
Military Conflicts and Their Effects on Science: A Bibliometric Perspective



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ABSTRACT

This pilot study aims to explore the impact of military conflict on research productivity (RP), domestic and international collaboration by analyzing bibliometric indicators in seven selected countries. Five of these countries Iran, Israel, Russia, Saudi Arabia, Ukraine, and have been directly involved in military conflicts, while the other two Egypt and Türkiye function as buffer zone states. The analysis covers the five year period from 2020 to 2024. Metadata for 553,370 records were downloaded from Web of Science and InCites.

Although all seven countries contributed a relatively small share of global publications, Saudi Arabia increased its output 1.8-fold and achieved a significant rise in research impact. The other four countries directly involved in military conflicts reduced their share of global RP.

Countries directly involved in conflicts generally showed stagnation or modest declines in domestic collaboration (DS) and research impact, although Saudi Arabia's strong international collaboration (IC) contributed to its notable increase in publications and CNCI, despite being conflict-involved. Buffer-zone countries (Egypt and Türkiye) demonstrate growth in both RP and impact, benefiting from strengthened international partnerships and relatively stable domestic collaboration networks. Russia remained the only country with CNCI consistently below the global average. Across all countries, IC had a stronger influence on citation performance than DC, with multilateral networks involving four or more countries expanding noticeably by 2024. These patterns underscore the complex role of military conflict in constraining domestic research systems while simultaneously promoting selective international collaboration.

Keywords: Military Conflict, Country, Research Productivity, Domestic and International Collaboration, Category Normalized Citation Impact, Web of Science, Incites

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1. Introduction

Following the unimaginable suffering, destruction, and human loss caused by World War II, Europe enjoyed relative political stability for decades. This is why Russia's full-scale military operation in Ukraine in February 2022 came as a profound shock to the global community.

The impact of war or military conflict on science is complex and multifaceted. While there is a substantial body of literature addressing the causes and consequences of armed conflicts, their specific effects on scientific productivity and international collaboration remain underexplored. A bibliometric search in the Web of Science Social Sciences Citation Index (SSCI) yielded over 6,300 records published in the past five years on this topic [search was done on April 7, 2025]. Notably, over 41% of these publications were authored by U.S.-based researchers. Despite the rapid growth of scientific output from China, only 4.6% of the publications on this topic were contributed by Chinese scholars.

Wars and military conflicts have numerous consequences: mass human displacement and suffering, destruction of infrastructure and economic resources, and long-term environmental damage. In the scientific sphere, war can disrupt communication and international cooperation. However, in some historical contexts, military conflict has paradoxically stimulated scientific innovation, domestic and international collaboration. For instance, the Manhattan Project during World War II [Wellerstein, A.] <https://ethos.lps.library.cmu.edu/article/id/35/>, and more recently, advances in drone technology [Franke U., 2025] <https://ecfr.eu/article/drones-in-ukraine-four-lessons-for-the-west/>

Since 2022, Russian researchers have faced restrictions on international engagement, including the practical impossibility of attending global conferences due to travel limitations and rising costs. According to the Stockholm International Peace Research Institute (SIPRI) report for 2024, military expenditures worldwide rose for the ninth consecutive year, reaching a record high. The report also highlighted escalating ecological disruption, noting that 2023 was the hottest year in at least 174 years <https://www.sipri.org/yearbook/2024>.

In addition to the Russia–Ukraine war, other high-intensity conflicts have shaped the geopolitical and scientific landscapes of affected regions. These include the Israel–Palestine conflict, where Iran has provided significant financial and military support to Hamas. In one recent attack, Iranian missiles reportedly destroyed Israel's distinguished Weizmann Institute of Science (Matthew D., 2025). <https://sciencebusiness.net/news/international-news/weizmann-institute-missile-strikes-hits-eu-funded-research-projects>

Other longstanding tensions include the Israel–Syria conflict, which began in 1948, and the Syrian civil war, which erupted in 2011 and led to the collapse of the Assad regime.

The Eastern Mediterranean region including Cyprus, Egypt, Greece, Israel and the Palestinian Territories, Lebanon, Libya, Syria, and Türkiye has also seen rising tensions since the mid-2000s [2023] https://www.iiss.org/globalassets/media-library/content/migration/files/publications/free-files/strategic-dossier/preview-eastern-med/iiss_strategic-dossier-preview-turbulence-in-the-eastern-mediterranean.pdf.

