

Beyond the blockade: exploring research outputs in the Gaza strip

Más allá del bloqueo: Explorando la producción científica en la Franja de Gaza

Para além do bloqueio: Explorando a produção científica na Faixa de Gaza

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ORIGINAL

Abstract

Objective. This study examines the scholarly output of researchers from the Gaza Strip. **Method.** Data from the Scopus database was analyzed, revealing 4,076 documents authored by Gaza-based researchers by february 2024. Bibliometric analysis was conducted using SciVal and VOSviewer. **Results.** Gaza's research output has grown significantly, surpassing 400 publications annually in 2022 and 2023. Citation analysis indicates increased global visibility. Key research fields include Medicine, Engineering, Materials Science, and Physics. Institutions like the Islamic University of Gaza and Al-Azhar University of Gaza have made substantial contributions despite the siege imposed by Israel. Prolific authors and international collaborations have contributed to Gaza's growing research impact. However, local academic network limitations due to external constraints are evident in lower FWCI scores for national collaborations. **Conclusions.** This study highlights the resilience of Gaza's academic community and underscores the importance of supporting and recognizing the region's scholarly contributions.

Keywords: bibliometrics, Gaza, publication and citation, research impact, visibility

Resumen

Objetivo. Este estudio examina la producción académica de los investigadores de la Franja de Gaza. **Método.** Se analizaron datos de la base de datos Scopus, los cuales revelaron 4.076 documentos escritos por investigadores con sede en Gaza para febrero de 2024. El análisis bibliométrico se realizó utilizando SciVal y VOSviewer. **Resultados.** La producción científica de Gaza ha crecido significativamente, superando las 400 publicaciones anuales en 2022 y 2023. El análisis de citas indica una mayor visibilidad global. Los campos de investigación clave incluyen Medicina, Ingeniería, Ciencia de Materiales y Física. Instituciones como la Universidad Islámica de Gaza y la Universidad Al-Azhar de Gaza han realizado contribuciones sustanciales a pesar del asedio impuesto por Israel. Autores prolíficos y colaboraciones internacionales han contribuido al creciente impacto de la investigación de Gaza. Sin embargo, las limitaciones de las redes académicas locales debido a restricciones externas son evidentes en los puntajes FWCI más bajos para las colaboraciones nacionales. **Conclusiones.** Este estudio resalta la resiliencia de la comunidad académica de Gaza y subraya la importancia de apoyar y reconocer las contribuciones académicas de la región.

Palabras-clave: bibliometría, Gaza, publicación y citación, impacto de la investigación, visibilidad

Resumo

Objetivo. Este estudo examina a produção académica de investigadores da Faixa de Gaza. **Método.** Foram analisados dados da base de dados Scopus, que revelaram 4.076 documentos escritos por investigadores sediados em Gaza até fevereiro de 2024. A análise bibliométrica foi realizada utilizando SciVal e VOSviewer. **Resultados.** A produção científica de Gaza cresceu significativamente, ultrapassando 400 publicações anuais em 2022 e 2023. A análise de citações indica uma maior visibilidade global. As principais áreas de investigação incluem Medicina, Engenharia, Ciência de Materiais e Física. Instituições como a Universidade Islâmica de Gaza e a Universidade Al-Azhar de Gaza fizeram contribuições substanciais, apesar do cerco imposto por Israel. Autores prolíficos e colaborações internacionais contribuíram para o crescente impacto da investigação em

Gaza. No entanto, as limitações das redes acadêmicas locais, devido a restrições externas, são evidentes nos scores FWCI mais baixos para colaborações nacionais. **Conclusões.** Este estudo destaca a resiliência da comunidade acadêmica de Gaza e sublinha a importância de apoiar e reconhecer as contribuições acadêmicas da região.

Palavras-chave: bibliometria, Gaza, publicação e citação, impacto da pesquisa, visibilidade

1 Introduction

The Gaza Strip is a territory in Palestine that has been a subject of geopolitical disputes since 1948 (Golan, 2023). On the eastern coast of the Mediterranean Sea, Gaza is bordered by Egypt on the southwest and Israel on the east and north. It has faced challenges such as denial of Palestinian statehood, Israeli military occupation, and refugee status (Ali, 2023). Over the past three decades, Gaza has been separated and confined, creating a state of exception (Joudeh, 2021). The conflict has led to a humanitarian crisis, with restrictions on movement, high unemployment rates, poverty, and poor health conditions (Alokaily, 2024; Awadallah & Elessi, 2021; Beiraghdar et al., 2023; Farhat et al., 2023; Latifi-Pour & Zavareh, 2023).

Containing 2 million people inside a 365 km² enclave, it has been under a land, sea, and air siege imposed by Israel since 2007 (Borralho, 2022). The embargo has transformed the lives of its inhabitants, leading to a reconfiguration of the economy and dependence on underground conduits for basic supplies (Pelham, 2014). Israel's aim in imposing the siege was to reduce the size of Gaza's population by encouraging emigration (Farhat et al., 2023). This siege has profoundly impacted all facets of life in Gaza, including education, research, and academic endeavors (Alarabed, 2024; Barakat et al., 2020).

