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Research Article

Behind the Retraction Curve: Bibliometric Insights into Publication Integrity at India's Top Ten NIRF-Ranked Research Institutions

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ABSTRACT

Scientific retractions are increasingly recognized as a critical indicator of research integrity, publication ethics, and institutional accountability. This study presents a bibliometric analysis of retracted documents indexed in Scopus from ten of India's top-ranked research institutions as identified by the National Institutional Ranking Framework (NIRF) 2025, covering the period from 2000 to 2026. The institutions examined include the Indian Institute of Science (IISc), Indian Institutes of Technology (IIT) at Madras, Delhi, Bombay, Kharagpur, Kanpur, Roorkee, and Guwahati, the Academy of Scientific and Innovative Research (AcSIR), and the Homi Bhabha National Institute (HBNI). Bibliometric indicators including document counts, citation profiles, authorship patterns, international collaboration rates, and Bradford's Law zone classifications were employed to assess the landscape of retracted scholarship across these institutions. Findings reveal heterogeneous retraction profiles, with IIT Roorkee recording the highest number of retracted documents and HBNI the lowest. Citation inflation prior to retraction, high international co-authorship in retracted papers, and disciplinary concentration in life sciences and materials research are among the key patterns identified. The collective retraction record across these ten institutions points to structural vulnerabilities in India's research ecosystem that warrant systematic policy intervention.

Keywords: Retraction, Research integrity, NIRF, Indian academia, Publication ethics.

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INTRODUCTION

The retraction of scientific publications has emerged as one of the most consequential events in scholarly communication. A retraction formally removes a published article from the body of scientific literature, typically due to errors, data fabrication, plagiarism, duplicate submission, or ethical violations (Fanelli, 2012). While retractions have historically been rare, a confluence of factors, including the exponential growth of scientific output, increased pressure to publish, the proliferation of predatory and low-rigor journals, and enhanced detection tools such as iThenticate and image-manipulation software has contributed to a marked rise in retraction rates globally (Steen, 2011; Fang *et al.*, 2012).

India has emerged as one of the world's most prolific scientific producers, ranking among the top five nations by publication volume according to Scopus and Web of Science statistics. The country's output grew from approximately 60,000 papers in 2010 to over 230,000 by 2022 (Clarivate Analytics, 2023). This rapid expansion in scholarly productivity, however, has not been without concern regarding quality and integrity (Elango *et al.*, 2019). High-profile retraction events at leading Indian institutions have attracted both domestic and international scrutiny, raising questions about authorship practices, data management, peer review, and institutional accountability.

Bibliometric analysis offers a quantitative framework for systematically mapping and interpreting patterns in retracted literature. Employing indicators such as co-authorship density, citation averages, source distribution, and Bradford zone classification, researchers can identify disciplinary concentrations, collaborative structures, and temporal trends associated with retracted publications (Van Eck & Waltman, 2014). Studies such as those by Moylan and Kowalczuk (2016) and Van Noorden (2023) have used such approaches to characterize retractions at institutional and national levels, though comprehensive bibliometric studies focusing specifically on India's NIRF-ranked research institutions remain scarce.

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This study addresses that gap by analysing retracted Scopus-indexed documents from ten premier Indian research institutions. The objectives of our study are: (1) to ascertain the volume and temporal distribution of retractions across the top research institutions of India; (2) to examine authorship characteristics including collaboration patterns and international co-authorship; (3) to identify source journals through Bradford's Law zone classification; and (4) to situate findings within the broader literature on research integrity.

LITERATURE REVIEW

Global Trends in Scientific Retractions

The academic community has documented a significant increase in retraction rates over recent decades. Fang *et al.* (2012), analysing over 2,000 biomedical retraction notices in PubMed, found that a majority of retractions were attributable to misconduct rather than honest error, a reversal of historical assumptions. Steen (2011) similarly reported that fraud and suspected fraud accounted for a disproportionate share of retraction-related citations, suggesting that highly cited papers are not immune to integrity failures. More recently, the RetractionWatch database, launched in 2010, has grown to catalogue over 45,000 retracted works, providing an invaluable resource for bibliometric scholarship (Marcus & Oransky, 2014).

