

Data Integrity and Scientific Publications: A Scientometric Study of Publication Retractions from India

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ABSTRACT: *This study investigates the trends, causes, and patterns of retracted publications within Indian scientific research, utilizing Web of Science and Retraction Watch data. Through a scientometric analysis, the study aims to identify the primary reasons for retractions, the distribution of retractions across different subject areas, and the institutional affiliations of retracted papers. The paper explored the trends, causes, and institutional patterns of retractions, focusing on India, and provides insights into the roles of funding agencies and publishers in these occurrences.*

Analysis revealed significant trends in retraction rates, showing a marked increase from 2020 onwards. A broader examination of subject-wise, institutional, and author-specific retraction patterns accompanies this rise. Computer Science and Telecommunications have emerged as leading fields in retractions. At the same time, major journals and prominent institutions in India, such as the Indian Institute of Technology and the Council of Scientific and Industrial Research, are highlighted for their high retraction counts. Additionally, top authors with significant retraction records are identified, alongside a detailed breakdown of retractions by funding agencies and publishers.

The study also investigated the access type of journals and the reasons behind retractions, identifying plagiarism and article duplication as predominant causes. The findings underscore the need for rigorous academic standards and transparent retraction processes to preserve the integrity of scientific literature.

Keywords: Retractions, WoS, India, Retracted Publication, Research Ethics, Plagiarism, Duplication, Falsification, Retraction watch and Scientometric Analysis

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1. Introduction

Errors that creep into the research manuscripts lead to incorrect data in the public domain, warranting correction in the form of 'retraction'. Such errors sometimes occur intentionally due to research misconduct and, on other occasions, happen due to a lack of rigour by authors, thus misleading readers in the absence of corrective measures. With the increase in the number of research publications, the number of retractions has also gone up. Retraction of scientific publications is critical in maintaining the integrity and credibility of academic research. Articles may be retracted when their findings are no longer considered trustworthy due to scientific misconduct or error, they plagiarize previously published work, or they are found to violate ethical guidelines. Lately, such retractions have not only happened in underdeveloped or developing nations, but high-profile authors (like Nobel laureates) from developed countries have also been part of such retractions. Using a novel measure called the "retraction index," we found that the frequency of retraction varies among journals and strongly correlates with the journal impact factor. Although retractions are relatively rare, the retraction process is essential for correcting the literature and maintaining trust in the scientific process. Retractions are crucial in correcting the scientific record by retracting flawed, misleading, or fraudulent publications. Maintaining the credibility of scientific literature is essential for public trust. Retractions help to mitigate the damage caused by erroneous or fraudulent publications, thereby preserving the reputation of the research community and promoting confidence in research findings. This study will help to prevent incorrect or unreliable information from influencing further research. The integrity of the research process is pivotal in advancing knowledge across diverse disciplines, including the sciences, humanities, and social sciences. Amidst rising concerns over plagiarism, fabrication, and falsification of research data, the need for rigorous scholarly communication and data integrity is more critical than ever. This rising concern gave me the idea to innovatively analyze the current literature landscape and propose possible solutions to tackle the challenges of research misconduct. This paper aims to highlight trends and reasons for retractions, examine India's status in retraction trends, and provide factual data to policymakers and funding agencies to ensure prudent allocation of research budgets. The goal is to bolster the credibility and reliability of scholarly publications, thereby reinforcing the foundational ethics of scholarly communication.

2. Review of Literature

Below is a thematic literature review that underscores the complexity of issues surrounding retractions, including the persistent challenges in maintaining research integrity,

Prevalence and Causes of Retraction

Several studies have focused on identifying the common causes of retraction across different regions and disciplines. **Elango et al. (2019)** found that plagiarism was the most frequent reason for retraction among Indian researchers, despite governmental efforts to curb such issues through plagiarism detection software. **Khademizadeh et al. (2023)** similarly identified intentional errors as the leading cause of retraction in the medical sciences, with China, the US, and India having the highest retraction counts. **Kocyigit et al. (2023)** highlighted fake-biased peer review, plagiarism, and duplication as the primary reasons for retraction in Kazakhstan. **Kumar & Siwach (2024)** emphasized duplicate publication and plagiarism as prevalent causes of retraction among Indian authors. **Shimray, Tiwari, & Ramaiah (2023)** also noted that legal issues were the most common reason for retraction, particularly in studies with two authors.

Retraction Trends and Impact on Citations and Research Integrity

Various studies have explored the trends and patterns in retracted publications over time, and the persistence of citations for retracted papers remains a concern across multiple studies.

Siva & Rajendran (2023) reported that many retracted papers from BRICS countries had multiple authors and that many papers were conference proceedings, particularly from the IEEE Computing Society. Additionally, **Kumar & Siwach (2024)** noted that while the annual number of retractions has risen, the rate per 10,000 publications has remained constant, with faster retractions occurring in open-access journals. **Silva & Dobránszki (2017)** highlighted that highly cited retracted papers continued to be referenced even after their retraction, perpetuating misinformation. **Priscila et al. (2017)** also noted that journals with higher impact factors published more retracted articles, particularly in engineering, where unethical research practices were prevalent.

Recommendations for Mitigating Retractions

Several studies have provided recommendations to address the issues surrounding retractions. **Siva and Rajendran (2023)** advocated for stricter enforcement of publication ethics to reduce fabrication and plagiarism. **Kumar and Siwach (2024)** suggested that insights from their study could help librarians and researchers manage and avoid retracted publications more effectively. **Silva Dobránszki (2017)** emphasized the importance of improving transparency in citation practices to prevent the spread of misinformation.

Based on the reviewed literature, we figured that a key gap remains in the absence of a longitudinal study utilizing the Web of Science database, wherein the trends of retractions for publications originating from Indian institutions since inception have been studied. Most existing research on retractions in India has relied on Scopus and Retraction Watch, focusing on specific periods or limited datasets. A comprehensive scientometric analysis using the Web of Science could fill this gap, offering a broader and more detailed view of Indian retractions across various disciplines and timeframes.

