisions regarding regional and global integration. In an effort to maintain its influence over the former Soviet republics, Russia initiated a new "integration project" almost simultaneously with the dissolution of the USSR—the Commonwealth of Independent States (CIS), also referred to as the Russian Commonwealth. All former Soviet republics, except for the Baltic states (Latvia, Lithuania, and Estonia), joined the CIS, which, as some analysts have described, functioned as a "civilized divorce" between Russia and its former republics. However, over time, the CIS proved to be largely ineffective, with its political relevance steadily declining.

Recognizing the limitations of the CIS, Russia launched new reintegration initiatives aimed at consolidating its influence in the post-Soviet space. These include the Collective Security Treaty Organization (CSTO), a military alliance formed to enhance regional security, and the Eurasian Economic Union (EAEU), modeled to some extent after the European Union's economic integration framework. Armenia, seeking to balance its foreign policy between East and West, initially engaged in

cooperation with both Russia-led and EU-led initiatives. The country's relations with the European Union began in 1999 with the signing of the EU-Armenia Partnership and Cooperation Agreement, which facilitated collaboration in political dialogue, economic development, trade, democracy, human rights, law-making, and cultural exchange. Armenia further participated in two key EU programs: the European Neighborhood Policy (ENP), since 2004, and the Eastern Partnership (EaP), since 2009, strengthening its engagement with European institutions. However, in 2013, Armenia opted to join the Eurasian Economic Union (EAEU) instead of signing an Association Agreement with the EU, marking a shift in its geopolitical trajectory (Sargsyan et al., 2020).

Georgia and Azerbaijan, while also part of the CIS in the 1990s, took divergent paths in their post-Soviet integration strategies. Georgia, following the 2003 Rose Revolution, actively pursued a pro-Western foreign policy, prioritizing deeper integration with the European Union and NATO. The country formally left the CIS in 2008 after its war with Russia and later signed an Association Agreement with the EU in 2014, reinforcing its European aspirations.

Meanwhile, Azerbaijan, despite being a CIS member, adopted a more independent and pragmatic foreign policy, leveraging its vast energy resources to maintain strategic partnerships with both Russia and Western countries. While Azerbaijan has engaged in select EU initiatives, such as the Eastern Partnership, it has refrained from deeper political or economic integration with either the EU or Russia-led blocs, preferring a non-aligned approach that maximizes its geopolitical leverage. Azerbaijan, however, has fostered exceptionally close relations with Turkey, a partnership rooted in deep historical, cultural, and linguistic ties (Mikail, et. al. 2019). The two countries often emphasize their bond through the phrase "One Nation, Two States," reflecting their strategic alliance in political, economic, and military domains. Turkey has played a crucial role in Azerbaijan's military modernization, particularly evident in the 2020 Nagorno-Karabakh war, where Turkish military support, including drone technology, significantly influenced the conflict's outcome. Economically, Turkey is a key transit country for Azerbaijani oil and gas exports, especially through major energy projects such as the Baku-Tbilisi-Ceyhan (BTC) pipeline and the Trans-Anatolian Natural Gas Pipeline (TANAP). These strong ties also extend to scientific and technological cooperation, with both countries engaging in joint research projects, educational exchange programs, and innovation initiatives, particularly in defense and energy sectors.

Since the early 1990s Turkey (Türkiye), after half a century of political, economic and cultural estrangement, has resumed its multifaceted engagement with the Caucasus (Sukiasyan et. al., 2025), alongside post-Soviet Central Asia and the post-communist Balkans. In 1992 Turkey became a founder of the Black Sea Economic Cooperation Organisation, with its headquarters in Istanbul; and during the 2000s and the 2010s asserted itself as a key player in major regional energy and transportation projects, including the Baku-Tbilisi-Ceyhan (BTC) and the Baku-Tbilisi-Erzerum (BTE) gas pipelines, the Trans-Anatolian Natural Gas Pipeline (TANAP), and the Trans-Caspian East-West Middle Corridor (known as the “Middle

Corridor") initiative connecting China and Turkey via Turkic Central Asia, Azerbaijan and Georgia (Yemelianova, 2023).