Despite structural limitations and resource constraints, universities in Gaza stand as bastions of resilience, embodying the aspirations of the Palestinian people for knowledge, empowerment, and self-determination. Gaza has endured several Israeli military operations, 2008-9, 2014, 2018-19, 2021, and 2023-25. The ongoing conflict has created a challenging environment for higher education and research, with a simultaneous process of construction and destruction undermining academic functioning (Jebri, 2023; Milton et al., 2023). On 9 October 2023, Israel declared a devastating war on Hamas and imposed a total blockade of the Gaza Strip. As of January 2024, Israel's offensive has either damaged or destroyed 70–80% of all buildings in northern Gaza, including universities (Chase, 2024). More than 85% of Palestinians in Gaza, or around 1.9 million people, were internally displaced, and one out of every 100 inhabitants were killed as of January 2024 (Bland, 2024). The United Nations has warned that Gaza could soon be uninhabitable (Nijim, 2023).

The objective of this work is to explore the bibliometric profile of the scientific research in Gaza in order to provide insights into the impact and visibility of Gaza's research on the global stage. This can help raise awareness of the valuable contributions being made by Gazan researchers and advocate for increased recognition and support for their work. This can inform initiatives aimed at supporting and strengthening Gaza's research ecosystem, ultimately empowering Gazan researchers to contribute meaningfully to global scientific progress and address the pressing challenges facing their communities.

This work is also dedicated to the memory of Taya S.A., President of the Islamic University of Gaza and a prominent physicist and mathematician, who was tragically killed, along with his family, in an Israeli airstrike on northeastern Gaza on December 2, 2023. Additionally, it honors the memory of all innocent scientists from Gaza who have been deliberately killed during this conflict.

2 Methodology

This study employed a bibliometric approach to systematically map and evaluate the research output of authors affiliated with institutions in the Gaza Strip. The methodology consisted of two sequential phases: (1) document retrieval and refinement from the Scopus database, and (2) quantitative analysis of the resulting corpus using SciVal and VOSviewer.

2.1 Document collection

The Scopus database¹ was utilized to retrieve documents authored by researchers from the Gaza Strip using the search query “Gaza” in the search field “Affiliation.” However, it was observed that some documents were unrelated to the Gaza Strip but instead pertained to the province of Gaza in Mozambique. To refine our search, we added a filtering search field "AND NOT 'Mozambique'" in "Affiliation Country." The Scopus document search was conducted on February 5th, 2024, resulting in 4,826 documents, comprising 3,878 articles, 198 reviews, 103 book chapters, 6 books, 60 letters, and 520 conference papers. More than 98% of these documents were in English. A final dataset of 4,076 documents, including only research articles and reviews, was selected for bibliometric analysis. The overall search string used is (AFFIL(Gaza) AND NOT AFFILCOUNTRY(Mozambique)) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re")).

2.2 Data analysis

The final dataset was exported to SciVal², a research analytics tool developed by Elsevier that offers metrics and insights into research performance (Mhamdi, 2023; Nadi-Ravandi & Batooli, 2022). Bibliometric analysis involved examining publication and citation metrics, subject areas and prominent topics, prolific authors, most cited papers, and international collaboration. The obtained results were then exported from SciVal to Microsoft Excel for visualization in the form of tables and graphs. The country collaboration network was constructed using VOSviewer³, a specialized bibliometric analysis tool commonly used to visualize bibliometric networks (Mhamdi, 2023).

3 Results and Discussion

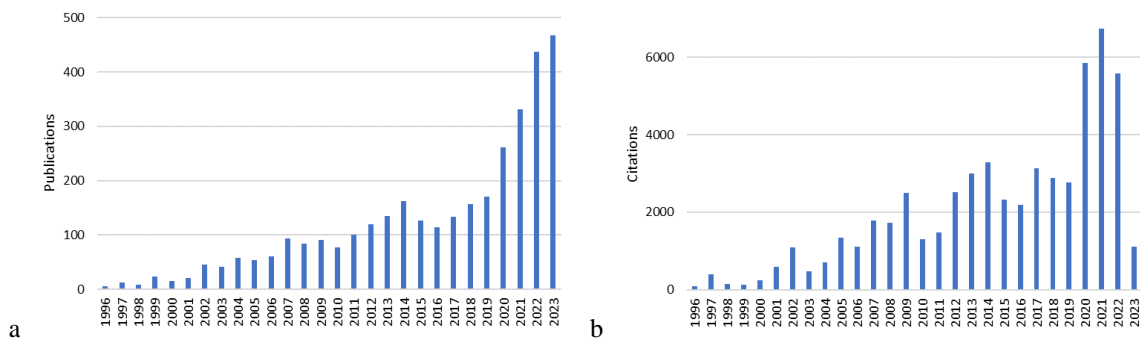
The bibliometric analysis of 4,076 documents authored by Gaza-affiliated researchers yielded a range of findings regarding publication output, citation impact, thematic focus, leading authors, and international collaboration. This section presents those results and offers a contextual discussion of their implications.

