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Independent Researchers and Their Scholarly Influence: A Scientometric Review

Fatemeh Salehi[1]✉, and **Alireza Noruzi**[2]

1. Corresponding author, Department of Information Science and Knowledge Management, Faculty of Public Administration and Organization Science, College of Management, Tehran, Iran. E-mail: salehi78f@gmail.com
2. Department of Information Science and Knowledge Management, Faculty of Public Administration and Organization Science, College of Management, Tehran, Iran. E-mail: noruzi@ut.ac.ir

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ABSTRACT

Objective: This bibliometric study aims to investigate the trends of publications contributed by 'independent' researchers indexed in the Web of Science Core Collection (WoS).

Methods: This research was conducted using scientific visualization techniques and other scientometric tools to effectively understand the scientific status of articles authored by independent researchers by collecting and analyzing various indicators of publications, countries, subject areas, languages, authors, institutes, journals, keywords, number of citations, and subject analysis. An advanced search was conducted on May 20, 2023, and the search results included articles in all languages from 1945 to 2023. This search retrieved 1,713 documents.

Results: The documents of independent researchers fall into two categories: those conducted solo and those written in collaboration with one or more other authors. Multi-authored documents of independent researchers have received more citations than those authored by independent researchers. Common topics of interest among independent researchers include COVID-19, myocardial infarction, Buerger's disease, epidemiology, oxidative stress, obesity, mortality, risk assessment, and Alzheimer's disease. Independent researchers are present in many countries across all continents. The number of papers contributed by independent researchers has increased significantly since 1975, peaking in 2020.

Conclusion: This study explored the trends of publications contributed by independent researchers. These scholars play a crucial role in advancing scientific knowledge. Notably, multi-authored documents authored by independent researchers received more citations than solo-authored works. As the number of papers contributed by independent researchers continues to rise, their impact remains a vital force in scholarly communication.

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Introduction

An "*independent researcher*" or "*independent scholar*" is an individual who conducts research outside the traditional framework of academic, corporate, or government institutions. They are typically self-funded or rely on grants, donations, crowdfunding, or other non-institutional sources of support. Independent researchers often work on topics of personal interest or niche areas that may not align with mainstream academic, institutional or industrial priorities. Their work can span various fields, including science, technology, humanities, and social sciences.

The *Research Excellence Framework* (2021) defines an "Independent Researcher" as: "*an individual who undertakes self-directed research, rather than carrying out another individual's research programme*."[1] In the current study, an independent researcher, scholar or author is someone who is not a university-bound academic and is mainly addressed his/her affiliation in the international databases as independent, independent consultant, independent researcher, independent scholar, freelance researcher, and freelance scholar.

The current research was inspired by a note entitled '*The dangerous myth of the "independent researcher"'* written by James Hayton (2023), where Hayton asked the following question: "Why do [*independent researchers*] co-author papers?"[2] When we collected the data, our assumption was that papers written by *solo* independent researchers receive fewer citations than papers written by independent researchers in collaboration with an academician. In other words, the assumption of the current study is that *solo* independent researchers receive fewer citations than multi authors. "*It's because people do better work when they can freely exchange and debate ideas, when they can collaborate with people with different expertise, when they can get feedback, or even when they can have arguments with people who fiercely disagree with them …*" (Hayton, 2023).

Solo-authorship refers to the situation where a person credited and takes full responsibility for the creation of a work which can be anything like an academic work, a novel, a piece of art, or even a song. In our research we focus on academic works such as articles, books, meeting abstracts, and so on. In this case, the author or researcher receives all the acknowledgement and recognition for the work published. Besides that, authors have freedom to develop and comment on their ideas without compromise or influence from others. But it has limitations, especially about complex projects since demand expertise beyond a single person's capabilities, and collaboration can bring diverse perspectives and resources.

Co-authorship refers to a situation where two or more individuals engage in a collaborative effort to produce a work and subsequently allocate recognition for its completion. This work can includes research papers, novels, musical pieces, artistic collaborations, or any other product requiring multiple contributors. Each person who participated in the collaboration receives

recognition for their contribution to the final work. Combining different perspectives and expertise can lead to a better and more comprehensive final product. Collaboration allows access to resources and skills unavailable to a single individual. Clear communication, outlining responsibilities, and determining authorship order are crucial to avoid conflicts and ensure fair recognition for all. Fields like scientific research, where diverse expertise is required for a complete understanding of the subject matter, or creative works seeking to combine different artistic styles. However, based on Sooryamoorthy's research (2009), co-authorship alone does not ensure higher rates of citation for South African publications, particularly in certain disciplines. The analysis of the data revealed that documents in psychiatry, biochemistry, agriculture, and material sciences are bound to receive a greater number of citations even if they are single-authored. In the same way the number of authors does not affect the number of citations for research in the fields of veterinary science and zoology (Sooryamoorthy, 2009).

Scientific collaboration among researchers is an essential factor in the production of scientific publications. Research and review articles co-authored by two or more researchers are more likely to attract attention and citations than those conducted by a single author. Sooryamoorthy's research (2009) unequivocally shows that researchers with more international collaborations also tend to publish more single-author papers. Moreover, research collaboration significantly increases the visibility of scientists and heightens the likelihood of receiving citations (Mirnezami & Mohammadi, 2022).

Regarding the receiving of citations, it is commonly believed that multi-authored articles receive more citations. This belief is supported by numerous studies across various fields (e.g., Mondal & Jana, 2018; Persson et al., 2004; Yaminfirooz & Ardali, 2018). Smart and Bayer discovered that multi-authored articles not only have a higher acceptance rate, but this can be attributed to their collaborative nature, which is seen as a mark of quality. Furthermore, this relationship remains consistent regardless of whether self-citation is considered. Although this holds true in general, there are certain cases within specific subjects or disciplines where single-authored articles receive more citations than collaborative ones. In terms of authorship type and collaboration, joint authorship or co-authorship articles significantly surpass single authorship articles, particularly in terms of citation reception. The number of citations is expected to increase with an increase in the number of authors. There is also a growing trend of collaborating with foreign institutions, and articles that result from international collaborations tend to receive more citations than those that are conducted locally or nationally (Peidu, 2020; Velez-Estevez et al., 2022).

The purpose of this bibliometric study was to investigate the trends of publications contributed by ‘independent’ researchers, as indexed in the Web of Science Core Collection maintained by Clarivate Analytics.