These divergent integration paths among Armenia, Georgia, and Azerbaijan have had direct implications for their scientific and technological development. While Georgia has sought closer collaboration with European research institutions, Armenia has attempted to balance cooperation between Russian and Western scientific networks. Azerbaijan, with its resource-driven economy and close ties with Turkey, has primarily invested in applied research tied to energy, infrastructure, and defense technology. This study examines how these geopolitical choices have influenced the scientific output of the three South Caucasus nations, analyzing recent trends, collaborations, and the broader regional research landscape.

Methods

This study is based on data retrieved from the Web of Science (WoS), InCites, and Journal Citation Report (JCR). The analysis encompasses scholarly publications affiliated with Armenia, Azerbaijan, and Georgia, indexed in WoS during the period 2012–2024. Citation data for the same timeframe were also included. The document types analyzed comprise WOS all types of documents.

Consistent with the challenges identified by Glänzel and Schlemmer (2009), accurately retrieving publications by country affiliation during the Soviet era presented methodological difficulties due to inconsistencies in institutional naming and geopolitical classifications. To address this, comprehensive search strategies were employed using both official and variant country names. In the case of Armenia, entries erroneously indexed under *Armenia (Colombia)* were manually identified and excluded. Similarly, for Georgia, records associated with the U.S. state of Georgia were filtered out to ensure the accuracy of national attribution.

To identify national/local journals, the Journal Citation Reports (JCR) were consulted. Additionally, a targeted search was conducted for journal titles containing the keywords "Armenian," "Georgian," and "Azerbaijani" to capture region-specific scholarly output not readily identifiable through affiliation data alone.

Analysis of Publication Trends in the South Caucasus (2012–2024)

Figure 1 illustrates the yearly distribution of scientific publications from Armenia, Georgia, and Azerbaijan as indexed in the Web of Science (WoS) between 2012 and 2024. The data reveal several notable trends and divergences in the scientific output of these three South Caucasus countries.

From 2012 to around 2018, all three countries displayed relatively modest but steady growth in publication output, with Armenia maintaining a slight lead over its neighbors. During this period, Armenia and Georgia showed gradual increases, while Azerbaijan's output remained close to theirs but slightly more variable.

A noticeable shift occurs around 2019–2020, where Azerbaijan's publication count begins to accelerate more rapidly, surpassing both Armenia and Georgia. This upward trajectory becomes particularly sharp between 2022 and 2024, culminating in a dramatic rise in 2024 where Azerbaijan reaches over 3,500 publications—nearly double that of Armenia and significantly more than Georgia.

Armenia and Georgia also experienced growth during this period, though at a more moderate pace. By 2024, Armenia surpassed 1,800 publications, while Georgia approached 1,600. The overall upward trend for all three countries suggests growing engagement in international research and increased visibility in indexed journals, but Azerbaijan's particularly steep rise in recent years indicates a potentially significant shift in research funding, institutional strategies, or international collaboration efforts.