3. Objectives

The present article focuses on research institutions in India as the primary subject of investigation, wherein the following principal points are scrutinised:

1. To know the trend of retracted publications from India and their distribution over the years.
2. To evaluate the subject areas of retracted publications.
3. To index the status of the retracted publication sources.
4. To identify institutions with higher rates of retraction to understand institutional patterns
5. To determine the author with the highest number of retracted publications.
6. To trace out the Corresponding Author's Countries of the retracted publications.
7. To examine the most associated funding agencies with retracted articles
8. To assess the role of various publishers in the prevalence of retracted articles
9. To analyze the retracted Articles with the highest citation counts.
10. To investigate retractions according to the Access type.
11. To categorize and quantify the reasons for retraction

4. Methodology

The present study is empirical research based on retracted papers indexed in the Web of Science database and published by Indian authors. A list of these papers was compiled using the search query "DOCUMENT TYPE (Retracted Publication) AND ADDRESS (India)" in the WoS database to identify the retracted papers published by Indian authors. Filters were applied to include only document types classified as Research Articles and Review articles. The first retracted articles were observed to be from the year 1990 by Indian Authors (DUTT, P (DUTT, P); VINAYAK, VK (VINAYAK, VK)), so the study period has been considered as 1990 to 2024. A list of a total of 2223 retracted papers was obtained from the WoS database and analyzed. The general characteristics, such as the publication year, source name, publication title, DOI, number of authors, publication date, Institutions, Funding agency source type, etc, were extracted from WoS and entered into an MS Excel spreadsheet. The extracted data were imported into R-Studio (Biblioshiny), a bibliometric analysis tool, to analyze temporal trends in retractions, examining annual retraction rates and changes over time. R-Studio (Biblioshiny) was used to visualize the author keywords (treemap), institutional collaboration network (social structure), most globally cited documents, and countries' collaboration world map. Descriptive statistics for authorship, institutional affiliation, publication sources, Publishers and tables related to year-wise distribution, and access type were calculated using Microsoft Excel. Further details, such as the reason for retraction, were retrieved from the 'Retraction Watch' database to enhance the understanding of retraction reasons and policies. (<http://retractiondatabase.org/RetractionSearch.aspx>) and were entered into the MS Excel sheet. The Retraction Watch database did not contain the data of a few documents mentioned in the WoS database. So, these remaining documents were excluded. The reasons for retractions have been grouped into various broad categories. All retrieved entries were screened, and items that did not fit the context of the analysis were excluded. The entries were curated manually and edited for any system-generated duplications or overlaps of erroneous entries. The authorship trends, institutional affiliation, publication stage, and sources of retracted publications are presented.

5. Data Analysis

Our analysis revealed a substantial rise in retractions, particularly from 2020, with Computer Science and Telecommunications leading in numbers. Prominent institutions and authors with high retraction counts are identified, highlighting issues in research integrity. Additionally, the analysis points to plagiarism and duplication as major causes, emphasizing the need for stricter academic standards and transparency.

This Figure illustrates the annual distribution of distinct trends in retraction rates from 1979 to 2024. The data shows a

marked increase in retractions from 2020 onwards, peaking at 573 in 2021 and 466 in 2022, suggesting heightened issues with research integrity or improved detection. Before 2020, retractions were relatively low and fluctuated, with minimal occurrences before 2000. From 2000 to 2005, retractions were low, increasing from 2 to 12, reflecting early-stage activity. Between 2006 and 2010, retractions rose from 27 to 54, signaling a growing trend. The period from 2011 to 2015 saw a sharper increase, with retractions jumping from 61 to 85, likely due to heightened scrutiny and improved detection mechanisms. From 2016 to 2020, retractions surged from 69 to 139, driven by increased awareness of research integrity.

This period contrasts sharply with earlier years, where retractions were relatively rare as late 1990s had minimal retraction activity, with counts of 2 retractions in 2000 and 3 in 1999 and most years from 1979 to 1998, feature only 1 or No retractions. The gradual rise in retractions from the early 2000s to 2020 reflects both an increased awareness of the importance of research integrity and the growing capacity of the academic community to address and correct issues in the scientific literature.