Materials and Methods

This applied bibliometric research was conducted using scientific visualization techniques and other scientometric tools to effectively understand the scientific status of articles authored by *independent researchers* by collecting and analyzing various indicators of publications, countries, subject areas, languages, authors, institutes, journals, keywords, number of citations and subject analysis.

The Web of Science Core Collection maintained by Clarivate Analytics was used to obtain the primary data (i.e., articles contributed by *independent researchers* or *freelancers*), including the following databases SSCI: Social Science Citation Index/ CPCI-S: Conference Proceedings Citation Index- Science/ ESCI: Emerging Sources Citation Index/ A&HCI: Arts & Humanities Citation Index/ CPCI-SSH: Conference Proceedings Citation Index- Social Science & Humanities/ IC: Index Chemicus.

We conducted a search in the '*address*' field using the advanced search interface search on May 20, 2023, with the following search command:

AD=("Independent" OR "Freelance" OR "Independent Consultant" OR "Independent Res*" OR "Independent Scholar" OR "Freelance Acad*" OR "Freelance Agronomist" OR "Freelance Architect" OR "Freelance Artist" OR "Freelance Consultant" OR "Freelance Crystallog" OR "Freelance Data Scientist" OR "Freelance Educ* Consultant" OR "Freelance Epidemiologist" OR "Freelance Healthcare Data Scientist" OR "Freelance Med* Writer" OR "Freelance Profess*" OR "Freelance Res*" OR "Freelance Sci* Writer" OR "Freelance Stat* Consultant" OR "Freelance Statistician" OR "Freelance Vet*" OR "Freelance Writer" OR "Vet Freelance" OR "DVM Freelance") NOT AD=("Independent Univ*")

The document types were not limited, and *All Languages* was subsequently selected as the document language from 1945 to 2023. This search retrieved 1,713 documents. Then, the data were extracted as 500-unit batches with plain text format from Web of Science. They were stored on a PC, and the extracted files were finally transformed into a comprehensive file.

The data obtained from Web of Science were transferred into the Bibliometric R. Package Software to examine several scientometric features of the articles contributed by "*Independent*" researchers. The resulting data were presented in Tables and Figures. This software allowed us to identify the trend of publications, citations, authors, institutes, countries, and journals contributed to the publication of retracted articles. It was also used to analyze and visualize the keywords and topics used in the articles (Gholampour et al., 2022a, b; Gholampour et al., 2020).

Results

The authorship status of independent researchers from 1945 to 2023 is presented in Table 1.

Table 1. Authorship status of independent researchers from 1945-2023

	No. of Documents	Total Citations	Average Citations Per Document
Single-authors	333	1,560	5
Multi-authors	1,383	49,744	36

According to Table 1, the total number of documents contributed by independent researchers is 1,713, of which 333 documents belong to the single authors. In addition, based on the data of Web of Science, the total number of citations to single-authored documents is 1,560, and the average citations per document received by these authors is 5. In addition, there are multi-authorships, whose total number of documents is 1,383. As indicated in the table, multi-authored documents have received significantly more citations than those authored by a single researcher, amounting to approximately 50,000 total citations. Table 2 shows the publication status, research areas, country, and the number of citations to the most prolific independent researchers from 19445 to 2023.

Table 2. Most Prolific Independent Researchers from 1945-2023

No.	Author Name	No. of Documents	No. of Citations		Research Area	Country
			Core Collection	All WoS Database		
1	Kevorkijan, Varuzan	17	84	89	Materials science, Metallurgy & Metallurgical Engineering, Mineralogy; Mining & Mineral Processing	Slovenia
2	Hallberg, O	8	24	26	Oncology; Dermatology; Research & Experimental Medicine, Neurosciences & Neurology, Life Sciences & Biomedicine - Other Topics; Biophysics	Sweden
3	Matlay, Harry	7	7	7	Education & Educational Research	England
4	Robinson, Richard	7	2	2	Biochemistry & Molecular Biology; Life Sciences & Biomedicine - Other Topics	USA
5	Connor, S	5	2	3	General & Internal Medicine	England
6	Gaude-Fugarolas, Daniel	5	2	-	Biotechnology & Applied Microbiology Materials Science Metallurgy & Metallurgical Engineering	Spain
7	Homainejad, Amir Saeed	5	6	6	Physical Geography; Geology; Meteorology & Atmospheric Sciences; Remote Sensing, Environmental Sciences & Ecology; Imaging Science & Photographic Technology	Iran
8	Yurchenko, Sergey B.	5	4	4	Behavioral Sciences; Neurosciences & Neurology, Philosophy	Uzbekistan
9	Mendez, Y.	3	8	8	Thermodynamics; Mechanics	Canada
10	Searls, David B.	3	45	44	Biochemistry & Molecular Biology; Mathematical & Computational Biology	USA
11	Wilkie, T.	3	54	56	General & Internal Medicine, Education & Educational Research, Information Science & Library Science; Science & Technology - Other Topics	England

Table 3 indicates the number of documents and citations of solo and multi-authorship of independent researchers. For the h-index, the total number of documents for each author listed in the Web of Science database were considered, irrespective of whether the author was a single author, a co-author, or collaborated with others. The number of citations for each document was analyzed, along with the count of uncited documents. In general, the data analysis revealed that even though researchers produced more documents, their multi-authored papers received more citations than those written by single authors. Additionally, a higher number of solo-authored documents have not received any citations to date compared to multi-authored documents.

Table 3. The number of documents and citations of solo and multi-authorship of independent researchers

No.	Author Name	H-index	Total No. of Doc.	No. of Doc.		No. of Citations		No. of Doc. without Citations	
				Multi	Solo	Multi	Solo	Multi	Solo
1	Kevorkijan, Varuzan	10	68	51	17	177	104	14	12
2	Hallberg, Orjan	6	18	10	8	157	24	1	2
3	Matlay, Harry	25	134	127	7	1551	719	6	55
4	Robinson, Richard	7	83	10	73	66	39	5	41
5	Connor, Susanne	2	21	2	19	7	5	_	15
6	Gaude-Fugarolas, Daniel	4	13	5	8	94	1	-	7
7	Homainejad, Amir Saeed	1	7	3	4	_	4	3	1
8	Yurchenko, Sergey B.	2	7	_	7	_	11	_	1
9	Mendez, Yohan	2	4	1	3	4	8	_	_
10	Searls, David B.	19	51	23	28	656	721	3	2
11	Wilkie, T.	4	7	2	5	11	54	_	2

Table 4 indicates the positions of the most prolific independent researchers in their solo-authored and multi-authored documents. The table reveals that these prolific independent researchers primarily occupy the first author position, even in their multi-authored papers.