3.1 Publication and citation patterns

A total of 4,076 publications from the Gaza Strip were retrieved from the Scopus database by February 2024, comprising 3,878 articles and 198 reviews, reflecting a notable scholarly output from the region. Since SciVal does not include data prior to 1996 and 2024 remains incomplete, our analysis focuses on the period from 1996 to 2023. The publication and citation metrics for this interval are presented in Figure 1.

Figure 1

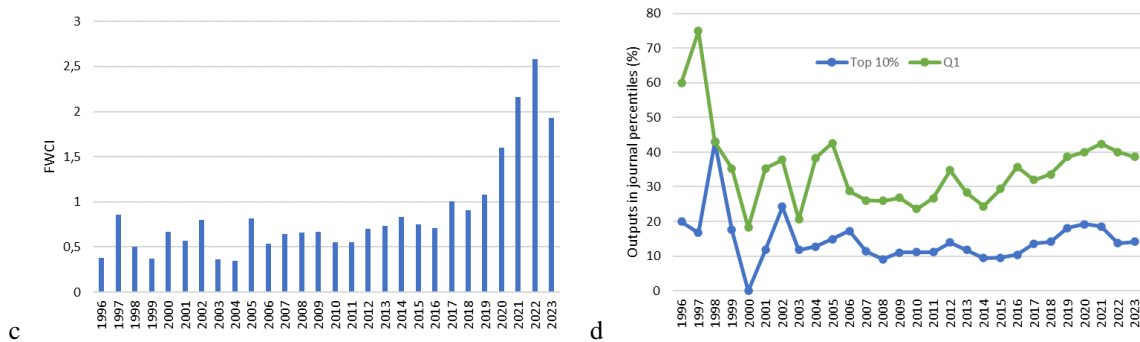
Evolution of publications (a), citations (b), Field-Weighted Citation Impact (FWCI) (c), and outputs in top journal percentiles (d) during the period from 1996 to 2023 in the Gaza Strip.



¹ Scopus is available at: <https://www.scopus.com/>

² SciVal is available at: <https://www.scival.com/>

³ VOSviewer is available at: <https://www.vosviewer.com/>



Note. Data source: SciVal (<https://www.scival.com/>). [Figure description] Four-panel chart grid (1996–2023). Panel (a), upper left: vertical bar chart of annual publications; bars rise from a low baseline in 1996 to over 400 in 2022 and 2023. Panel (b), upper right: vertical bar chart of annual citations; bars show accelerating growth across the period, exceeding 6000 citations in 2021. Panel (c), lower left: vertical bar chart of FWCI scores with a horizontal reference line at 1.0 (global Scopus average); bars start below 1.0, cross it around 2009, and climb higher, exceeding 2.5 in 2022. Panel (d), lower right: line graph tracking outputs in top journal percentiles; two lines represent the top 10% and Q1, both trending upward over the last decade, reaching around 20% and 40% respectively in 2020 [End of description].

A steady increase in annual publications is observed, reaching more than 400 publications per year in 2022 and 2023. The upward trend in annual publications, particularly since 2020, indicates an increasing scholarly engagement despite all the constraints faced by researchers in the region. The citations count also significantly increased, notably in recent years, amassing a total of 57,294 citations from 1996 to 2023 (retrieval date february 2024). The Field-weighted Citation Impact (FWCI), which considers average citation rates in the field providing a normalized impact measure, also significantly increased. It surpassed the threshold value (1.0) since 2019, indicating that Gaza’s publications have a citation impact significantly higher than the global average of the Scopus database. The average FWCI score during the last 10 years (2013-22) registered at 1.54, and that of the last five complete years (2018-22) registered at 1.9. This surge in citation impact not only reflects the quality and significance of the research conducted in the region but also demonstrates its increasing visibility and influence worldwide. The global percentage of self-citation did not exceed 9%. The proportions of documents published in the top journal CiteScore percentiles during the last ten years were 14.6% and 36.3% in the top 10% and top 25% percentiles, respectively (Figure 1d).

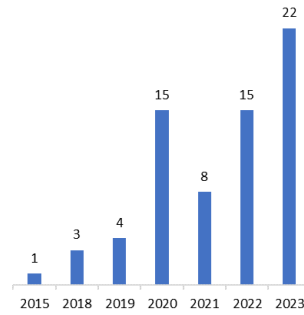
The CiteScore of Scopus differs from the Impact Factor of Clarivate by relying on a 4-year citation window rather than a 2-year one. This extended timeframe accommodates more recent years' citations, potentially rendering CiteScore more robust and stable (Fernandez-Llimos, 2018). The distribution of documents across top journal CiteScore percentiles indicates a notable presence of high-quality research output from Gaza in reputable academic journals. This suggests that Gaza's researchers are not only producing a substantial volume of research but are also publishing in journals with high impact and visibility within their respective fields.