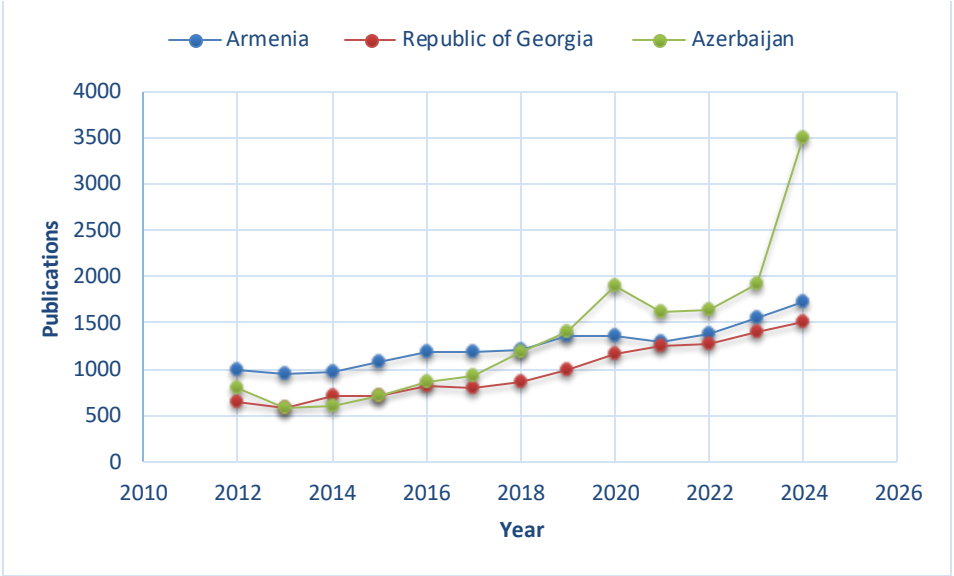


Figure 1. Yearly distribution of publications from Armenia, Georgia, and Azerbaijan (WoS, 2012–2024).

The next **Figure 2** shows the number of citations received by publications from Armenia, Georgia, and Azerbaijan between 2012 and 2024. Armenia had high citation numbers in the early years, especially in 2012 and 2018, reaching around 30,000 and 39,000 citations, respectively. Georgia saw a major peak in 2014, also with nearly 30,000 citations, while Azerbaijan showed more gradual growth, peaking in 2020 with close to 28,000 citations.

From 2012 to 2018, Armenia consistently had the most citations. Starting in 2019, Azerbaijan caught up and became the leading country in 2020. In the later years (2021–2024), citation numbers dropped for all three countries, but Azerbaijan maintained a relative lead, especially in 2023 and 2024.

Armenia's sharp rise in 2018 and Georgia's spike in 2014 stand out from the general patterns. Azerbaijan's peak in 2020 might be linked to increased international collaboration or activity in highly cited research fields.

Citation numbers declined significantly for all three countries after 2020. Armenia was most affected, with fewer than 5,000 citations by 2024. Possible reasons include a natural citation delay for recent publications, reduced research output, or external factors such as the COVID-19 pandemic.

The data reflect changing scientific visibility in the South Caucasus region. Armenia was the leader in earlier years, but Azerbaijan gained ground in recent times. Georgia's performance was more uneven, with one standout year in 2014. The overall decline in citations after 2020 suggests broader challenges that may require national-level strategies to improve research impact and visibility.

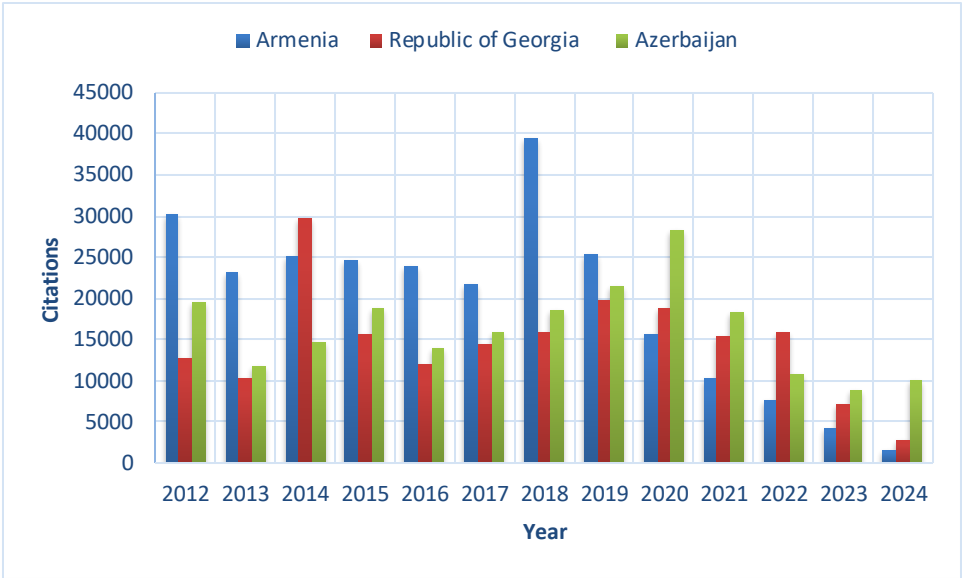


Figure 2. Annual distribution of citations received by publications from Armenia, Georgia, and Azerbaijan (WoS, 2012–2024).