Table 4. The author position of the most prolific independent researchers

No.	Author Name	Author Position (Percent)		
		First	Last	Corresponding
1	Kevorkijan, Varuzan	87	4	71
2	Hallberg, Orjan	83	6	72
3	Matlay, Harry	66	27	47
4	Robinson, Richard	90	6	16
5	Connor, Susanne	90	0	24
6	Gaude-Fugarolas, Daniel	92	0	77
7	Homainejad, Amir Saeed	100	0	86
8	Yurchenko, Sergey B	100	0	57
9	Mendez, Yohan	75	0	75
10	Searls, David B	65	20	41
11	Wilkie, T	86	14	29

Based on Table 5, independent researchers have shown a keen interest in various research areas, including those that have received citations from other researchers. The table indicates that independent researchers have paid the most attention to engineering (135 documents), environmental sciences ecology (121 documents), public environmental occupational health (104 documents), and science technology other topics (95 documents). These subject areas have received attention from independent researchers at a rate of 5 to 8 percent.

Table 5. The subject areas of documents contributed by independent researchers

Research Areas	Record Count	% of 1,713
Engineering	135	7.88
Environmental Sciences Ecology	121	7.06
Public Environmental Occupational Health	104	6.07
Science Technology Other Topics	95	5.55
Computer Science	89	5.20
Biochemistry Molecular Biology	88	5.14
General Internal Medicine	75	4.38
Business Economics	69	4.03
Genetics Heredity	55	3.21
Materials Science	56	3.27
Neurosciences Neurology	56	3.27
Pharmacology Pharmacy	52	3.04
Education Educational Research	51	2.98
Agriculture	50	2.92
Health Care Sciences Services	50	2.92
Oncology	50	2.92
Chemistry	51	2.98
Physics	47	2.74
Psychology	47	2.74

Figure 1 displays the high-frequency keywords used in the documents published by independent researchers. The main themes of the researchers are represented with larger labels, indicating more repetition, while secondary themes are displayed with smaller labels (Elahi et al., 2021). The information and keywords presented in this tag cloud reveal that COVID-19, myocardial infarction, thromboangiitis obliterans (also known as Buerger's disease), epidemiology, oxidative stress, obesity, mortality, risk assessment, and Alzheimer's disease are among the most common topics that have attracted the attention of independent researchers.

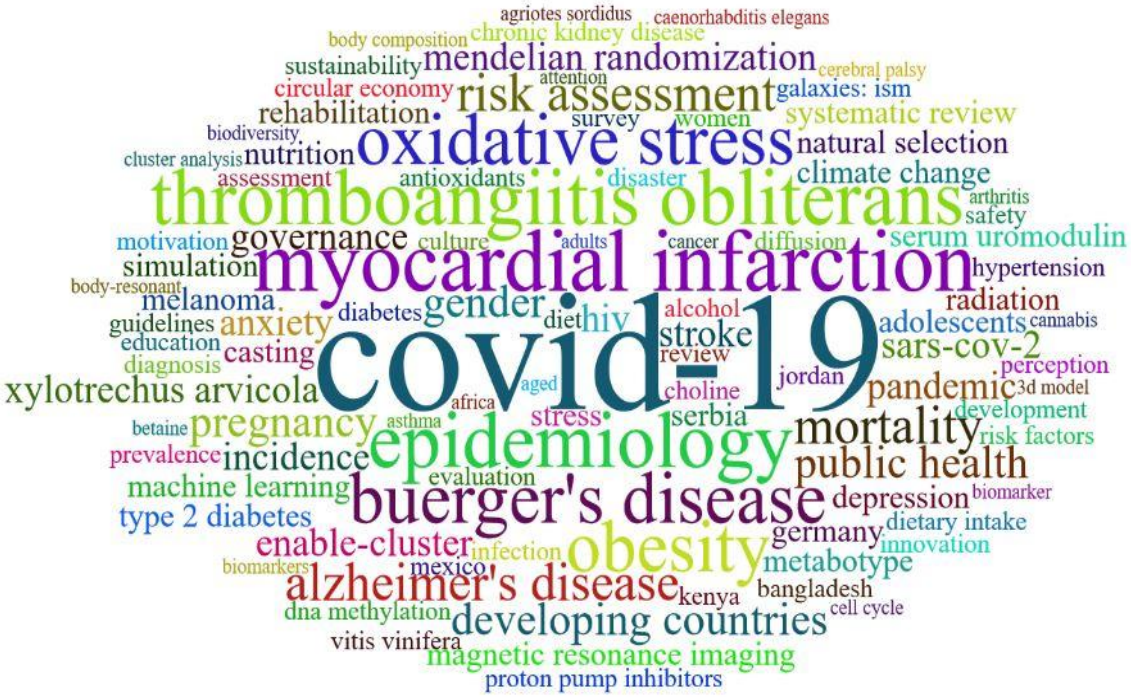

Figure 1. Keywords which are most used by independent researchers

Figure 2 represents the structure of documents published by independent researchers and clearly highlights the thematic trends of the documents. Figure 2 includes 10 clusters: red, blue, green, yellow, purple, pink, brown, and turquoise, which are the largest clusters in this network. The nodes in the network represent the topics and subject areas of documents published by independent researchers. Each node color represents the first co-occurrence, and the thickness of the nodes indicates the number of co-occurrences created. The lines that connect the nodes together represent the link between each node (Gholampour, Saboory & Noruzi, 2020).

The results show that topics such as COVID-19, myocardial infarction, thromboangiitis obliterans (or Buerger's disease), epidemiology, oxidative stress, obesity, mortality, risk assessment, and Alzheimer's disease are among the topics most frequently studied in the research of independent researchers. These represent the hot topics in their research. For instance, the most prominent issue in the green cluster is COVID-19. In the pink cluster, the most prominent topic is epidemiology, with myocardial infarction being a key focus. In the brown cluster, obesity is the main topic, while in the yellow cluster, oxidative stress and thromboangiitis obliterans are the prominent topics.