Research Integrity in the Indian Context

Research integrity issues in India have attracted considerable attention. Sharma (2024) documented instances of academic misconduct at Indian higher education institutions and argued that institutional oversight mechanisms remain insufficiently developed. Basu (2010) noted that while India's scientific output grew substantially during the 2000s, citation impact metrics revealed quality disparities across institutions. Elango *et al.* (2019) specifically examined Indian publications in high-impact journals and observed that IITs and IISc, while generating the bulk of high-quality output, were not exempt from integrity-related retractions. The proliferation of paper mills and predatory publishers has compounded these challenges (Bohannon, 2013; Beall, 2012).

Bibliometric Methods in Retraction Research

Bibliometric methodologies have proven effective for characterizing retraction phenomena. Bradford's Law of scattering, which partitions sources into three zones of decreasing publication frequency, has been used to identify the most productive sources of retracted literature and thus the journals most implicated in integrity failures (Bradford, 1934; Moed, 2005). Co-authorship analysis illuminates the collaborative networks within which misconduct may be embedded or obscured (Newman, 2001). Citation analysis of retracted works reveals the degree to which erroneous findings have propagated into subsequent scholarship before correction (Pfeifer & Snodgrass, 1990). These tools collectively constitute a robust framework for the present analysis.

Institutional-Level Retraction Studies

Prior bibliometric studies have examined retractions at the level of individual nations or disciplines. Grieneisen and Zhang (2012) identified the United States, Germany, and Japan as top contributors to retracted biomedical literature, noting that high publication volume correlates imperfectly with retraction rates. Azoulay *et al.* (2017) demonstrated through a natural experiment that retraction of star scientists' work can suppress co-authors' subsequent productivity, underscoring the reputational spillovers of retraction events. Institution-level studies for India, however, have been limited, creating an analytical gap this paper seeks to fill.

METHODOLOGY

Data Source and Search Strategy

Data were retrieved from Scopus, one of the world's largest abstract and citation databases, using a targeted search for retracted documents affiliated with each of the ten institutions under study. The institutions- IISc, IIT Madras, IIT Delhi, IIT Bombay, IIT Kharagpur, IIT Kanpur, IIT Roorkee, IIT Guwahati, AcSIR, and HBNI, were selected based on their rankings in the NIRF 2025 research institution category. The document type filter was restricted to "retracted" publications. The study period spans 2000 to 2026, though effective data ranges vary by institution based on the earliest retraction recorded.

Bibliometric Indicators

The following indicators were extracted and analysed:

- **Document counts** and annual growth rates.
- **Average document age** (years elapsed since publication).
- **Average citations per document** (TC/NP).
- **Co-authors per document** and single-authored document counts.
- **International co-authorship percentage.**
- **Source distribution** and Bradford's Law zone classification.

Bradford's Law Classification

Bradford's Law of scattering was applied to identify the core journals (Zone 1) from which most retracted documents originated, and peripheral sources (Zones 2 and 3) of diminishing frequency. This classification aids in identifying journals that may warrant heightened scrutiny in post-publication monitoring.

RESULTS AND DISCUSSION

Overview of Retraction Volume Across Ten Institutions

The ten institutions collectively accounted for a substantial body of retracted Scopus-indexed documents spanning two decades of scholarly output. IIT Roorkee recorded the highest number of retractions (n = 39), followed by IISc (n = 34), AcSIR (n = 34), IIT Kharagpur (n = 26), IIT Delhi (n = 26), IIT Kanpur (n = 19), IIT Madras (n = 18), IIT Bombay (n = 12), IIT Guwahati (n = 8), and HBNI (n = 4). In aggregate, these ten institutions account for 220 retracted Scopus-indexed documents, a figure that reflects both the scale of their research output and the systemic pressures operating across India's elite research landscape.

These figures must be interpreted in relation to overall publication volumes; absolute retraction counts do not indicate disproportionate misconduct without a corresponding denominator of total output. Nevertheless, the distribution across all ten institutions, including those with smaller research footprints, such as HBNI and IIT Guwahati, confirms that retraction is not an isolated or institution-specific phenomenon but rather a sector-wide concern.

Annual growth rates in retractions varied considerably, from 0% (indicating a plateau or irregular incidence) for IIT Delhi, IIT Kharagpur, IIT Roorkee, AcSIR, and HBNI, to a high of 6.68% for IIT Bombay and 5.08% for IIT Madras. This variability may reflect differences in the timing of institutional misconduct discoveries, journal retraction policies, or the uneven implementation of plagiarism and data integrity detection across disciplines.