The next focus of the research was on international collaboration of the tree states. The data in **Table 1** highlights the leading international partners in scientific collaboration for Armenia, Georgia, and Azerbaijan, reflecting both geopolitical alignments and strategic research ties.

The United States emerges as the top collaborator for both Armenia and Georgia, underscoring strong academic and institutional connections with North America. This trend aligns with broader political and educational exchanges between these countries and the U.S., as well as the influence of diaspora networks, particularly in Armenia's case.

For Azerbaijan, Turkey ranks first—a reflection of close historical, cultural, and political ties, including extensive bilateral cooperation in higher education and scientific exchange.

Russia ranks second for both Armenia and Azerbaijan, and is notably absent from Georgia's top five. This likely reflects the more strained post-Soviet relationship between Georgia and Russia, especially after the 2008 conflict. In contrast, Armenia and Azerbaijan maintain strong educational and research connections with Russian institutions, rooted in shared language, legacy networks, and continued participation in regional alliances.

Germany and Italy appear consistently across all three countries, suggesting a broader pan-European scientific engagement in the South Caucasus. Germany, in

particular, ranks within the top three for all, highlighting its role as a significant science and innovation partner in the region. France also features prominently for Armenia and Georgia, indicating active bilateral academic initiatives and EU-funded collaborations.

Interestingly, China appears only in Azerbaijan's list (3rd place), pointing to Baku's growing scientific and strategic cooperation with Beijing, likely tied to broader infrastructural and technological investments as part of China's Belt and Road Initiative.

Overall, this table illustrates how geopolitical orientation, historical ties, and strategic interests shape patterns of international research collaboration in the South Caucasus. Armenia and Georgia show stronger alignment with Western institutions, while Azerbaijan maintains close ties with Turkey and is diversifying eastward.

Table 1. Top 5 collaborating countries.

Rank	Armenia	Republic of Georgia	Azerbaijan
1	USA	USA	Turkey
2	Russia	Germany	Russia
3	Germany	United Kingdom	China
4	France	Italy	USA
5	Italy	France	Italy

The Contribution of National/Local Journals to Overall Scholarly Output

As a next step, we have tried to identify the role and share of national/local journals in the number of publications of three republics (Moed et. al., 2021). We have first identified the national journals indexed in the WoS/Scopus (**Table 2**).

Table 2. Local/national journals of Armenia, Georgia and Azerbaijan indexed in WoS (JCR 2023).

Armenia			
№	Name	Categories	Year Entered WoS
1	Armenian Journal of Mathematics	Mathematics	2020
2	New Armenian Medical Journal	Medicine, General & Internal	2020
3	Journal of Contemporary Physics-Armenian Academy of Sciences*	Physics, Multidisciplinary	2010
4	Journal of Contemporary Mathematical Analysis-Armenian Academy of Sciences*	Mathematics	2010
5	Astrophysics	Astronomy & Astrophysics	2004

Republic of Georgia			
№	Name	Category	Year Entered WoS
1	Journal of Homotopy and Related Structures	Mathematics	2010
2	Tbilisi Mathematical Journal	Mathematics	2020
3	Advanced Studies-Euro-Tbilisi Mathematical Journal	Mathematics	2022
4	Memoirs on Differential Equations and Mathematical Physics	Mathematics, Applied	2020
5	Transactions of A Razmadze Mathematical Institute	Mathematics	2020
6	European Journal of Transformation Studies	Political Science	2020
7	Georgian Mathematical Journal*	Mathematics	2009
Azerbaijan			
№	Name	Category	Year Entered WoS
1	Applied and Computational Mathematics	Mathematics, Applied	2009
2	TWMS Journal of Pure and Applied Mathematics	Mathematics; Mathematics, Appliied	2020
3	Proceedings of the Institute of Mathematics and Mechanics	Mathematics	2020
4	Azerbaijan Journal of Mathematics	Mathematics	2020
5	New Materials Compounds and Applications	Chemistry Multidisciplinary; Material Science, Multidisciplinary	2022
6	Processes of Petrochemistry and Oil Refining	Engineering, Chemical	2020
7	Khazar Journal of Humanities and Social Sciences	Social Sciences, Interdisciplinary	2020
8	SOCAR Proceedings	Engineering, Petroleum	2020