The Gulf Cooperation Council (GCC), led by the Kingdom of Saudi Arabia (SA), remains a key regional player. As Hassan I. (2015) noted, the GCC has been increasingly shaped by Saudi Arabia's efforts to centralize influence and develop a unified foreign policy under King Salman and Crown Prince Mohammed bin Salman. [https://www.researchgate.net/publication/277566867_GCC's_2014_Crisis_Causes_Issues_and](https://www.researchgate.net/publication/277566867_GCC's_2014_Crisis_Causes_Issues_and_Solutions)

[Solutions](#). It is important to note that a comprehensive analysis of research publications (RP) and other bibliometric indicators of Middle Eastern countries over a period of more than 30 years (1981–2013), based on statistics from InCites, was conducted by Aêmad S. *et al* (2015).

Our pilot study aims to explore the impact of military conflict on scientific productivity, domestic and international collaboration by analyzing bibliometric indicators in eight selected countries. Six of these countries—Iran, Israel, Russia, Saudi Arabia, Ukraine, and Syria—have been directly involved in military conflicts, while the other two—Egypt and Türkiye—function as buffer zone states. The role and significance of buffer states were described by Atzili B. *et al* (2023). The analysis covers the five-year period from 2020 to 2024 and focuses particularly on trends in research productivity and impact of the military conflict on domestic and international scientific collaboration.

2. Methodology

The main sources of bibliometric statistics were products from Clarivate Analytics: Science Citation Index Expanded (SCI-

E), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), and the InCites analytical tool. The selected countries are: Iran, Israel, Russia, Saudi Arabia, Ukraine, Syria, Egypt, and Türkiye. Search was performed in 10.05.2025.

To monitor changes in research productivity (number of records), all document types were selected for the last 25-year period. Search strategy example was “CU=(IRAN) and PY= 2000-2024)”. This strategy was used for each selected country. Due to the relatively low number of records (approximately 500 publications per year), Syria was excluded from the analysis.

To evaluate the impact of a military crisis on bibliometric indicators, we downloaded metadata on 553,370 records for each selected country in 2020 and 2024.

The “Research Analysis” option in WoS was used to identify changes in research performance and patterns of international collaboration in each country.

The impact on research activity was assessed using statistics collected from InCites, including research productivity (RP), citation score, Category Normalized Citation Impact (CNCI), the share of publications in the top 10% most highly cited journals, and the share of domestic versus international publications, among other indicators.

It is a well-established phenomenon that international collaborative publications have a strong positive effect on citation impact, particularly on CNCI. The Category Normalized Citation Impact (CNCI) is a widely used measure of research influence. This “standard” CNCI approach compares the accumulated citation count of a document with that of other documents of the same type, published in the same year and in the same research area. A CNCI value of 1.0 represents performance at the world average.

A new indicator, Collaborative CNCI (Collab-CNCI), was officially introduced by Clarivate in 2022 in the Global Report Adams *et al.*: “Making it count: Research credit management in a collaborative world.” <https://clarivate.com/academia-government/lp/making-it-count-research-credit-management-in-a-collaborative-world/> However, the concept was introduced earlier by Potter, R. W. K. in 2021. Detailed explanations of this new collaboration metric are available in the InCites Help documentation: <https://incites.zendesk.com/hc/en-gb/articles/32405722942481-Collaboration>.

Collab-CNCI was developed as one additional step to normalize citation counts also for the collaboration type, distinguishing between domestic and international research. Next to Collab-CNCI, InCites includes a set of Collab-CNCI for each type of collaborative documents. The list of document’s classification is as following:

Domestic – Single Documents (DSD): publications where all authors are affiliated with the same institution in a single country.

Domestic – Multiple Documents (DMD): Publications where all authors are affiliated with multiple institutions within the same country.

International – Bilateral Documents (IBD): Publications with author addresses from exactly two distinct countries.

International – Trilateral Documents (ITD): Publications with author addresses from exactly three distinct countries.

International – Quadrilateral Documents (IQD): Publications with author addresses from four or more distinct countries.

The percentage of each type of domestic and international collaboration is also available.

To provide context on the economic conditions of the selected countries, we collected data from World Bank statistics on GDP, GDP per capita, and other relevant economic indicators in 2024 <https://data.worldbank.org/country/>

Data on R&D expenses of seven selected countries were collected from the website https://en.wikipedia.org/wiki/Global_Innovation_Index

3. Results and Discussion

3.1 Economic and Demographic Context

To contextualize research activity, we collected data from the World Bank on GDP, GDP per capita, R&D expenditure, and

population in 2024 (Table 1). Buffer-zone countries (Egypt and Türkiye) are marked with an asterisk.