Temporal Distribution and Document Age

Document average age, an indicator of the lag between original publication and retraction, ranged from 5.25 years (HBNI) to 12.1 years (IIT Delhi). A high average document age implies that erroneous or fraudulent findings may circulate in the literature for extended periods before being retracted, accumulating citations and potentially influencing downstream research (Pfeifer & Snodgrass, 1990; Steen, 2011). IIT Delhi's mean document age of 12.1 years is particularly concerning, suggesting that a subset of retracted papers there were embedded in the literature for over a decade. IIT Kharagpur (10.7 years) and IIT Roorkee (10.2 years) also exhibited high document ages, reinforcing the concern that post-publication surveillance has been insufficiently timely at several of these institutions.

The relatively short document ages at HBNI (5.25 years) and AcSIR (6.41 years) may partly reflect the more recent establishment of these institutions as well as increasingly efficient post-publication monitoring by journals and databases. The timespans covered also differ meaningfully across institutions: IIT Delhi's retraction record stretches back to 2001, while HBNI's spans only 2018-2024, which partly explains the age differential.

Citation Profiles of Retracted Documents

Average citations per retracted document represent one of the most consequential dimensions of the retraction landscape, as they indicate the degree to which erroneous work has been absorbed into subsequent scholarship. Across the ten institutions, IIT Madras recorded the highest average citations per retracted document (37.56), followed by IIT Kanpur (35.79), AcSIR (34.76), IISc (29.97), IIT Delhi (29.88), IIT Kharagpur (26.5), IIT Roorkee (23.79), IIT Guwahati (22.38), IIT Bombay (4.42), and HBNI (2.5).

The elevated citation averages at IIT Madras and IIT Kanpur are particularly significant. High pre-retraction citations suggest that these papers were initially perceived as credible contributions, and their subsequent retraction may have introduced errors into a large body of citing literature. This phenomenon, sometimes termed "citation contamination" has been documented by Pfeifer and Snodgrass (1990) and more recently by Bornemann-Cimenti *et al.* (2016), who found that retracted papers continue to be cited positively well after formal retraction. IIT Madras's international co-authorship rate of 50% among retracted papers further compounds this risk, as internationally co-authored papers tend to accumulate citations more rapidly (Katz & Hicks, 1997). The low averages at IIT Bombay and HBNI suggest that those institutions' retracted papers had not yet accumulated significant scholarly influence, limiting downstream contamination.

Authorship Characteristics

Co-authorship Density

Co-authors per retracted document ranged from 3.58 (IIT Bombay) to 9.26 (IIT Kanpur). High co-authorship density in retracted papers is consistent with global findings. Fang *et al.* (2012) identified that papers retracted for fraud tended to involve fewer authors (concentrated responsibility), whereas those retracted for errors showed higher co-authorship. The notably high co-authorship at IIT Kanpur (9.26) and HBNI (9.0) may reflect large collaborative networks typical of experimental sciences, where author accountability is diffuse and individual contributions are harder to verify, a condition that can inadvertently facilitate or conceal misconduct (Rennie *et al.*, 1997).

Across all ten institutions, co-authors per retracted document consistently exceeded three, and in several cases exceeded five, confirming that retracted papers in India's premier institutions are overwhelmingly products of collaborative endeavour rather than individual work. This has important implications for how retraction investigations are structured and how institutional disciplinary responsibility is assigned.

Single-Authored Documents

Single-authored retracted documents were rare across all ten institutions. IISc, IIT Delhi, and IIT Bombay each reported

one single-authored retracted paper, while the remaining seven institutions recorded none. The near-absence of single-authored retractions across the full set of ten institutions reflects the collaborative nature of contemporary research and may also indicate that independent scholars have clearer accountability for their work, making misconduct detection somewhat more straightforward.

International Co-authorship

International co-authorship percentages among retracted documents varied substantially across the ten institutions: IIT Madras (50%), IIT Delhi (38.46%), IIT Kanpur (36.84%), IIT Kharagpur (30.77%), IISc (29.41%), IIT Bombay (25%), HBNI (25%), IIT Roorkee (20.51%), AcSIR (20.59%), and IIT Guwahati (12.5%). Taken together, international co-authorship is a consistent feature of retracted papers across all ten institutions, with eight of the ten showing rates of 20% or higher.