Moreover, Gaza’s research demonstrates tangible real-world influence, as evidenced by citations in international patents. Over the past decade (2013–2022), scholarly outputs from the Gaza Strip were cited 71 times across 68 international patents, primarily from the United States (55 patents), followed by the World Intellectual Property Organization (7), the European Patent Office (4), and Japan (2). The fact that U.S.-based patents account for the majority of citations underscores the international reach and potential commercial impact of this work.

While these citations reflect the global relevance of Gaza’s research, it is important to note that the direct contribution of Gaza-based researchers to these patents appears to be very limited or absent. This suggests that their work is primarily being referenced for its foundational knowledge rather than as part of collaborative or proprietary patent development. Figure 2 illustrates the trend of patents citing Gaza’s research, highlighting its role in supporting innovation, albeit indirectly.

Figure 2

Number of international patents citing articles coauthored by researchers from Gaza published during the period 2013–22.



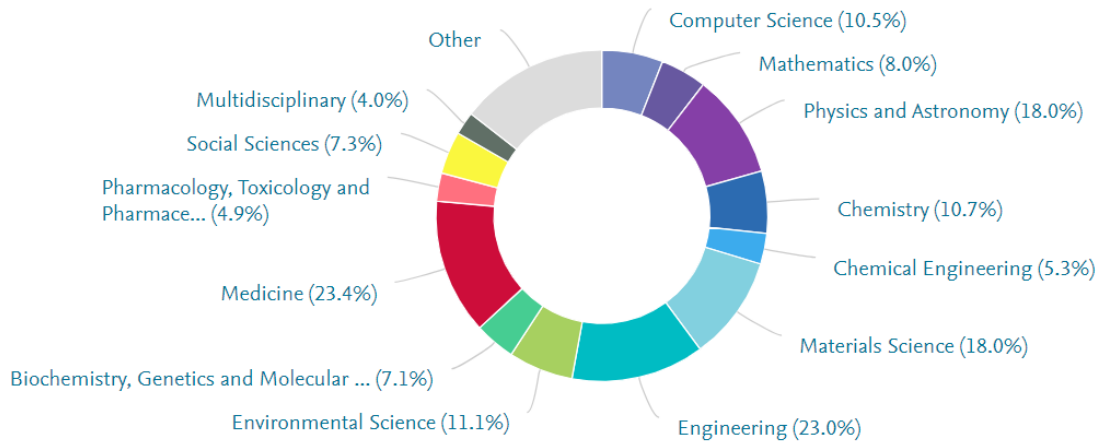
Note. Data source: SciVal (<https://www.scival.com/>). [Figure description] The histogram illustrates the yearly number of international patents that reference scholarly work co-authored by researchers from Gaza (based on articles published between 2013 and 2022). The chart reveals a significant rise in patent citations, with one patent in 2015, three in 2018, four in 2019, 15 in 2020, eight in 2021, 15 in 2022, and 22 in 2023 [End of description].

3.2 Subject areas and topics

Gaza’s publications span several Scopus subject areas, with Medicine (23.4%), Engineering (23%), Materials Science (18%), Physics and Astronomy (18%), Environmental Science (11.1%), Chemistry (10.7%) and Computer Science (10.5 %) emerging as the most prolific (Figure 3).

Figure 3

Publication shares by subject area for the period spanning 2013 to 2022.



Note. Data source: SciVal (<https://www.scival.com/>). [Figure description] Donut chart showing the percentage distribution of Gaza Strip publications across Scopus subject areas (2013–2022). Segments are labeled with field and share: Medicine 23.4%, Engineering 23%, Materials Science 18%, Physics and Astronomy 18%, Environmental Science 11.1%, Chemistry 10.7%, and Computer Science 10.5%. Medicine and Engineering together comprise nearly half the output [End of description].

The SciVal’s topic classification offers a potent tool for navigating the intricate scientific research landscape of Gaza. With around 96,000 topics formed through direct citation linking, Gaza’s researchers contributed to 1,068 topics and 505 topic clusters over the last 10 years (Table 1).

Most topic clusters are exhibiting high prominence, determined by citation count, Scopus view count, and average journal CiteScore, giving a nuanced understanding of topic’s momentum. The most prolific topic cluster is [Concretes; Compressive Strength; Cements] with 155 papers and FWCI of 5.37, and a 100% prominence percentile, highlighting an area of active research. This suggests that Gaza’s researchers are actively addressing issues related to infrastructure development and building resilience in the face of societal challenges (Almeshal et al., 2022; Elsayed et al., 2022; Tayeh, Akeed, et al., 2022b, 2022a; Tayeh, Hakamy, et al., 2022), a critical

priority given the region’s recurrent conflicts and reconstruction needs. This research directly addresses local demands for durable, low-cost building materials to mitigate housing shortages and post-war recovery challenges. Similarly, clusters like [Groundwater; Aquifers] and [Post-Traumatic Stress Disorders; Disasters] reflect urgent social priorities, including water scarcity and mental health crises exacerbated by geopolitical instability.