An examination of the national journals from Armenia, Georgia, and Azerbaijan indexed in the Web of Science (JCR 2023) reveals notable differences in scale, timing, and disciplinary focus, reflecting broader patterns in national research policy and academic development across the South Caucasus.

As of 2023, Azerbaijan leads the region with eight WoS-indexed journals, followed by Georgia with seven, and Armenia with five. While the numbers may appear

modest in absolute terms, they are significant for understanding each country's strategy for achieving international scientific visibility through academic publishing. A closer look at the chronology of indexing shows a clear regional trend: a major wave of journal inclusion occurred around 2020, likely the result of deliberate national efforts to meet international editorial and peer-review standards. In Armenia, both the *Armenian Journal of Mathematics* and the *New Armenian Medical Journal* were indexed in 2020, adding to earlier entries such as *Astrophysics* (2004) and two journals affiliated with the Armenian Academy of Sciences (2010). Georgia experienced a similar pattern, with four journals added in 2020, though its earliest inclusion, the *Georgian Mathematical Journal*, dates back to 2009. Azerbaijan also saw the majority of its journals indexed in or after 2020, with the exception of *Applied and Computational Mathematics* (2009), and the more recent *New Materials Compounds and Applications* in 2022.

In terms of scientific fields, a heavy concentration in mathematics is evident across all three countries. Armenia's indexed journals are predominantly in mathematics and physics, with a single title in medicine. Georgia's representation is also math-heavy, accounting for five out of seven journals, but it extends modestly into applied mathematics and political science. Azerbaijan, in contrast, demonstrates the broadest disciplinary range, with journals not only in mathematics but also in chemistry, materials science, petroleum engineering, chemical engineering, and interdisciplinary social sciences. This diversity suggests a more deliberate and multifaceted national strategy aimed at integrating a wider spectrum of disciplines into the international scholarly community.

The presence of legacy journals—such as those affiliated with national academies—indicates the role of traditional academic institutions in maintaining continuity, but the recent indexing of newer journals may reflect efforts to modernize editorial practices and increase impact metrics.

This comparison highlights the varied levels of institutional capacity, policy commitment, and strategic direction among the three countries. Azerbaijan appears to be the most proactive in expanding the scope of its internationally recognized journals, while Georgia is steadily reinforcing its strength in the mathematical sciences. Armenia, despite having fewer indexed journals, maintains a strong reputation in foundational sciences, though its narrower disciplinary scope may limit broader academic visibility.