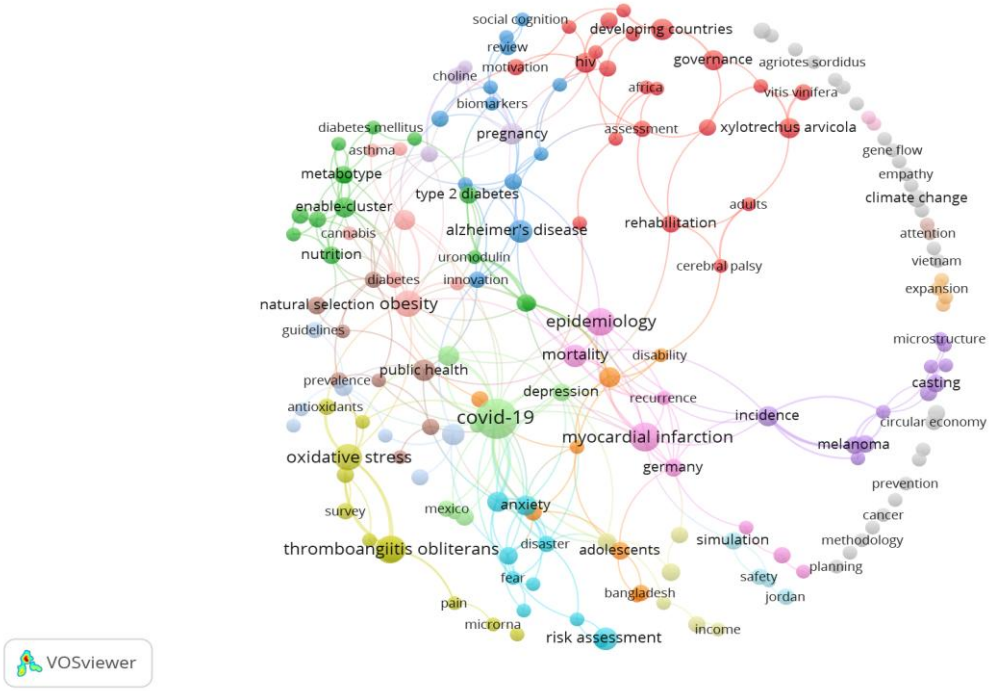

Figure 2. Thematic trend of the articles

Figure 3 displays the document types of publications contributed by independent researchers. Based on the data obtained from the WOS Core Collection, there were various types of documents contributed by independent researchers. These document types included articles, proceeding papers, meeting abstracts, review articles, editorial materials, book reviews, letters, early access publications, corrections, art exhibit reviews, data papers, items about individuals, and others. Figure 3 also reveals that research articles with 1,124 documents, proceeding paper with 183 documents, meeting abstract with 138 documents, review article with 101 documents, and editorial material with 87 documents are the most significant document types written by independent researchers.

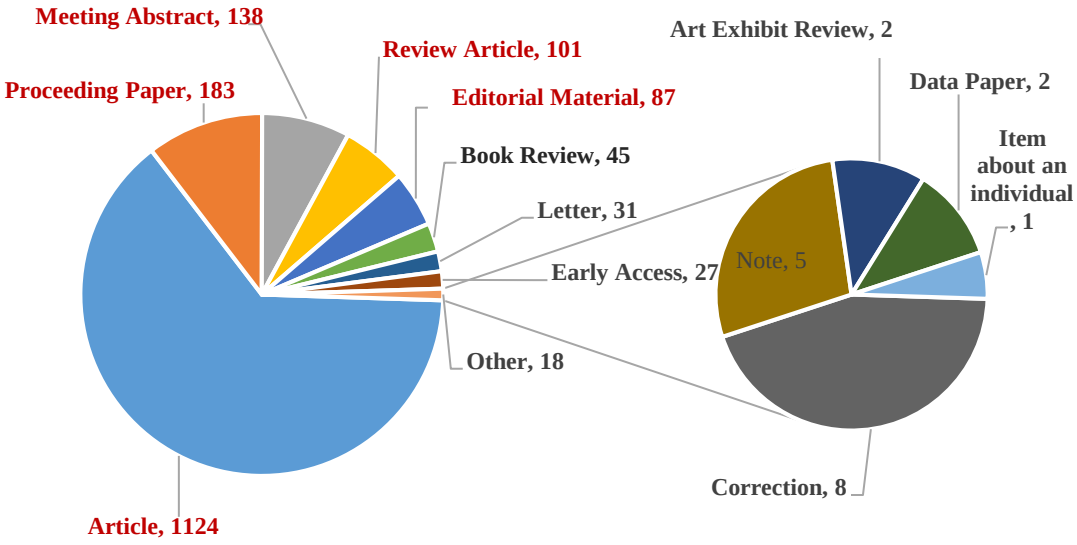

Figure 3. Document types of independent researchers

As indicated in the Table 6, most documents are written in English, making it the most common language. Following English, we have Russian and German as the next prominent languages of investigations conducted by independent researchers.

Table 6. Document's Language

Languages	Record Count	% of 1,713
English	1,700	99.24
Russian	8	0.18
German	3	0.47
Portuguese	1	0.06
Turkish	1	0.06

The fact that most documents are written in English underscores its role as the lingua franca of global academic and scientific communication. English's prevalence suggests that independent researchers prioritize this language to maximize the reach, accessibility, and impact of their work, as it allows them to engage with a broader international audience, including scholars, institutions, and publishers.