Table 1. Key socioeconomic indicators for seven selected countries based on World Bank data, 2024. (Search 3.04.2025)

Country name	GDP, BLN, US \$	GDP growth, %%	R&D expenses, %% of GDP	GDP per Capita, US \$,	Population. MLN	Population Growth, %%	Life exp., Years	Internet users, %% of population
1	2	3	4	5	6	7	8	9
EGYPT*	389	2.4	1.02	3,389	116.6	1.7	72	73
IRAN	436.9	5.0	0.96	4,500	91.5	1.2	78	80
ISRAEL	513.6	2.4	6.00	52,642	9.7	2.1	83	87
RUSSIA	2.17 TRL	3.6	0.93	14,889	143.8	-0.2	73	92
UKRAINE	178.7	5.3	0.33	5,067	37.7	-8.4	73	82
SAUDI ARABIA	1.24 TRL	1.8	0.56	32,094	35.7	4.6	79	100
TURKIYE*	1.32	3.2	1.32	15,473	85.5	0.2	77	87

The indicators reveal substantial variation across the seven states. Russia, Saudi Arabia, and Türkiye reported the largest GDPs, while Israel stood out for its exceptionally high research intensity, allocating approximately 6% of GDP to R&D—the highest share globally. Saudi Arabia's R&D share remained modest at 0.56% of GDP, yet total expenditure rose to USD 6 billion in 2023, a 17.4% year-on-year increase, in line with the Vision 2030 initiative to diversify the economy and reduce oil dependence (Helou E.A., 2024).

Population dynamics also varied significantly. Russia had the largest population (143.8 million) but experienced negative growth (−0.2%). It was followed by Egypt (116.6 million) and Türkiye (85.5 million), the two buffer-zone states, both of which showed moderate growth. In contrast, Ukraine faced a sharp demographic decline (−8.4%). Life expectancy ranged from 72 years in Egypt to 83 years in Israel, while internet penetration spanned from 73% in Egypt to 100% in Saudi Arabia. These socioeconomic differences form an essential backdrop for interpreting research productivity and collaboration patterns.

3.2 Research Productivity and Impact

Analysis of global and country-level research productivity (RP) from 2000 to 2024 confirms the persistent growth trend described by Derek J. de Solla Price (1963), although with notable regional variation (Appendix 1). Between 2000 and 2013, global RP increased 1.7-fold, from 1.2 million to 2.1 million publications. Growth slowed between 2014 and 2021 (1.4-fold), reaching 2.9 million publications. Since 2022, however, global RP has modestly declined (~3%). Only Saudi Arabia and Türkiye maintained steady growth during this period. In the case of Saudi Arabia, the outstanding performance of its universities was examined by Hamdi A. Al-Jamimi et al. (Scientometrics, 2023).

The other five countries mirrored the global downturn reflecting combined effects of COVID-19 and ongoing conflicts, particularly the Russia–Ukraine war and the Israel–Hamas–Iran and Saudi Arabia–Yemen (Houthi) confrontation. Table 2 summarises RP trends for 2020 and 2024.

Table 2. Trends in Research Productivity, InCites, 2020 and 2024.

Country name	InCites Records, 2020	InCites, Records 2024
Global Science	2,991,498	2,979,508
EGYPT*	25,391	29,109
IRAN	56,665	46,845
ISRAEL	25,452	22,933
RUSSIA	71,560	43,308
SAUDIARABIA	31,428	53,948
UKRAINE	8,809	6,716
TURKIYE*	52,065	59,898

Research quality was assessed using InCites indicators, including Category Normalized Citation Impact (CNCI) and the share of publications in the top 10% of cited journals. The trends in quality indicators of research activity are presented in Table 3.

Table 3. The trends on quality indicators of research activity, InCites, 2020 and 2024

Name	Category Normalized Citation Impact		%Documents in Top 10%		Impact Relative to Global Science		% Global Science	
	2020	2024	2020	2024	2020	2024	2020	2024
Global science	1.02	1.00	10.73	8.41	1.05	1.05	100	100
EGYPT*	1.15	1.42	14.24	14.62	1.37	1.76	0.85	0.98
IRAN	1.01	1.12	11.79	10.80	1.33	1.49	1.89	1.57
ISRAEL	1.33	1.38	13.40	10.27	1.31	1.21	0.85	0.77
RUSSIA	0.71	0.73	5.67	4.96	0.70	0.82	2.39	1.45
SAUDIARABIA	1.30	1.41	16.12	14.71	1.65	1.88	1.05	1.81
TURKIYE*	0.92	1.01	9.41	8.32	0.97	1.07	1.74	2.01
UKRAINE	0.81	1.11	6.31	6.80	0.67	1.03	0.29	0.23

Although all seven countries contributed a relatively small share of global publications, Saudi Arabia increased its output 1.8-fold and achieved a significant rise in research impact. Notably, with the exception of Saudi Arabia, the four countries directly involved in military conflicts reduced their share of global research productivity.