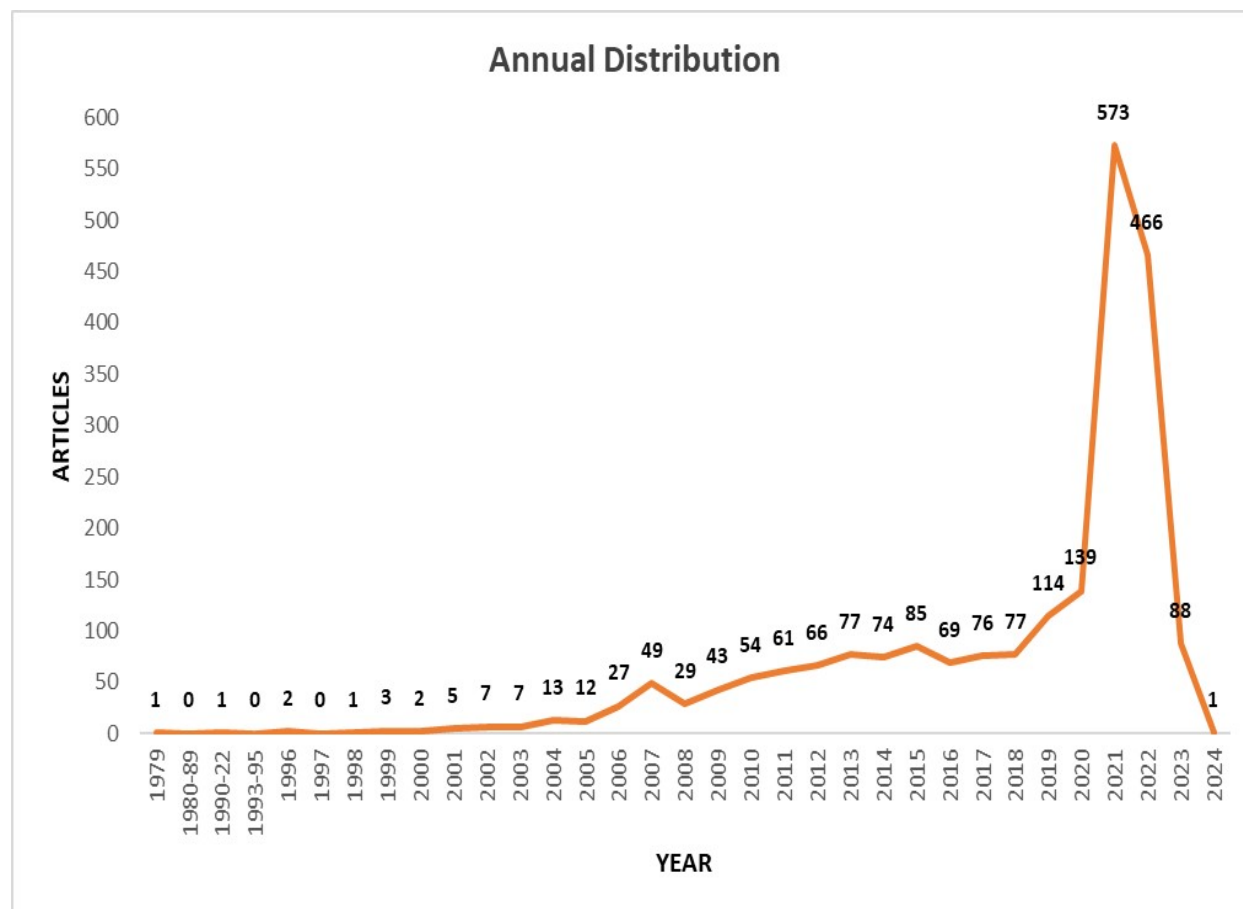


Figure 1. Annual Distribution of Retracted Articles

Analyzing the subject-wise distribution of retractions highlights significant variations across different academic fields. The Computer Science field is most affected as 561 retracted articles were from this field. Telecommunications followed this with 467 retractions. Materials Science and Engineering also show substantial retraction counts, with 278 and 276 articles, respectively. Other notable fields facing this issue include Chemistry (252 retractions), Science and Technology Other Topics (201), and Biotechnology Applied Microbiology (136). Additionally, Biochemistry, Molecular Biology, Research Experimental Medicine and Neurosciences and Neurology contribute 130, 103, and 96 retractions, respectively. With 95 retractions, mathematics is also a significant field in this context. Subjects such as Physics, Pharmacology, Pharmacy, and Health Care Sciences and Services report retractions ranging between 52 and 92. Fields with fewer retractions, including Environmental Sciences and Cell Biology and many others, are aggregated under "Others," which collectively account for 814 retracted articles. This distribution underscores that retraction issues are pervasive across various disciplines, with certain fields, notably Computer Science and Telecommunications, experiencing particularly high rates.

Table 1. Subject wise distribution of Retractions

Subject Area	No of Retractions
Computer Science	561
Telecommunications	467
Materials Science	278
Engineering	276
Chemistry	252
Science Technology Other Topics	201
Biotechnology Applied Microbiology	136
Biochemistry Molecular Biology	130
Research Experimental Medicine	103
Neurosciences Neurology	96
Mathematical Computational Biology	95
Physics	92
Pharmacology Pharmacy	90
Health Care Sciences Services	52
others	814

Table 2. Most Contributing Publication Sources

Publication Sources	No. of Retractions
Journal of Ambient Intelligence and Humanized Computing	355
Advances in Materials Science and Engineering	114
Biomed Research International	83
PLOS One	78
Computational Intelligence and Neuroscience	68
Security and Communication Networks	47
Journal of Healthcare Engineering	43
Bioinorganic Chemistry and Applications	32
Others	915

The analysis of journal contributions to retractions reveals that a few prominent journals lead in the number of retracted articles. Notably, the **Journal of Ambient Intelligence and Humanized Computing** tops the list with 355 retractions, followed by **Advances in Materials Science and Engineering** with 114, and **Biomed Research International** with 83. Other journals like Computational Intelligence and Neuroscience (68), Security and Communication Networks (47), Journal of Healthcare

Engineering (43), Bioinorganic Chemistry and Applications (32), Cluster Computing the Journal of Networks Software Tools and Applications (31) also contribute a considerable count. These high retraction counts are likely correlated with the large publication volumes of these journals. The remaining journals, collectively categorized as “Others,” also contribute many retractions (915). Additionally, a broad category labelled “Others” encompasses a diverse array of journals, significantly 92 journals with two retractions each and various others with up to 30 retractions, collectively contributing 915 retracted articles.

Table 3. Top Affiliation Contributions to Retractions

Institutions	No of Retractions
Anna University and Anna University Chennai	104+65= 169
Indian Institute of Technology System IIT System	133
Council of Scientific Industrial Research CSIR India	116
Saveetha Institute of Medical Technical Science	112
Saveetha School of Engineering	94
National Institute of Technology NIT System	87
Vellore Institute of Technology VIT	83
SRM Institute of Science Technology Chennai	78
VIT Vellore	66
Graphic Era University	55
Others	1148

The analysis of institutional contributions to article retractions reveals a notable concentration of retractions among prominent research institutions, particularly those in India. Anna University leads the list, including its Chennai campus, which leads with 169 retractions, followed closely by the Indian Institute of Technology (IIT) and IT Systems with 133 retractions, indicating challenges even in highly reputable institutions. The Council of Scientific and Industrial Research (CSIR) India also has 116 retractions, reflecting concerns within India's prominent research bodies. Saveetha Institute and Saveetha School of Engineering account for 206 retractions, underscoring potential systemic issues in medical and engineering fields. Other prominent institutions like the National Institute of Technology (87 retractions) and the Vellore Institute of Technology (149 retractions) face challenges in maintaining academic integrity. In addition to these major Institutions, a diverse group of smaller institutions, each contributing 50 or fewer retractions, collectively accounts for considerable retracted articles. The data suggests a pressing need for improved ethical oversight, better research training, and stricter publication standards across various academic sectors.