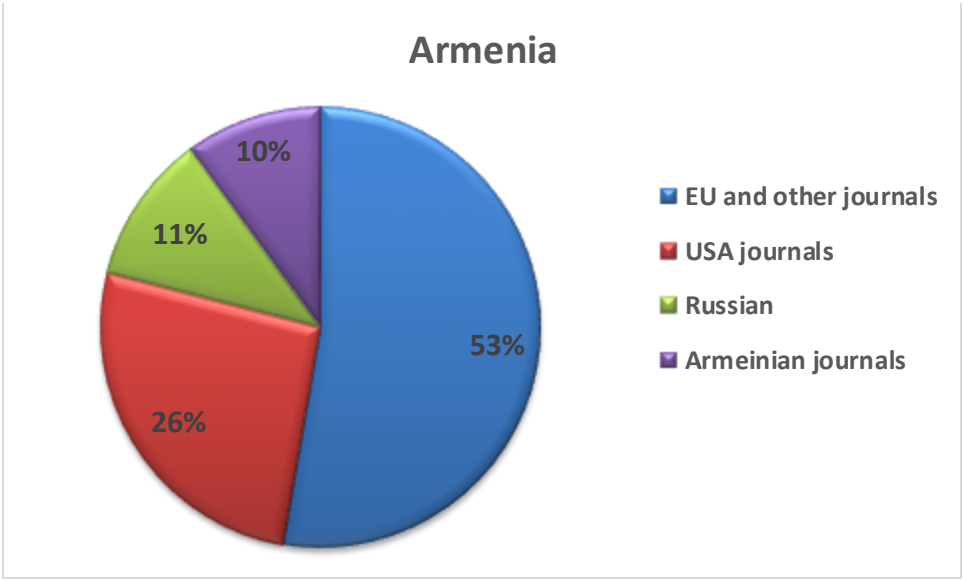
The distribution of publications in foreign journals presents the following picture (**Figure 3**). An analysis of publication data from Armenia, Georgia, and Azerbaijan between 2012 and 2024 reveals distinct trends in the use of Russian, U.S., Turkish, and nationally indexed journals, reflecting varying degrees of geopolitical orientation, linguistic affiliation, and academic strategy. Russian-indexed journals played a prominent role in the publication profile of Armenia and Azerbaijan, but far less so for Georgia.

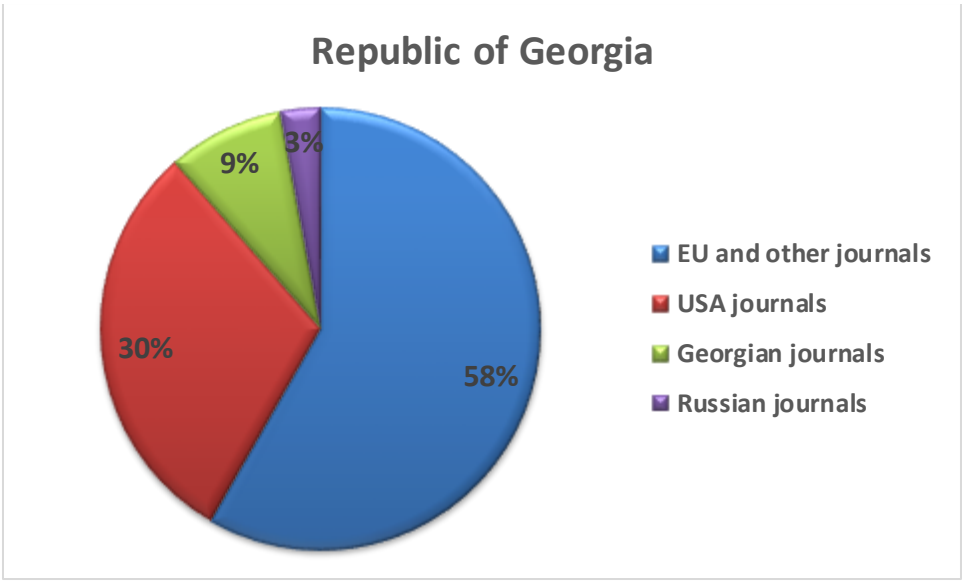
Specifically, 14% of Azerbaijani's publications appeared in Russian journals—by far the highest among the three countries—demonstrating Azerbaijani's strong post-Soviet scholarly ties and the continued use of the Russian language in certain scientific fields. Armenia followed with 3%, also indicating sustained academic

linkage with Russia. In contrast, Georgia's output in Russian journals was relatively marginal, at just 3%, consistent with its broader efforts to pivot toward Western academic integration.

U.S.-indexed journals constituted a significant share of publications across all three countries, but especially in Georgia, where they represented 30% of the total output. This was followed by Armenia at 26% and Azerbaijan at 15%. These figures suggest that all three states are engaged in global scholarly communication, though Georgia leads in Western journal dissemination. Turkish-indexed journals featured in Azerbaijani academic output although surprisingly slightly (2%), underscoring linguistic and cultural proximity as well as growing institutional cooperation between the two countries.