However, high-impact clusters such as [Photonic Crystals] (FWCI: 1.47) and [Metamaterials] (FWCI: 2.06) demonstrate a parallel emphasis on cutting-edge science, likely driven by global academic trends rather than immediate local applications. While these fields enhance Gaza’s scientific reputation, their societal linkage is less direct. Notably, research on [COVID-19] (FWCI: 2.63) and [Breast Cancer] (FWCI: 1.18) bridges both global relevance and regional health needs, suggesting a balanced approach to addressing pressing local issues while contributing to international scholarship. Table 1 further underscores this duality, with high-FWCI clusters like [Corrosion Inhibitors] (FWCI: 3.55) serving industrial applications globally, while others like [Construction Industry] (FWCI: 0.9) align closely with Gaza’s reconstruction efforts. This indicates a forward-looking approach to research, with an emphasis on exploring new frontiers and pushing the boundaries of knowledge in science and technology. By actively engaging with diverse research themes and demonstrating high levels of prominence and citation impact, Gaza’s researchers are making significant contributions to their respective fields and enhancing the region’s reputation as a hub of scientific inquiry and innovation.

Table 1

Top 30 topic clusters by document number (2013-2022).

Topic Cluster	Scholarly Output	Field-Weighted Citation Impact	Prominence percentile
Concretes; Compressive Strength; Cements	155	5.37	100
Photonic Crystals; Photonics; Waveguides	88	1.47	83
COVID-19; SARS-CoV-2; Coronavirus	47	2.63	100
X Rays; Fluorescence; Shielding	45	3.31	61
Plasmons; Metamaterials; Surface Plasmon Resonance	39	2.06	100
Photocatalysis; Photocatalysts; Solar Cells	37	0.79	100
Post-Traumatic Stress Disorders; Wounds and Injuries; Disasters	37	1.13	87
Estimator; Models; Variable Selection	36	0.96	86
Corrosion; Carbon Steel; Corrosion Inhibitors	35	3.55	86
Fractional Differential Equation; Positive Solution; Impulsive	33	3.6	54
Groundwater; Groundwater Resources; Aquifers	30	0.68	77
Optimization; Algorithms; Evolutionary Algorithms	28	4.31	92
Construction; Construction Industry; Project Management	28	0.9	94
Synthesis (Chemical); Derivatives; Pyridines	23	0.58	87
Silicon Solar Cells; Solar Cells; Silicon	23	0.41	70
Breast Neoplasms; Early Detection Of Cancer; Women	22	1.18	74
Adsorption; Adsorbents; Activated Carbon	21	1.81	97
Cognitive Radio; MIMO Systems; Orthogonal Frequency Multiplexing	20	0.92	97
Anti-Bacterial Agents; Infection; Methicillin-Resistant <i>S. Aureus</i>	20	0.97	97
Microbial Fuel Cells; Anaerobic Digestion; Bioreactors	20	0.57	99
Health; Research; Income	20	0.8	50
Harmonic Generation; Crystals; Nonlinear Optics	19	1.03	45
Obesity; Motor Activity; Child	18	0.71	98
Work; Personality; Psychology	18	1.89	98
Algorithms; Computer Vision; Models	16	1.42	100
Students; Medical Students; Education	15	1.62	95
Radon; Radioisotopes; Radioactivity	14	0.85	67
Fractional; Fractional Order; Derivatives	14	2.51	87
Ion Selective Electrodes; Potentiometers; Ionophores	14	0.5	37
Climate Models; Model; Rainfall	13	0.76	99

Note. Data source: SciVal (<https://www.scival.com/>). [Figure description] The table lists the top 30 research topic clusters from 2013-2022, ranked by the number of scholarly documents. For each cluster, the table provides the corresponding Scholarly Output, Field-Weighted Citation Impact, and Prominence Percentile. A FWCI score greater than 1.0 indicates that the publications have a citation impact higher than the global average of Scopus. The prominence percentile gives an indication of the momentum of the topic, highlighting areas of active research [End of description].

3.3 Highly cited papers

The top 10 most cited papers with first author from the Gaza strip are given in Table 2.

In construction engineering, Tayeh et al. (2012, 2013) investigated the mechanical and permeability properties of interfaces between regular and ultra high-performance concretes, contributing to the development of stronger and more durable structures. Alnahhal et al. (2018) explored the use of recycled materials and waste products in concrete production, demonstrating a sustainable approach while maintaining essential properties. Enshassi et al. (2007, 2009) shed light on the complexities of construction projects in this region. Their studies identified factors like material shortages and political instability as key hurdles impacting efficiency and cost. Thabet et al. (2002, 2008) and Thabet & Vostanis (2000) explored public health concerns related to occupation and violence in the region. Their research painted a poignant picture of the long-term effects of war trauma on children and adults, highlighting the prevalence of post-traumatic stress disorder and emotional problems. Venturing into mathematics, Matar et al. (2021) investigated the p-Laplacian nonperiodic nonlinear boundary value problem utilizing generalized Caputo fractional derivatives. These studies showcase the breadth and significance of research conducted in the Gaza Strip, spanning practical applications in construction and public health to theoretical advancements in mathematics. They demonstrate the dedication and potential of researchers in the region, contributing to progress across diverse disciplines.