Egypt and Saudi Arabia both reached CNCI values well above the global average in 2024 (1.42 and 1.41, respectively). Their strong performance reflected not only high levels of international collaboration but also a larger share of publications in influential journals, with their proportion of top-10%-cited papers exceeding those of other countries by approximately 1.5-fold.

In contrast, Russia was the only country with CNCI values below 1 in both 2020 and 2024, and it also had the lowest share of top-10 % cited publications. Ukraine, despite severe war-related challenges, exhibited modest CNCI growth and an increase in publications in the top 10%, likely linked to expanded international collaboration [Figure 1].

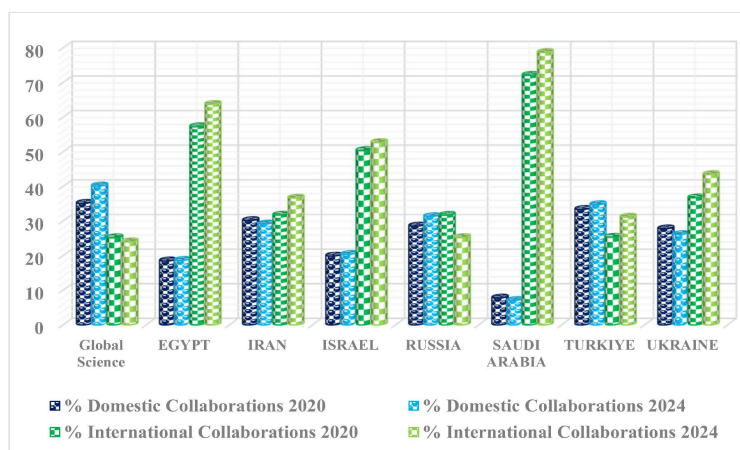


Figure 1. Trends on domestic and international collaboration, InCites, 2020 and 2024

3.3 Domestic and International Collaboration

The globalization of science has reshaped co-authorship patterns. One of the pioneers of studies on research collaborations was D. Price [1963], D. Beaver [1978], Braun T *et al* [1988]. According to D. Price, “the size of research teams and consequently the number of authors per paper increased after the Second World War in richer nations, driven by the cost of research, as part of the development of ‘big science’ [1963]. There is a huge amount of bibliometric literature devoted to the pattern of IC at various levels: countries, disciplines, and organizations. As C. Wagner *et al* [2015] noted, “International projects account for at least 20% of national government spending on scientific research. Some countries spend as much as 50% of these funds on international collaborations. Domestic collaboration (DC) reinforces national research systems, while international collaboration (IC) accelerates cross-border knowledge transfer. Gilyarevskii R. *et al.* (2024) investigated more than 30 years of co-authorship trends in Russia.

We analyzed DC and IC patterns for 2020 and 2024 using new InCites indicators: Domestic Single Documents (DSD), Domestic Multiple Documents (DMD), International Bilateral Documents (IBD), International Trilateral Documents (ITD), and International Quadrilateral or higher-order Documents (IQD) (Table 4).

At both global and national levels, DSD declined between 2020 and 2024, reflecting the reduced prevalence of research confined to single institutions. DMD remained relatively stable across most countries, except in Russia, where it increased to nearly 39%. This rise suggests that ongoing conflict may have strengthened intra-national collaboration. By contrast, Saudi Arabia displayed the weakest national co-authorship network, with only 11.5% DSD and 5.4% DMD, reflecting its disproportionately high reliance on IC.

International collaboration showed a slight negative trend in IBD across most countries, except Ukraine, where cooperation with Poland rose sharply to 21% in 202. IBD levels remained consistently higher than ITD and IQD. Globally, IBD, ITD, and IQD shares remained relatively low (d° 4.3% for IBD and \sim 3% for IQD), whereas all studied countries recorded significantly higher ITD and IQD proportions, indicating their integration into multilateral networks.

Saudi Arabia, Egypt, and Türkiye expanded collaboration with each other and with China, India, Pakistan, and the Arab states.

Despite sanctions, Iran increased cooperation with both the United States (9% in 2024) and China (7%), keeping the U.S. as its leading international partner.