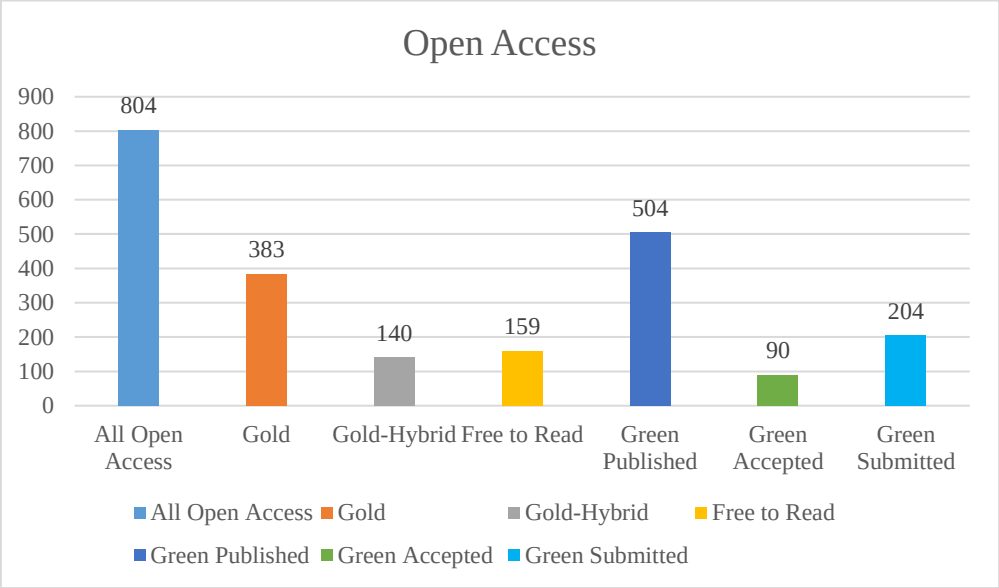

Figure 4. Accession Status of documents

Figure 4 displays the status of document access, based on data collected from the Web of Science database during the period from 1945 to 2023. According to the data, the most frequent documents are related to open access documents with 804 documents, and the next category of documents falls under the title of Green Published with 504 documents. Additionally, based on the type of access, Green-Accepted documents were the least frequent in terms of the number of documents, with 90 documents. The data presented in Table 7 and Figure 5 show that more than 130 publishers published documents contributed by independent researchers. Accordingly, publishers such as Elsevier, Springer Nature, Wiley, Taylor and Francis and MDPI have published the most documents conducted by independent researchers with 298, 219, 139, 109 and 102 respectively.

Table 7. Publishers

Publishers	Record Count	% of 1,713
Elsevier	298	17.40
Springer Nature	219	12.78
Wiley	139	8.11
Taylor & Francis	109	6.36
MDPI	102	5.95
IEEE	74	4.32
Oxford Univ Press	59	3.44
Public Library Science	55	3.21
Sage	41	2.39
Frontiers Media Sa	37	2.16
BMJ Publishing Group	25	1.46
Lippincott Williams & Wilkins	23	1.34
Nature Portfolio	22	1.28
Cambridge Univ Press	21	1.23
Emerald Group Publishing	15	0.88
International Institution Anticancer Research	14	0.82
American Chemical Society	12	0.70
Nation Co Inc.	10	0.58

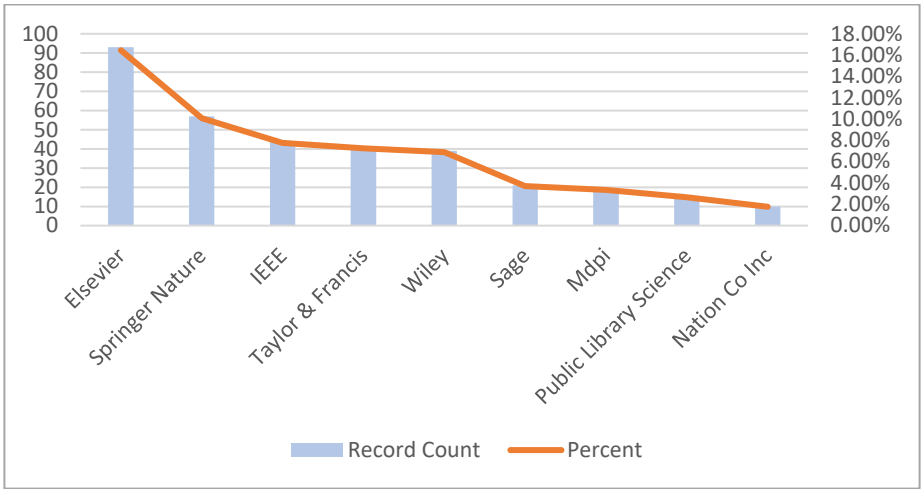

Figure 5. The most prolific publishers

In Table 8, affiliations of independent researchers have been examined according to their geographical distribution and country. The data reveal that the United States of America with 585 documents, Germany with 347 documents, the UK with 318 documents, Italy with 225 documents, and Canada with 132 documents have contributed more to the advancement of scientific research conducted by independent researchers. These countries occupy the first to fifth ranks in terms of document contributions.

Table 8. Countries/ Regions

Countries/Regions	Record Count	% of 1,713
USA	585	34.15
Germany	347	20.26
UK	318	18.56
Italy	225	13.13
Canada	132	7.71
China	119	6.95
Australia	108	6.30
Spain	104	6.07
Netherlands	99	5.78
Japan	95	5.55
France	85	4.96
Sweden	72	4.20
Switzerland	67	3.91
India	64	3.74
Scotland	54	3.15
Iran	54	3.15
Belgium	50	2.92
Mexico	49	2.86
Poland	49	2.86
Russia	46	2.69
Singapore	46	2.69
Turkey	44	2.57
Denmark	41	2.39
Brazil	40	2.34

Figure 6 shows the geographical distribution of independent researchers and their research in different fields of science. The blue color spectrum from deep blue to light blue indicates the most and least attention, and the grey color indicates lack of attention (Gholampour et al. 2022).

We see the presence of independent researchers on all continents of Europe, Asia, America, Africa and Oceania. It is worth noting that China and Japan (from Asia), the United States of America and Canada (from America), Germany and the UK (from Europe), Australia (from Oceania), and Egypt and Nigeria (from Africa) had the most support for independent researchers.