Table 2

Top 10 most cited research papers with first author from Gaza during the period 1996-2023

Article title	Citations	Reference
Mechanical and permeability properties of the interface between normal concrete substrate and ultra high-performance fiber concrete overlay	317	(Tayeh et al., 2012)
Factors affecting labour productivity in building projects in the Gaza strip	203	(Enshassi et al., 2007)
Post traumatic stress disorder reactions in children of war: A longitudinal study	179	(Thabet & Vostanis, 2000)
Delays and cost overruns in the construction projects in the Gaza Strip	174	(Enshassi et al., 2009)
Emotional problems in Palestinian children living in a war zone: A cross-sectional study	172	(Thabet et al., 2002)
Characterization of the interfacial bond between old concrete substrate and ultra high-performance fiber concrete repair composite	155	(Tayeh et al., 2013)
Knowledge, attitude, practice, and toxicity symptoms associated with pesticide use among farm workers in the Gaza Strip	152	(Yassin et al., 2002)
Investigation of the p-Laplacian nonperiodic nonlinear boundary value problem via generalized Caputo fractional derivatives	140	(Matar et al., 2021)
Exposure to war trauma and PTSD among parents and children in the Gaza strip	135	(Thabet et al., 2008)
Assessment on engineering properties and CO2 emissions of recycled aggregate concrete incorporating waste products as supplements to Portland cement	130	(Alnahhal et al., 2018)

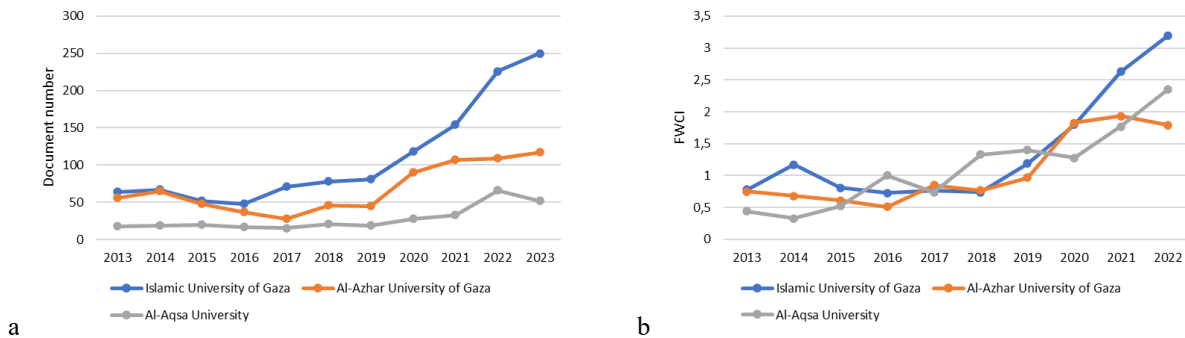
Note. Data source: Scopus (<https://www.scopus.com/>). [Figure description] This table lists the top 10 most cited research papers with a first author from Gaza between 1996 and 2023, excluding review articles. For each entry, the article title, citation count, and bibliographic reference are provided. The citation counts range from 130 to 317, as retrieved from Scopus in February 2024 [End of description].

3.4 Top institutions

The top three universities in the Gaza Strip are outlined in Figure 4. Over the period from 2013 to 2022, the Islamic University of Gaza produced a total of 959 papers, garnered 20,659 citations, and achieved a FWCI score of 1.83. Established in 1978 in Gaza City, the Islamic University of Gaza stands as an independent Palestinian institution. It has faced multiple attacks, notably during the 2008 Gaza War, the 2014 Israel–Gaza conflict, and the 2023 Israel–Hamas war, resulting in significant destruction of its infrastructure and educational facilities (Murphy, 2009; Mwafy, 2020; O’Malley & Sawahel, 2023; WSJ, 2014). Sadly, Taya S.A. the university president and a prominent physicist and mathematician, was tragically killed alongside his family in an Israeli airstrike during the 2023 Israel–Hamas conflict (Reuters, 2023).

Figure 4

Publication (a) and citation impact (b) of the top 3 universities in the Gaza strip (2013-2023). A FWCI score greater than 1.0 indicates that the publications have a citation impact higher than the global average of the Scopus database. Note that 2023 is still an incomplete year at the time of data retrieval.



Note. Data source: SciVal (<https://www.scival.com/>). [Figure description] Two-panel comparison of Gaza's top three universities (2013–2023). Panel (a), left: vertical bar chart of annual publications by institution; the Islamic University of Gaza consistently has the tallest bars, followed by Al-Azhar and Al-Aqsa, with decade totals of 959, 631, and 256 papers respectively. Panel (b), right: line graph of annual FWCI; the Islamic University line sits highest, peaking at 3.19 in 2022 (decade average 1.83), while Al-Azhar averages 1.27 and Al-Aqsa 1.39. The global Scopus average is 1.0. Data for 2023 are incomplete as of the retrieval date [End of description].