National journals accounted for a considerable share of total outputs, pointing to almost the same share (Armenia and Azerbaijan 10% and Georgia 9%). This representation suggests that for international visibility and citation impact, researchers across the region tend to favor publishing in national journals indexed in WoS and/or Scopus.





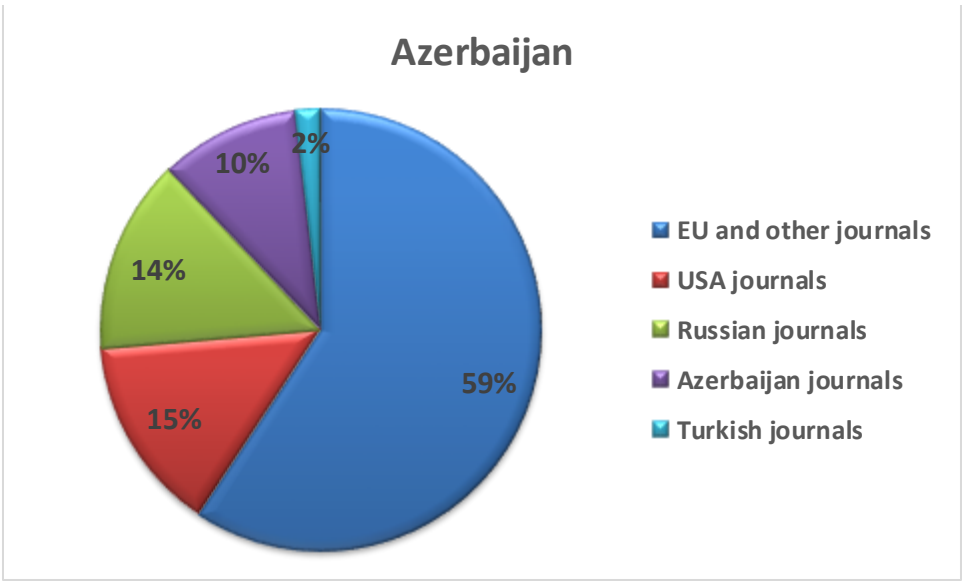


Figure 3. Percentage distribution of publications from Armenia, Georgia, and Azerbaijan by the country of indexed journals (WoS, InCites, 2012–2014), indicating the publishing countries of the respective articles.

Conclusion

This study provides a comprehensive scientometric analysis of the research output of Armenia, Azerbaijan, and Georgia from 2012 to 2024, revealing both shared challenges and divergent trajectories shaped by each country's geopolitical choices, policy priorities, and institutional capacities. While all three nations have demonstrated growth in publication volume and international collaboration, Azerbaijan has experienced a particularly sharp increase in research output since

2020. likely reflecting expanded state investment and broader international engagement, including with China and Turkey.

The data underscore the continued significance of historical and linguistic ties, with Russia remaining a key partner for Armenia and Azerbaijan, but largely absent in Georgia's scientific collaboration. Conversely, Georgia has shown the strongest integration with Western academic institutions, particularly through high publication rates in U.S.-indexed journals and consistent cooperation with European partners. Armenia remains more balanced in its orientation, maintaining ties with both Russian and Western networks.

National and local journals play a growing role in regional research visibility. Azerbaijan leads in the number and disciplinary diversity of WoS-indexed journals, while Georgia excels in mathematics-focused titles. Armenia, although maintaining a strong base in fundamental sciences, appears more limited in scope. The inclusion of national journals in global databases reflects a strategic effort to increase scientific visibility and foster domestic publication ecosystems.

The analysis also highlights notable disparities in citation performance, with Armenia leading in earlier years but Azerbaijan gaining prominence in recent times. The overall decline in citations after 2020 across all three countries may reflect broader structural challenges, such as delays in citation accumulation or disruptions due to the COVID-19 pandemic.

Ultimately, this study demonstrates that while Armenia, Azerbaijan, and Georgia have all made measurable progress in expanding their scientific output, their development paths remain shaped by differing political alignments, economic priorities, and integration strategies. Continued investment in research infrastructure, international collaboration, and journal development will be essential for sustaining and enhancing their positions in the global scientific landscape.

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