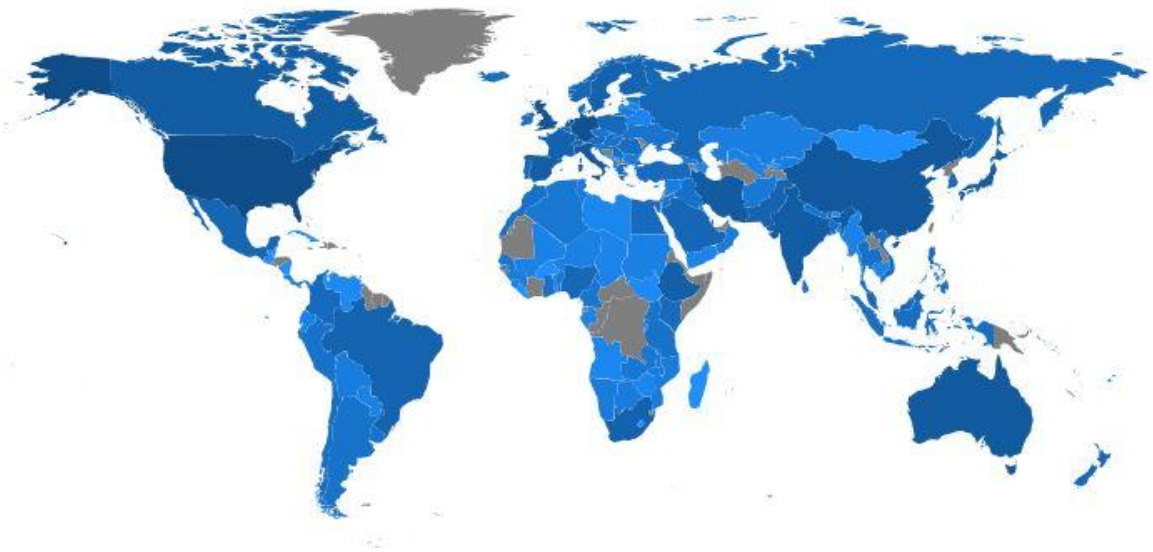

Figure 6. Geographical distribution of independent researchers

Figure 7 represents a three-field plot of countries, keywords, and independent researchers. As the figure shows, independent researchers in the United States have been primarily interested in Alzheimer's disease, Covid-19, obesity, mortality, and risk assessment. In Germany, independent researchers have focused on myocardial infarction, Alzheimer's disease, epidemiology, COVID-19, obesity, and mortality. Independent researchers in China focused on Alzheimer's disease and risk assessment. The research of Italian independent researchers has been in the subject areas of COVID-19, obesity, and obstructive thromboangiitis (or Buerger's disease). Independent Iranian researchers also followed the topic of obstructive thromboangiitis (or Buerger's disease). Most of these investigations have been written by researchers such as C. Meisinger, A. Peters, J. Linseisen, and M. Heier.

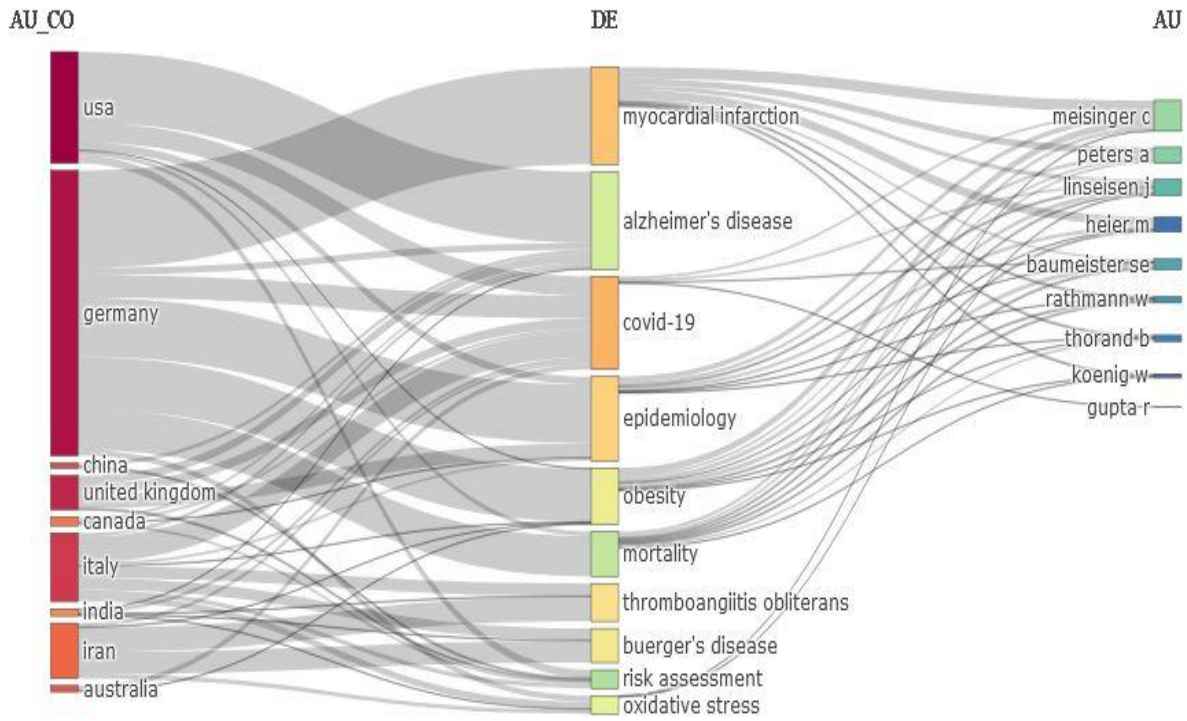

Figure 7. A three-field plot of Keywords, Countries, and independent researchers

Figure 8 illustrates the distribution of documents conducted by independent researchers indexed in the Web of Science Core Collection. These indexes comprise the Art & Humanities Citation Index (A&HCI), Emerging Sources Citation Index (ESCI), Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH), Conference Proceedings Citation Index- Science (CPCI-S), Science Citation Index Expanded (SCI-Expanded), and Social Sciences Citation Index (SSCI). Notably, the Social Sciences Citation Index (SSCI) holds the majority share at 52%, followed by the Conference Proceedings Citation Index- Science (CPCI-S) at 27% in terms of documents contributed by independent researchers.