Table 4 categorizes authors with errors in publications that led to retractions; the list highlights those with more than 15 retractions. It reveals key insights into the patterns of research retractions and the profiles of the most impacted individuals. L. Natrayan from Saveetha Institute of Medical & Technical Science is at the forefront, with 30 retracted articles and an h-index of 26. Similarly, Pravin P. Patil from Graphic Era University, with 29 retracted articles and an h-index of 16, and Prashant Kumar K. Sharma from the Indian Institute of Technology (Indian School of Mines), Dhanbad, with 28 retractions and an h-index of 48, also show high retraction counts. Sharma's notably higher h-index suggests a strong influence in his field. Yet, such a substantial number of retractions could have implications for his academic reputation and the validity of his research contributions. Madhuri R., another prominent figure from the Indian Institute of Technology (Indian School of Mines), Dhanbad, has 24 retracted articles with an h-index 32. In contrast, Santanu Patra, associated with the Technical University of Denmark and IIT (ISM) Dhanbad, has 22 retractions and an h-index of 14. Authors like Mohammad Shabaz, Ekta Roy, and Mohammad Javed Ansari, each with h-indices ranging from 24 to 30, further exemplify this trend, where significant retraction records accompany high research output. The case of Sathish T. from SIMATS Saveetha School of Engineering, with 16 retracted articles and an h-index of 43, is particularly noteworthy, suggesting a significant influence in the field, yet simultaneously marred by a considerable number of retractions. The “Others” category, which includes authors with 14 or fewer retractions, collectively contributes a substantial number of retracted articles.

Table 4. Top Authors Contributing to Retractions

Authors	No of Articles	H Index	Affiliation
L, Natrayan	30	26	Saveetha Institute of Medical & Technical Science
Patil, Pravin P	29	16	Graphic Era University
Sharma, Prashant Kumar K	28	48	Indian Institute of Technology (Indian School of Mines), Dhanbad
Madhuri, R	24	32	Indian Institute of Technology (Indian School of Mines) Dhanbad
Patra, Santanu	22	14	Technical University of Denmark, Indian Institute of Technology (Indian School of Mines) Dhanbad
Shabaz, Mohammad	20	28	Model Institute of Engineering and Technology
Roy, Ekta	19	24	Medi Caps Univ Govt Engn Coll Jhalawar Indian Institute of Technology (Indian School of Mines) Dhanbad
Ansari, Mohammad Javed	19	30	Department of Botany, Hindu College Moradabad, Uttar Pradesh, India-244001
Govindaiah, T N	18	8	Govt Coll Autonomous University of Mysore
Sreepad, H R	16	10	Bharathiar University Govt Coll Autonomous University of Mysore
Sathish, T	16	43	SIMATS Saveetha School of Engineering Saveetha Institute of Medical & Technical Science
Chiranjeevi, P	15	13	Sri Venkateswara University

Fig-2 Focusing on countries with at least ten retracted articles, the data reveals significant differences in research retraction patterns across these nations. India stands out with a substantial number of 1,593 retracted articles, predominantly from single-country publications (SCP), indicating internal research challenges. However, India's 239 multi-country publications (MCP), Ethiopia with 238 retracted articles, and China's 71 retracted articles, also solely MCPs, reinforce the notion that international collaborations may be prone to higher risks of retraction, a trend echoed by Bangladesh (40 articles), Saudi Arabia (39 articles), and the USA (33 articles). Countries like Korea, Ghana, and Pakistan, with 24, 23, and 16 retracted articles respectively, where United Kingdom and Malaysia, with 15 and 13 retracted articles respectively emphasize the prominence of MCPs in research retractions.