Ranked second among the top institutions is Al-Azhar University of Gaza, which produced 631 papers, received 10,476 citations, and obtained a FWCI score of 1.27. Established in 1991, Al-Azhar University is a public, non-profit, and independent educational institution. It too suffered severe damage during the 2023 Israel–Hamas conflict (Middle East Monitor, 2023).

Finally, Al-Aqsa University, the first higher education institution in the Gaza Strip founded in 1955, produced 256 papers, received 4,167 citations, and achieved an FWCI score of 1.39. On February 6th, 2023, Israeli warplanes targeted Al-Aqsa University in Gaza City, causing extensive damage (Euro-Med, 2024a).

According to Scholars Against the War on Palestine (SAWP), all 11 of the enclave's universities, including those mentioned above, have been targeted by Israeli bombings since October 7, 2023 (Toolkit - Scholars Against the War on Palestine, 2024). These acts have been characterized as "scholasticide," a term coined by Palestinian professor Karma Nabulsi, indicating the deliberate destruction of educational infrastructure and the harm inflicted upon educators and students (Toolkit - Scholars Against the War on Palestine, 2024). Such actions, as highlighted by the Euro-Med Monitor, are considered violations of international law and constitute war crimes under the Geneva Conventions and the Rome Statute of the International Criminal Court (Euro-Med, 2024b). It also affirmed that these actions are part of Israel's recent openly declared policies, aiming to make the Gaza Strip an uninhabitable place, forcibly displacing its inhabitants by creating an environment devoid of the basic elements of life and services.

The systematic targeting of these institutions reveals the broader struggle for public education in Gaza. Universities here are not merely academic centers but lifelines for socioeconomic development, training engineers, doctors, and scientists critical for post-war recovery. These universities play a unique role in democratizing access to education amid poverty and blockade, fostering a generation of researchers who address both local challenges and global scientific frontiers. Their destruction undermines Gaza's capacity to rebuild and innovate, violating international law and perpetuating cycles of deprivation. The resilience of these institutions, despite repeated attacks, underscores the urgent need for international protection of academic spaces as zones of peace and progress.

3.5 Top authors

The top 30 authors by h-index are given in Table 3. These top authors are affiliated to the Islamic University of Gaza (16), Al-Azhar University of Gaza (12), and Al-Aqsa University (2). Ten authors exhibited an h-index above 20. The most prolific and impactful author among them is Tayeh B.A. from the Islamic University of Gaza with 260 documents and an h-index of 60. More than 88% of his documents (177) are classified in the top 25% most cited documents worldwide. His average FWCI score is 5.08. The most contributed Topics during the period

spanning 2018–22 are: [Mechanical Properties; Self Compacting Concrete; Concrete Slabs (23 documents)], [Geopolymers; Coal Ash; Alkali (21 documents)], and [Rubber Waste; Mechanical Properties; Tires (18 documents)].

The most prolific and impactful author from the Al-Azhar University is Alajerami Y.S.M. with 113 documents and an h-index of 30. More than 86% of his documents (60) are classified in the top 25% most cited documents worldwide. His average FWCI score is 1.78. The most contributed Topics during the period spanning 2018–22 are: [Radiation Shield; Gamma Ray; Shielding (40 documents)], [Breast Neoplasms; Mammography; Early Detection of Cancer (3 documents)], and [Computed Tomographic Angiography; Image Quality; Coronary Artery Atherosclerosis (3 documents)].

The most prolific and impactful author from the Al-Aqsa University is Awadallah M.A. with 102 documents and an h-index of 32. More than 66% of his documents (49) are classified in the top 25% most cited documents worldwide. His average FWCI score is 3.42. The most contributed Topics during the period spanning 2018–22 are: [Metaheuristics; Fireflies; Chiroptera (14 documents)], [Economic Dispatch; Particle Swarm Optimizer; Economics (5 documents)], and [Feature Subset Selection; Genetic Algorithm; High-Dimensional Data (5 documents)].

Table 3

Top 30 most prolific authors in the Gaza Strip (as of February 2024).