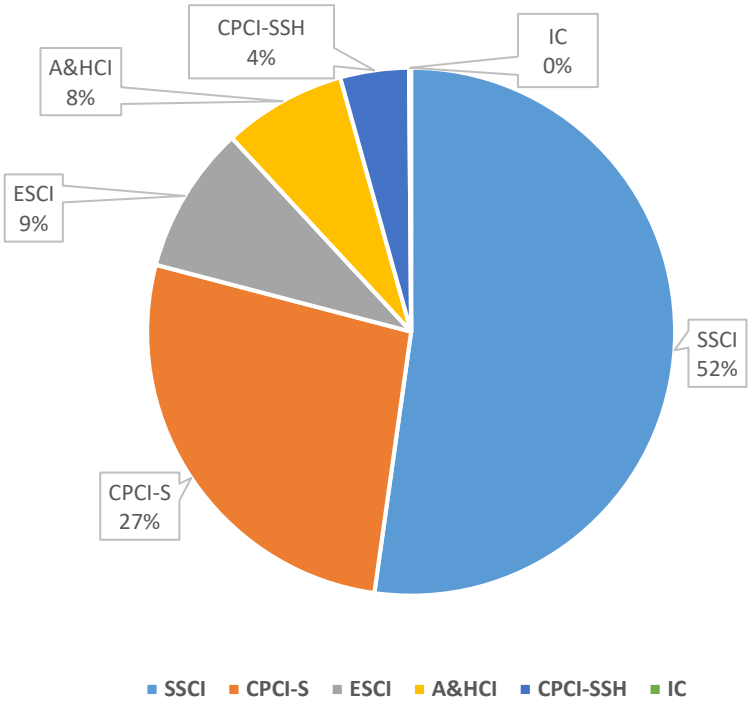

Figure 8. Distribution of documents conducted by independent researchers per index

Figure 9 demonstrates a continuous increase in the publication of various information sources and document types across different subjects within the Web of Science database contributed by independent researchers. This upward trajectory has been particularly notable starting from 1975, experiencing a significant acceleration since 2006, with the peak being reached in 2020. Despite analyzing data spanning from 1945 to 2023, no scholarly work authored by independent researchers appeared in the Web of Science Core Collection prior to 1975.

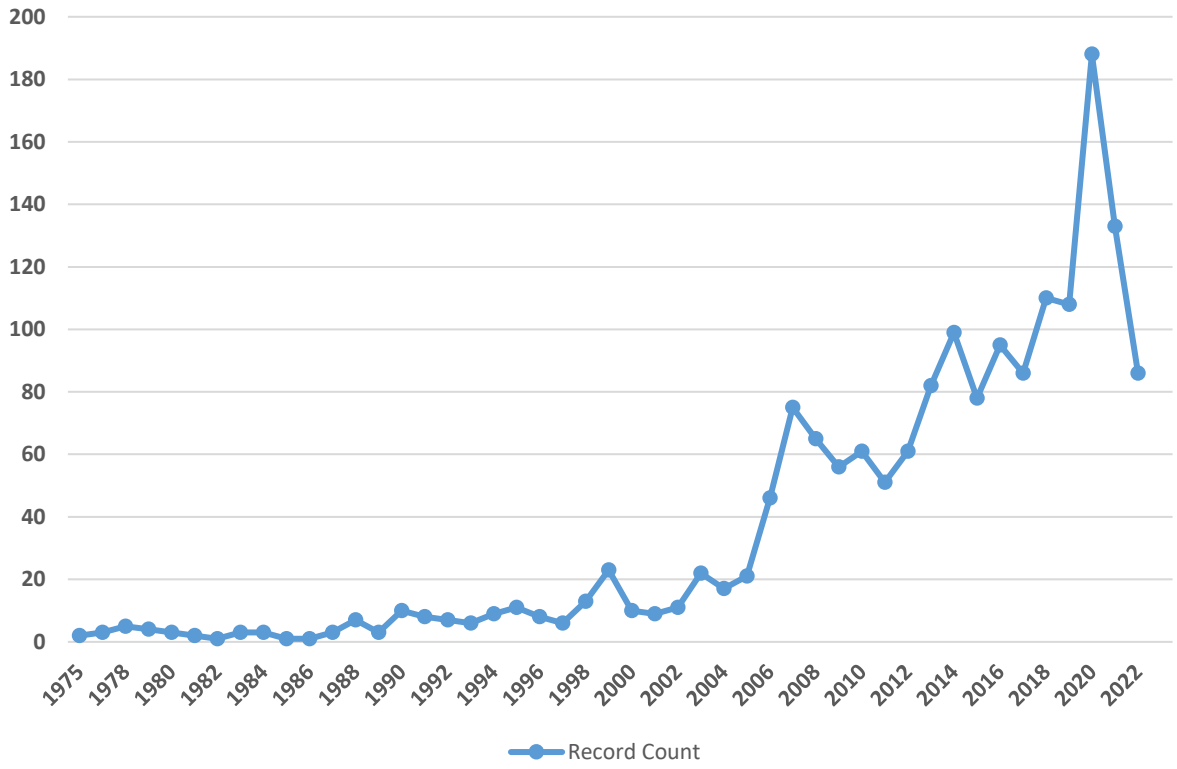

Figure 9. Publication trends over time for research conducted by independent researchers

Figure 10 illustrates the trend of topics based on keywords used in documents written by independent researchers. Nodes represent thematic fields, with node size indicating frequency in the network. The movement of keywords from left to right signifies shifts in thematic focus over time (Gholampour, Saboory, Noruzi, 2020).

Common keywords used in the documents include COVID-19, myocardial infarction, epidemiology, Thromboangiitis obliterans, oxidative stress, and Buerger disease. Pre-2000, independent researchers focused on casting, while post-2000 saw attention shift to Melanoma, Alzheimer's disease, and radiation. Recent research emphasizes pandemic, public health, stroke, adolescence, and rehabilitation topics, reflecting evolving research interests.