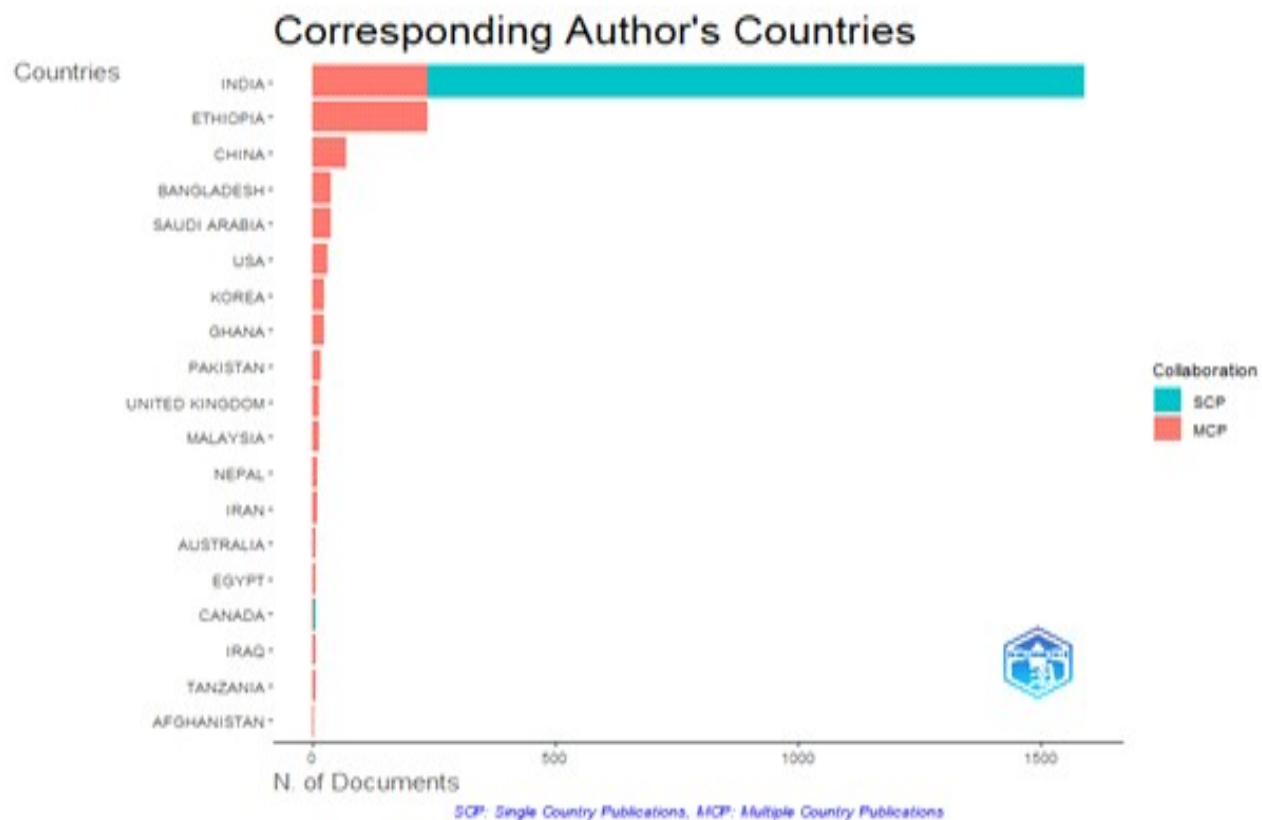


Figure 2. Corresponding Authors' Countries

Table 5. Collaborative Country Distributions of Retractions

Collaborating countries	No of Retractions
Saudi Arabia	283
Ethiopia	270
USA	120
Peoples R China	102
South Korea	68
Pakistan	65
Malaysia	57
Bangladesh	49
Iraq	45
Others	1164

The analysis of retraction data for the top 10 collaborative countries reveals distinct patterns across different nations. Saudi Arabia and Ethiopia show considerable numbers, with 283 and 270 retractions, respectively, highlighting a comparable

concern. The United States, with 120 retractions, and the People's Republic of China, with 102, show notable but lower figures than the top two, reflecting their substantial global research output. South Korea, Pakistan, Malaysia, Bangladesh, and Iraq complete the top 10, each contributing between 45 and 68 retractions significantly to the overall retraction landscape. The "Others" category, which includes countries like Egypt, England, Australia, Iran, and several others, accounts for a substantial total of 1164 retracted articles, highlighting a broader but more dispersed issue across various nations.

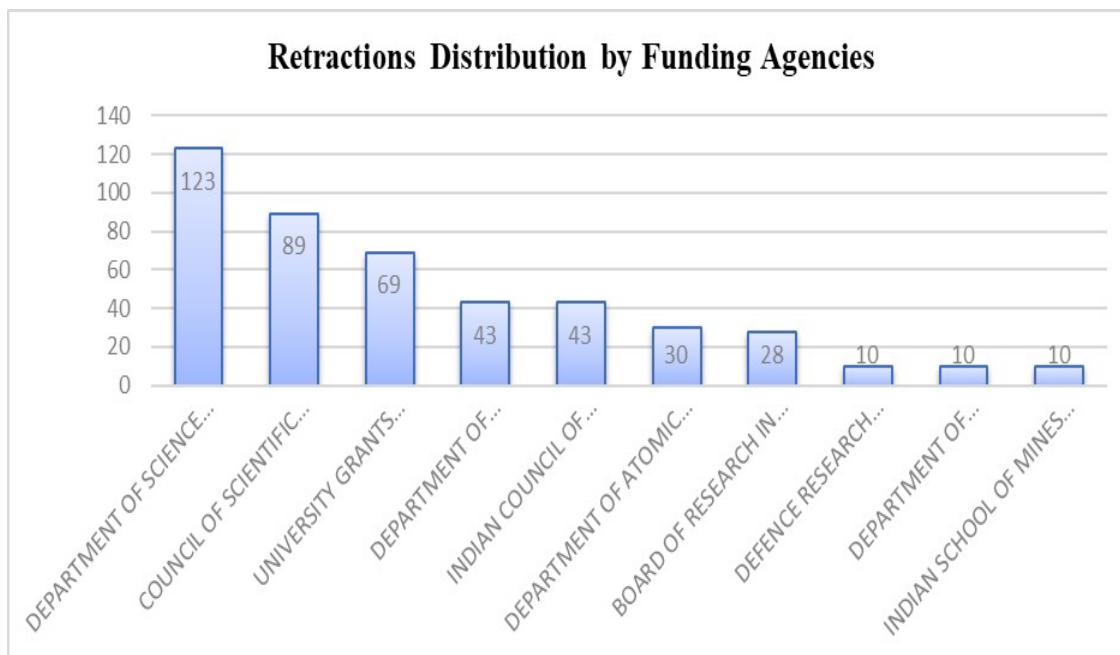


Figure 3. Retraction Distribution by Funding Agencies

Figure 3 presents an analysis of retracted articles funded by various agencies, focusing on those funded at least ten retracted studies. A total of 123 retracted articles, with the highest number, came from research funded by the Department of Science and Technology (India). The Council of Scientific and Industrial Research (CSIR) India follows with 89 retractions, highlighting challenges within Indian-funded research. The University Grants Commission (India) have 69 retractions, raising similar concerns in their research communities. Other significant contributors include research projects funded by the Department of Biotechnology (India) and the Indian Council of Medical Research (ICMR), with 43 retractions each. The Department of Atomic Energy (DAE) and the Board of Research in Nuclear Sciences (BRNS) have provided financial support to 30 and 28 retractions, respectively, indicating integrity concerns in nuclear research. The Defence Research and Development Organisation, the Department of Biotechnology, ISM, each account for ten retracted articles indicating relatively lower but still notable issues in the defense, biotechnology, and mining research sectors.