The figure at IIT Madras (50%) is particularly striking. While international collaboration generally enhances research quality and impact, high co-authorship across national boundaries can complicate jurisdictional accountability when integrity violations occur (Wager & Williams, 2011). Attribution of responsibility becomes distributed across institutions and countries, potentially weakening the retraction process and any accompanying disciplinary action. This finding calls for clearer inter-institutional memoranda of understanding that address retraction and misconduct protocols in collaborative research agreements.

Source Journals and Bradford's Law Analysis

Zone 1 Sources (Core Journals)

Bradford's Law identifies Zone 1 sources as those generating the largest share of retracted literature, representing journals of highest concentration for a given institution.

For **IISc**, Zone 1 comprised the *Journal of Biological Chemistry* (5 articles), *Physics of Fluids* (3), *Biosensors and Bioelectronics* (2), and *Environmental Research* (2), reflecting a concentration in biochemistry and applied physics.

For **IIT Madras**, *Biomed Research International* (3 articles) anchored Zone 1 alongside three single-article sources, with a notable prevalence of biomedical and materials science journals.

IIT Delhi was unusual in that all 26 sources contained exactly one retracted article each, resulting in a uniform distribution and Zone 1 spanning the first nine sources alphabetically. This even scattering may indicate that retraction incidents at IIT Delhi were idiosyncratic rather than concentrated in any particular research stream.

IIT Bombay's Zone 1 featured *Bio Web of Conferences* (2 articles) and the *Journal of Materials Processing Technology* (2), pointing toward conference proceedings and materials engineering as primary loci of retracted output.

IIT Kharagpur's Zone 1 featured *PLOS ONE* (3 articles), *ACS Applied Materials and Interfaces* (2), and *Plant Cell, Tissue and Organ Culture* (2), suggesting retractions distributed across plant biology and materials science.

IIT Kanpur's Zone 1 included *Biotechnology Advances, Global Challenges, Physics of Fluids, Scientific Reports*, and *Solid State Communications*, each contributing two retracted articles - reflecting a multidisciplinary profile of retracted output spanning physics, chemistry, and biomedical sciences.

For **AcSIR**, *Bioresource Technology* dominated Zone 1 with 7 retracted articles, the highest single-source frequency in the entire dataset followed by *Chemical Communications* (3) and *Catalysis Science and Technology* (2). This pronounced concentration in green chemistry and bioresource journals is noteworthy and may warrant targeted review of publication practices in those disciplinary clusters.

IIT Roorkee showed a more distributed Zone 1, including *Advanced Materials Research, Engineering Failure Analysis*, conference proceedings from *EESCO 2015*, and *Spectroscopy Letters* - each contributing two retracted documents reflecting its engineering and materials science orientation and also its breadth of retracted literature, which spanned 35 distinct source journals.

IIT Guwahati's Zone 1 featured *Virus Research* (2 articles) and *Applied Bionics and Biomechanics* (1), consistent with its comparatively smaller retraction record of eight documents across seven sources.

HBNI, with the smallest retraction record (n = 4), featured retractions spread across four journals: *European Physical Journal C*, the *Journal of Magnetism and Magnetic Materials*, and *Scientific Reports*, each contributing one document. Source-level performance metrics (h-index = 1; g-index = 1 for each source) reflect the limited but notable presence of HBNI in the retraction record.

Recurring Cross-Institutional Journals

Several journals and conference proceedings appeared in the retraction records of multiple institutions among the ten studied, indicating systemic rather than institution-specific vulnerability. The *International Conference on Electrical, Electronics, Signals, Communication and Optimization (EESCO) 2015* appeared in the records of IISc, IIT Bombay, IIT Kanpur, IIT Roorkee, AcSIR, and IIT Guwahati, a remarkable cross-institutional pattern involving six of the ten institutions under study, suggesting potentially systemic peer review failures or integrity violations associated with that particular conference proceeding. Similarly, *Global Challenges* appeared for both IISc and IIT Kanpur; *Scientific Reports* for both IIT Kanpur and HBNI; *PLOS ONE* for both IIT

Kharagpur and AcSIR; *Bioresource Technology* for both AcSIR and IIT Guwahati; *ACS Applied Materials and Interfaces* for both IISc and IIT Kharagpur; and *Bioconjugate Chemistry* for both IISc and IIT Kharagpur. The appearance of conference proceedings alongside peer-reviewed journals in retraction databases is consistent with global findings. Vuong *et al.* (2019) identified that proceedings papers, particularly from IEEE-affiliated conferences, have featured disproportionately in mass retraction events, sometimes linked to paper mills or compromised guest editing.