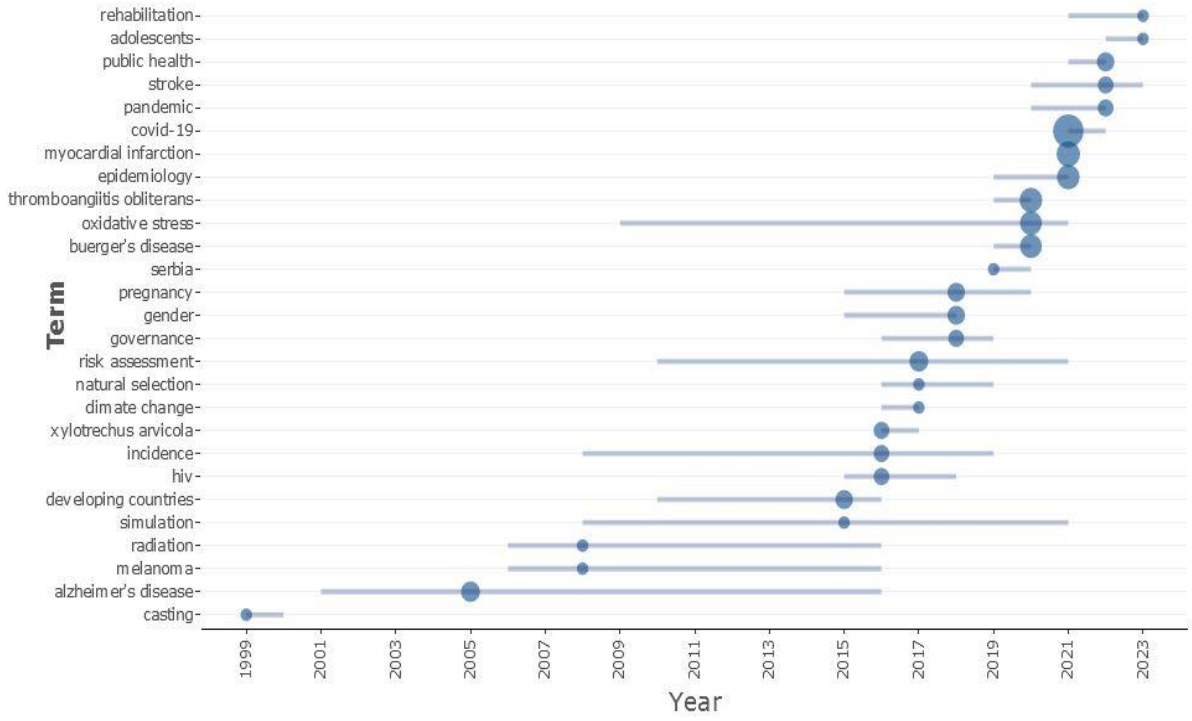

Figure 10. Historical trends of topics based on the keywords

Discussion

Our study explored independent researchers to analyze the effect of independent authorship in several aspects, such as the number of citations received, subject areas, keywords, and thematic trends. An independent researcher is an author no longer affiliated with a university or research center but still active in their subject area. Research collaboration and co-authorship involve the engagement of multiple authors in the research process, resulting in the creation of scientific output that may exhibit superior quantity or quality compared to works published by individual scientists.

Co-authored publications of independent researchers are cited more often than their single-author papers. Based on previous research, the number of citations for each document depends on various variables, such as publication year, number of authors, countries, journals, and fractional count of publications (Sooryamoorthy, 2009). Additionally, according to the "*Global Research Report: Multi-authorship and Research Analytics*," the influence increases with the number of authors, but the impact of including more countries outweighs the effect of including more authors (Adams et al., 2019). Hsu and Huang (2010) argued that there are two potential scenarios: 1. Articles with higher citation counts tend to have more co-authors; 2. Articles with more co-authors may receive more citations.

As indicated, documents with multiple authors tend to receive significantly more citations compared to those authored by a single researcher. Furthermore, a greater number of documents written by a solo author have not been cited to date in comparison to multi-authored documents. Independent researchers have displayed a strong interest in a variety of research areas, with a particular focus on engineering, environmental sciences, ecology, public and occupational health, as well as other topics related to science and technology. The keyword analysis indicates that topics like COVID-19, Myocardial Infarction, Buerger's disease, Epidemiology, Oxidative Stress, Obesity, Mortality, Risk Assessment, and Alzheimer's disease have been prominent areas of interest for independent researchers.

In addition to a variety of document types contributed by independent researchers, the most notable ones include research articles, conference papers, abstracts, review articles, and editorial pieces. Analysis of document accessibility reveals that most of these documents are open access, with the following common category being *green published* documents. More than 130 publishers published documents contributed by these researchers. Accordingly, publishers such as Elsevier, Springer Nature, Wiley, Taylor and Francis and MDPI have published the most documents conducted by independent researchers. Moreover, we see the presence of independent researchers from all continents. It is worth noting that China and Japan (from Asia), the United States of America and Canada (from America), Germany and the United Kingdom (from Europe), Australia (from Oceania), and Egypt and Nigeria (from Africa) had the most support for independent researchers.

The outcomes reveal a notable presence of documents beginning in 1975, with a notable increase in activity since 2006 and reaching a peak in 2020. Despite analyzing data from 1945 to 2023, no scholarly work authored by independent researchers was found in the WoS Core Collection before 1975. Prior to 2000, independent researchers concentrated on casting, whereas after 2000, there was a shift towards research on Melanoma, Alzheimer's disease, and radiation. Recent research highlights topics such as pandemics, public health, stroke, adolescence, and rehabilitation, showcasing the evolving interests in research.

Conclusion

This study addresses the contributions and scholarly influence of independent researchers on scholarly discourse. This bibliometric analysis not only highlights the trends in publication by independent researchers but also underscores their role in advancing scientific knowledge across various disciplines. Independent researchers, often unaffiliated with formal institutions, represent a distinct population within the academic landscape. Their scientific contributions are crucial, as they bring diverse perspectives and flexibility to research endeavors. Unlike traditional academics, independent researchers typically have fewer bureaucratic constraints, allowing them

to explore innovative research ideas and undertake research projects that may not align with institutional priorities. This independence can lead to unique insights and findings that enrich scholarly discourse.

The study reveals a significant increase in publications by independent researchers since 1975, peaking in 2020. Notably, multi-authored documents produced by independent researchers tend to receive more citations than solo-authored works. This finding suggests that collaboration enhances the visibility and impact of research outputs, reinforcing the idea that collective efforts can lead to greater scholarly influence. Furthermore, common research themes among independent researchers include pressing health issues such as myocardial infarction and Alzheimer's disease, indicating their engagement with critical societal challenges.

This study sheds light on an often-overlooked segment of the research community. As their numbers grow and their contributions become more pronounced, understanding the dynamics of independent research will be essential for promoting a more inclusive and effective scholarly communication landscape. The scientometric study advocates for further exploration into this field to better appreciate the impact of independent researchers on scientific progress and knowledge dissemination.

Author Contributions

Conceptualization, F.S. and A.N.; methodology, F.S. and A.N.; software, F.S.; validation, F.S. and A.N.; formal analysis, F.S.; investigation, F.S. and A.N.; resources, F.S.; data curation, F.S.; writing—original draft preparation, F.S.; writing—review and editing, A.N.; visualization, F.S.; supervision, A.N.; project administration, A.N.; funding acquisition, A.N. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

Data available on request from the authors.

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Ethical considerations

The authors avoided data fabrication, falsification, plagiarism, and misconduct.

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Conflict of interest

The authors declare no conflict of interest.

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