The analysis of retracted articles by type of journal publication shows a diverse distribution. Most retractions are found in "All Open Access" journals, totalling 1,032 articles. "Gold" Open Access journals are the most frequent within this category, with 741 retractions, while "Gold-Hybrid" journals account for 49 retractions. "Free to Read" journals have 195 retractions, indicating a significant but smaller proportion. The "Green" category, which includes journals with various stages of open access, shows notable figures as well, with 576 retractions for "Green Published," 87 for "Green Submitted," and 22 for "Green Accepted." This distribution suggests that open-access journals, especially "Gold" ones, are most frequently associated with retractions, while "Green" journals represent a significant portion of the retraction landscape.

Analyzing the publisher-wise distribution of retracted articles, it's evident that a few key publishers are responsible for most retractions. A significant concentration is observed among a few publishers, with Springer Nature leading at 731 retractions, followed by Hindawi Publishing Group (506) and Elsevier (305). Other publishers like Sage, Taylor & Francis, Wiley-Hindawi, Wiley, and the Public Library of Science also contribute substantially, each with retractions ranging from 82 to 109 articles. The remaining publishers, each contributing fewer than 30 retractions, are grouped under "Others," reflecting a broader, less concentrated pattern of retractions across numerous smaller publishers. This concentration suggests that larger publishers may face more challenges in maintaining consistent quality control, given the vast number of publications they manage.