Table 4. Tendencies on Domestic and International Documents, InCites, 2020 and 2024

Name	% Domestic Single Documents		% Domestic Multiple Documents		% International Bilateral Documents		% International Trilateral Documents		% International Quadrilateral + Documents	
	2020	2024	2020	2024	2020	2024	2020	2024	2020	2024
1	2	3	4	5	6	7	8	9	10	11
Global Science	35.5	32.1	35.6	40.1	16.9	15.7	4.3	4.4	2.5	3.0
EGYPT*	19.1	13.9	17.7	16.8	36.7	33.2	15.6	18.1	11.0	18.0
IRAN	35.5	32.5	28.6	27.4	22.7	23.9	7.5	8.6	5.6	7.6
ISRAEL	26.0	23.2	22.0	21.8	28.3	27.7	10.5	10.8	13.2	16.4
RUSSIA	31.3	28.6	35.1	39.0	17.8	16.4	7.6	6.5	8.2	9.5
SAUDI ARABIA	14.3	11.5	5.7	5.4	42.7	32.1	21.7	25.6	15.7	25.4
TURKIYE*	36.9	31.3	34.2	34.8	15.4	15.2	5.8	7.0	7.8	11.7
UKRAINE	27.6	20.3	21.4	15.5	27.5	31.4	10.5	13.1	12.9	19.7

Name	Web of Science Documents		Category Normalized Citation Impact		Collab-CNCI Domestic		Collab-CNCI International	
	2020	2024	2020	2024	2020	2024	2020	2024
1	2	3	4	5	6	7	8	9
Global Science	2,991,498	2,979,508	1.00	0.98	0.99	0.97	1.00	0.99
EGYPT*	25,394	29,144	1.15	1.42	0.97	1.14	0.94	1.11
IRAN	56,676	46,914	1.02	1.12	0.87	0.91	1.03	1.10
ISRAEL	25,478	23,118	1.32	1.39	0.87	0.87	1.06	1.06
RUSSIA	71,581	43,439	0.71	0.72	0.39	0.39	0.84	0.84
SAUDI ARABIA	31,444	54,074	1.30	1.40	0.90	0.93	1.00	1.07
TURKIYE*	52,088	60,063	0.92	1.01	0.70	0.73	1.01	1.03
UKRAINE	8,811	6,734	0.79	1.11	0.41	0.49	0.67	0.76

Table 5. Impact of domestic and international collaboration research quality, InCites, 2020 and 2024

3.4 Impact of Collaboration on Citation Performance

To assess the effect of collaboration on research quality, we used CNCI indicators for domestic and international publications (Table 5).

Between 2020 and 2024, CNCI values showed modest growth overall. Egypt, Iran, Israel, Saudi Arabia, and Ukraine all exceeded the global average, while Russia recorded minimal growth and the lowest values (0.71 and 0.72. In 2020, compared to 2024.

CNCI for domestic publications was generally lower (average ~0.9), except in Russia and Ukraine, where values were considerably lower (Russia: 0.39 in both 2020 and 2024; Ukraine: 0.41 in 2020 and 0.49 in 2024). In contrast, CNCI for international publications consistently outperformed domestic values across all countries. Russia exhibited the largest gap (0.39 domestic vs. 0.85 international in 2024), indicating the decisive role of international collaboration in boosting research impact.

4. Conclusion

This pilot study examined the effects of military conflict on scientific productivity, collaboration, and impact across seven countries in the Eastern Mediterranean and surrounding regions during 2020–2024. The countries are Egypt, Iran, Israel, Russia, Saudi Arabia, Ukraine and Türkiye. The analysis revealed several important patterns. Countries directly engaged in armed conflicts, such as Russia and Ukraine, experienced notable declines in research productivity and quality, while buffer-zone states, particularly Egypt and Türkiye, showed resilience and even growth. Saudi Arabia stood out for its rapid expansion of research output and rising impact, reflecting targeted investments in science and technology as part of its economic diversification agenda.

Across all countries, international collaboration proved critical for maintaining and enhancing research impact. CNCI values were consistently higher for internationally co-authored publications compared with domestic-only research, underscoring the importance of cross border cooperation in mitigating the negative effects of conflict. Russia's widening gap between domestic and international citation impact illustrates the exposure of research systems to global scientific networks.

The findings show that military conflict and instability not only disrupt national research systems but also reshape patterns of international collaboration. Buffer zone countries can play an important bridging role by maintaining stable ties with multiple partners. For policymakers, strengthening mechanisms that support international scientific collaboration even under conditions of geopolitical strain emerges as a key strategy to preserve research quality and global knowledge exchange.

Disclaimer

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Appendix

Trends on research productivity by selected countries according to Web of Science statistics. Search 10.05.2025. Buffer zone countries are marked with asterisk.