Rank	Author	Affiliation	<i>h</i> -index	<i>h</i> ₅ -index	Documents	Citations
1	Tayeh, B.A.	Islamic University of Gaza	60	38	261	9,995
2	Awadallah, M.A.	Al-Aqsa University	32	19	102	3,014
3	Alajerami, Y.S.M.	Al-Azhar University of Gaza	30	14	113	2,633
4	Taya, S.A.	Islamic University of Gaza	29	12	210	2,989
5	Safi, Z.	Al-Azhar University of Gaza	25	16	85	2,082
6	Safi, Z.S.	Al-Azhar University of Gaza	25	16	85	2,082
7	Enshassi, A.	Islamic University of Gaza	23	5	81	1,726
8	El-Nahhal, I.M.	Al-Azhar University of Gaza	23	6	80	1,586
9	Salem, J.K.	Al-Azhar University of Gaza	21	6	58	1,246
10	Daher, M.G.	Islamic University of Gaza	17	7	64	567
11	Hammad, T.M.	Al-Azhar University of Gaza	17	4	34	866
12	Abu-Naser, S.S.	Al-Azhar University of Gaza	17	7	49	724
13	Shabat, M.M.	Islamic University of Gaza	16	6	189	1,044
14	Abadla, M.M.	Al-Aqsa University	16	10	35	531
15	Sirdah, M.M.	Al-Azhar University of Gaza	16	3	32	703
16	El-Ashgar, N.M.	Islamic University of Gaza	15	2	46	758
17	El-Agez, T.M.	Islamic University of Gaza	15	3	45	663
18	Matar, M.M.	Al-Azhar University of Gaza	15	11	48	686
19	Zaggout, F.R.	Al-Azhar University of Gaza	15	1	28	452
20	Saadeh, S.M.	Islamic University of Gaza	14	4	32	526
21	Abdel-Latif, M.S.	Islamic University of Gaza	14	1	36	713
22	El-Khozondar, H.J.	Islamic University of Gaza	13	8	103	695
23	Bottcher, B.	Islamic University of Gaza	12	9	54	363
24	Elmanama, A.A.	Islamic University of Gaza	12	4	31	445
25	Kodeh, F.S.	Al-Azhar University of Gaza	12	5	26	323
26	Abu-El-Noor, N.	Islamic University of Gaza	12	7	44	360
27	Sharif, F.A.	Islamic University of Gaza	12	1	24	340
28	Awadallah, A.M.	Islamic University of Gaza	11	2	36	339
29	Aljeesh, Y.	Islamic University of Gaza	11	4	41	298
30	Yassin, M.M.	Islamic University of Gaza	10	4	37	542

Note. Data source: Scopus (<https://www.scopus.com/>). [Figure description] The table ranks the top 30 most prolific authors from the Gaza Strip, listing their affiliation and key bibliometric indicators: *h*-index, recent *h*₅-index of the last five years (2019-2022), total Scopus documents, and citation count [End of description].

3.6 Collaborating countries

Gaza's researchers are engaged in collaborations with 159 countries worldwide, as illustrated by the VOSviewer collaboration network in Figure 5. Notably, the top collaborating countries are Egypt (466 papers), Saudi Arabia

Israeli interference inhibits also academic effectiveness, reduces collaboration, and prevents international visits, equipment supply, and employment of foreign teaching staff (Stefanini, 2015). At various times, campuses have been ordered closed, while during "routine" times, the inviting of guest lecturers has been banned, as have departures abroad for training and conferences (Matar, 2024).

Moreover, Gaza's higher education system has been repeatedly subjected to attacks, resulting in the destruction of infrastructure and loss of life (Jebril, 2023; Milton et al., 2023). Among its thousands of airstrikes on Gaza during the last war, the Israeli army deliberately and specifically targeted academic, intellectual, and scientific figures in Gaza. Dozens of them were killed in direct strikes on their homes without prior warning and crushed under the rubble with their families (Euro-Med, 2024a).

The Israel's military attack, characterized by widespread and deliberate destruction of cultural and historical properties, such as universities, schools, libraries, and archives, is part of Israel's declared policies to make Gaza uninhabitable, creating a coercive environment devoid of the minimum essentials of life and services, which may eventually force its residents to migrate (Euro-Med, 2024b).

4 Conclusions

In conclusion, our comprehensive bibliometric analysis sheds light on the scholarly landscape within the Gaza Strip, offering insights into the remarkable resilience and perseverance of researchers amidst challenging circumstances. Despite facing enduring constraints due to resource limitations, and the physical barriers imposed by the siege and occupation, Gaza's academic community has demonstrated a remarkable commitment to advancing knowledge across various disciplines.

The substantial increase in publications over the years, coupled with a notable rise in citation impact, underscores the growing recognition and influence of research originating from Gaza on the global stage. This upward trajectory in scholarly output, particularly evident in recent years, reflects the unwavering dedication of researchers to overcome barriers and contribute meaningfully to their respective fields. Despite facing significant adversity, researchers affiliated with institutions such as the Islamic University of Gaza, Al-Azhar University of Gaza, and Al-Aqsa University have emerged as influential contributors to their fields, garnering international recognition for their work. However, it is essential to acknowledge the profound impact of occupation on academic institutions and individuals within the Gaza Strip. The deliberate targeting of universities and scholars by military actions not only undermines academic freedom and scholarly exchange but also perpetuates cycles of violence and oppression.

In light of these challenges, it is imperative for the international community to recognize the vital role of academic solidarity and support in safeguarding the integrity and autonomy of Gaza's academic institutions. Efforts to promote research collaboration, capacity-building initiatives, and advocacy for academic freedom are essential steps towards promoting a conducive environment for scholarly inquiry and innovation within the Gaza Strip.

Ultimately, our study underscores the resilience, innovation, and potential of Gaza's academic community to overcome adversity and contribute meaningfully to the advancement of knowledge and human welfare. By amplifying the voices and achievements of researchers within the region, we hope to inspire greater recognition and solidarity with Gaza's scholarly endeavors, ultimately contributing to the pursuit of peace, justice, and intellectual freedom in the region and beyond.

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