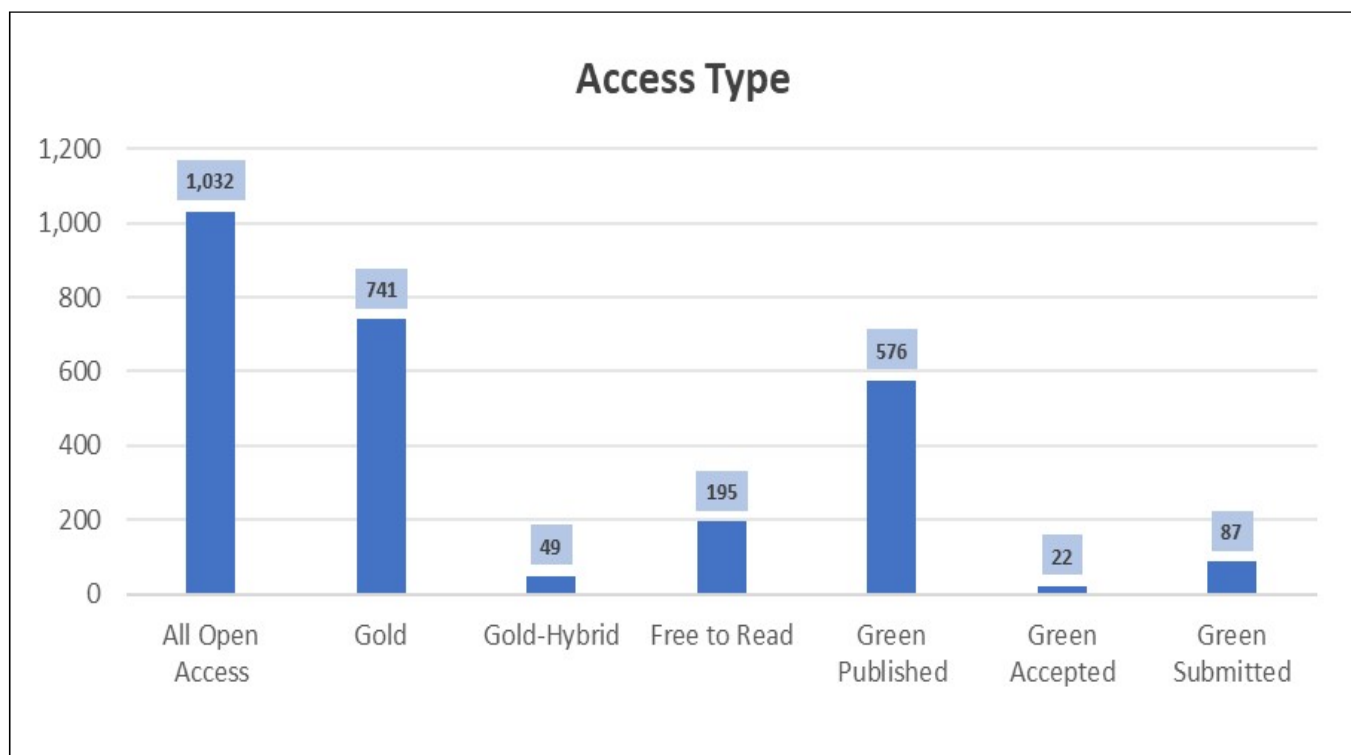


Figure 4. Retractions based on Access Type

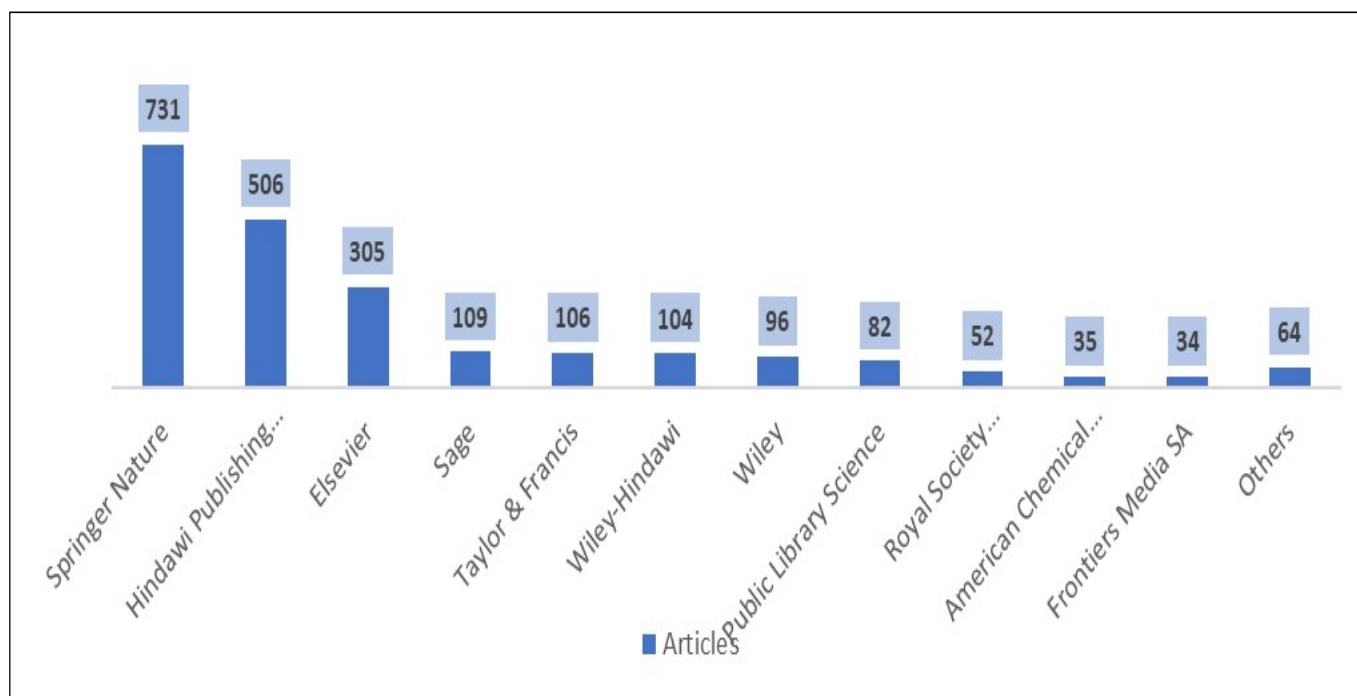


Figure 5. Retraction Distribution by Publisher

Table 6 . Top Retracted Articles by Citation Count

Author Full Names	Article Title	Source Title	Cited Reference Count
Patil, Arun; Patil, Vaishali; Choi, Ji-Won; Kim, Jin-Sang; Yoon, Seok-Jin	RETRACTED: Solid Electrolytes for Rechargeable Thin Film Lithium Batteries: A Review (Retracted Article)	JOURNAL OF NANOSCIENCE AND NANOTECHNOLOGY	530
Dhusia, Kalyani; Bajpai, Archana; Ramteke, P. W.	RETRACTED: Overcoming antibiotic resistance: Is siderophore Trojan horse conjugation an answer to evolving resistance in microbial pathogens? (Retracted article. See vol. 283, pg. 290. 2018)	JOURNAL OF CONTROLLED RELEASE	402
Ray, Chaiti; Pal, Tarasankar	RETRACTED: Recent advances of metal-metal oxide nanocomposites and their tailored nanostructures in numerous catalytic applications (Retracted Article)	JOURNAL OF MATERIALS CHEMISTRY A	298
Manivasagan, Panchanathan; Venkatesan, Jayachandran; Sivakumar, Kannan; Kim, Se-Kwon	RETRACTED: Marine actinobacterial metabolites: Current status and future perspectives (Retracted article. See vol. 211, pg. 69, 2018)	MICROBIOLOGICAL RESEARCH	286
Attri, Pankaj; Arora, Bharti; Choi, Eun Ha	RETRACTED: Utility of plasma: a new road from physics to chemistry (Retracted article. See vol.7, pg. 15735,2017)	RSC ADVANCES	277
Dar, Mehraj U. Din; Shah, Aamir Ishaq; Bhat, Shakeel Ahmad; Kumar, Rohitashw; Huisingh, Donald; Kaur, Rajbir	RETRACTED: Blue Green infrastructure as a tool for sustainable urban development (Retracted article. See vol. 367, 2022)	JOURNAL OF CLEANER PRODUCTION	251
Bharathiraja, B.; Sudharsana, T.; Jayamuthunagai, J.; Praveenkumar, R.; Chozhavendhan, S.; Iyyappan, J.	RETRACTED: Biogas production - A review on composition, fuel properties, feed stock and principles of anaerobic digestion (Retracted Article)	RENEWABLE & SUSTAINABLE ENERGY REVIEWS	244
Elakkiya, R.	RETRACTED: Machine learning based sign language recognition: a review and its research frontier (Retracted Article)	JOURNAL OF AMBIENT INTELLIGENCE AND HUMANIZED COMPUTING	241
Rathee, Mandeep; Ram, Pala	RETRACTED: Impact of cold storage on the performance of entomophagous insects: an overview (Retracted Article)	PHYTOPARASITICA	227
Kashyap, Dharambir; Pal, Deeksha; Sharma, Riya; Garg, Vivek Kumar; Goel, Neelam; Koundal, Deepika; Zaguia, Atef; Koundal, Shubham; Belay, Assaye	RETRACTED: Global Increase in Breast Cancer Incidence: Risk Factors and Preventive Measures (Retracted Article)	BIOMED RESEARCH INTERNATIONAL	223
Gupta, Sadhana M.; Mania-Pramanik, Jayanti	RETRACTED: Molecular mechanisms in progression of HPV-associated cervical carcinogenesis (Retracted Article)	JOURNAL OF BIOMEDICAL SCIENCE	216

Analyzing the list of highly cited retracted articles provides insights into how influential research can significantly impact even after being retracted. All articles listed have a significant number of citations, ranging from 216 to 530. The retraction of highly cited articles entitled “Solid Electrolytes for Rechargeable Thin Film Lithium Batteries” (530 citations), “Overcoming antibiotic resistance” (402 citations), “Recent advances of metal-metal oxide nanocomposites” (298 citations), “Marine actinobacterial metabolites” (286) and “Utility of plasma: a new road from physics to chemistry” received substantial count of citations and published in the Journal of Nanoscience and Nanotechnology, Journal of Controlled Release, Journal of Materials Chemistry A, Microbiological Research and RSC Advances respectively. The retracted articles cover various disciplines, including nanotechnology, microbiology, materials science, biomedical research, and environmental science.

Table 7. Reasons for Retraction

Reasons for Retraction	No of Articles
Plagiarism of Article/Image	398
Duplication of Article/Image	386
Authorship issue	296
Manipulation/ Manipulation of Images	268
Fake Peer Review	207
Falsification /Fabrication/Conflict of Interest	198
Error/Mistake	119
Fraud/Suspected Fraud	116
Breach of Policy by Author	112
Other Unknown	83
Copyright Claims	40

The table of reasons for retractions provides a detailed breakdown of the various issues leading to the retraction of articles, shedding light on the predominant causes of research integrity breaches. Plagiarism emerges as the leading cause, responsible for 398 retractions, followed by Duplication of articles resulting in 386 retractions, highlighting the frequency of redundant publications, while authorship issues, accounting for 296 retractions, point to significant disputes over contributor recognition. Image manipulation, with 268 retractions and fake peer review, is responsible for 207 retractions. Additionally, falsification, fabrication, and conflicts of interest have led to 198 retractions. Fraud or suspected fraud, accounting for 116 retractions, further complicates the landscape, while errors and mistakes, leading to 119 retractions, emphasize the need for rigorous methodological standards. Breach of policy by authors (112 retractions) and copyright claims (40 retractions) add layers of ethical and legal concerns. The presence of 83 retractions categorized as “Other/Unknown”(e.g. Investigation by Journal/Publisher/ Rogue Editor /Third Party) highlights gaps in understanding and transparency in the retraction process, pointing to the need for clearer guidelines and reporting mechanisms. This data collectively underscores the multifaceted nature of retractions and their significant impact on the credibility of scientific research.

6. Findings

1. The frequency of retractions increased substantially from 2020 onwards, peaking in 2021 and 2022. This trend reflects either heightened research integrity issues, improved detection mechanisms, or increased scrutiny due to increased awareness of ethical conduct in research.
2. Computer Science and Telecommunications lead in retractions, with significant numbers also from Materials Science, Engineering, and Chemistry. This suggests that errors in published data leading to retraction issues are widespread across various academic fields.
3. High retraction counts are prevalent in journals like the Journal of Ambient Intelligence and Humanized Computing. This

may be due to their large publication volumes and increased scrutiny.

4. Indian institutions such as IIT and CSIR exhibit high retraction rates, indicating a need for enhanced quality control and oversight in these high-output research settings.

5. Authors with numerous retractions, such as L. Natrayan and Pravin P. Patil, are often affiliated with institutions with high retraction counts. This suggests a correlation between individual author output and retraction rates.

6. Major Indian funding agencies, including DST and CSIR, are linked with many retracted articles emphasizing the need for robust research quality controls by funding bodies.

7. Open Access journals, especially “Gold” Open Access, have the highest number of retractions, indicating that increased visibility may come with higher retraction rates.

8. Large publishers such as Springer Nature and Hindawi Publishing Group have high retraction counts, suggesting a need for improved quality assurance processes in these organizations.

9. Highly cited retracted articles show significant impact even after retraction, underscoring the importance of rigorous review and correction in influential research.

10. The leading causes for retractions are plagiarism, duplication, and authorship issues, highlighting ongoing problems in research integrity and the need for stricter oversight which can be established by having scientific audit processes within institutions, before a manuscript is communicated for publication.

11. Authors, Research institutions, Funding agencies, and Publication bodies have a role to play at their respective levels in establishing robust systems that help identify possible errors or malpractices during the submission and publication process.

7. Suggestions

Several measures should be implemented to address the challenges identified in the analysis of research retractions. First, strengthening oversight is crucial; institutions and funding agencies must enforce stricter quality control mechanisms to mitigate research misconduct and reduce retraction rates. Enhanced training programs for authors and researchers on ethical research practices and rigorous methodologies are also essential, as these will help minimize errors and prevent misconduct. Furthermore, improving transparency in retraction is vital; journals and publishers should adopt clearer procedures and more comprehensive reporting to foster better understanding and trust in how retractions are handled. Special attention should be directed towards high-risk areas—such as specific fields and journals with elevated retraction rates—by applying increased scrutiny and rigorous quality control measures to address underlying issues. Given the association of open-access journals with higher retraction rates, there is a need to uphold stringent peer review and quality control standards within these publications. Lastly, funding agencies should strongly emphasize ethical research practices by integrating robust ethical guidelines into their funding criteria, thereby promoting integrity across all levels of research.

8. Conclusions

The study reveals a complex landscape of research retractions, marked by increasing rates in recent years and significant variations across fields, institutions, and publication sources. High retraction rates in certain disciplines and institutions suggest the need for enhanced quality control and integrity measures. Prominent funding agencies and publishers are also implicated, indicating areas for potential improvement in oversight and processes. The high citation counts of retracted articles illustrate the far-reaching consequences of research misconduct and the critical need for thorough review and correction mechanisms. The solution lies in having mechanisms that can identify data-related issues at earlier stages of the communication and publication process.

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