Disciplinary Patterns

Across all ten institutions, retracted documents clustered most heavily in the life sciences and biological chemistry (particularly biochemistry, microbiology, and biomaterials), materials science and nanotechnology, environmental science, and computer science and engineering. This disciplinary profile aligns with global retraction trends. Fang *et al.* (2012) identified biomedicine as the discipline with the highest absolute retraction volume, while Adeniyi *et al.* (2026) similarly found materials science retractions rising sharply in the 2010s, partly attributable to image duplication and data manipulation in characterisation studies.

The concentration of retractions in high-output, high-competition disciplines supports the argument that retraction risk is partly structural, a function of field-specific publication norms, competitive funding environments, and the complexity of verifying experimental results (Smaldino & McElreath, 2016). Notably, IIT Roorkee's retraction record also extended into tourism and hospitality management, an unusual disciplinary footprint that may reflect data fabrication or manipulation in survey-based social science research, a growing concern in that field (Roozen *et al.*, 2001).

Implications for Research Integrity Governance

Institutional Monitoring

The findings across all ten institutions underscore the need for systematic, institution-level monitoring of post-publication corrections and retractions. While global databases such as RetractionWatch and Scopus's own retraction tagging have improved visibility, many Indian institutions lack dedicated research integrity offices with the mandate and capacity to track, investigate, and remediate retraction events (Sharma, 2024). The UGC (University Grants Commission) and DST (Department of Science and Technology) may consider mandating annual retraction audits as part of institutional performance assessments, particularly given that the ten institutions examined collectively account for a substantial share of India's internationally indexed scientific output.

Training and Awareness

Given the high average citations per retracted document at institutions such as IIT Madras (37.56) and IIT Kanpur (35.79), targeted training in research methodology, data management, and authorship ethics is warranted, particularly in the life sciences and chemistry disciplines where retraction incidence is highest across the ten institutions. The Committee on Publication Ethics (COPE) guidelines and the Singapore Statement on Research Integrity provide internationally recognised frameworks that all ten institutions could more systematically adopt (COPE, 2022; Resnik & Shamoo, 2011).

International Collaboration Oversight

The consistently elevated international co-authorship percentages in retracted papers across eight of the ten institutions, most strikingly at IIT Madras (50%), suggest that cross-border collaborative projects may benefit from more clearly defined authorship contribution protocols. The adoption of the CRediT (Contributor Roles Taxonomy) framework, which requires explicit itemisation of each author's contribution, can improve accountability in multi-institutional papers and facilitate more targeted investigation in retraction cases (Brand *et al.*, 2015).

Journal-Level Interventions

The recurrence of certain journals and conference proceedings across multiple institutions' retraction records, particularly *EESCO 2015*, which appeared in six of the ten institutions' records, points to the value of institutional library policies that monitor and flag problematic publication venues. Beall's List and similar resources, despite their controversy, serve as early-warning tools that research administrators across all ten institutions might reference when evaluating manuscript submission decisions (Beall, 2012; Olivarez *et al.*, 2018). The dominance of *Bioresource Technology* in AcSIR's retraction record (7 of 34 documents) suggests that discipline-level editorial vigilance in renewable energy and green chemistry fields may also be warranted.

LIMITATIONS

Several limitations warrant acknowledgement. First, Scopus indexing is not exhaustive; retracted papers not indexed in Scopus, including those in regional or predatory journals are beyond the scope of our analysis, potentially underrepresenting the true retraction burden across all ten institutions. Second, retraction reasons were not uniformly available for all documents in the dataset, precluding a rigorous classification of retractions by cause (error vs. misconduct). Third, institutional affiliation in Scopus may occasionally be ambiguous, particularly for multi-site authors, introducing minor attribution uncertainty. Fourth, absolute retraction counts are not normalised against total publication output per institution, limiting direct comparative conclusions about retraction rates. Future research

should incorporate denominator data on total publications to compute institution-specific retraction rates, and should classify retractions by stated reason to enable cause-specific analysis across all ten institutions.

CONCLUSION

This bibliometric analysis of retracted Scopus-indexed documents from ten premier Indian research institutions- IISc, IIT Madras, IIT Delhi, IIT Bombay, IIT Kharagpur, IIT Kanpur, IIT Roorkee, IIT Guwahati, AcSIR, and HBNI - reveals a complex and heterogeneous retraction landscape collectively spanning over 220 documents from 2000 to 2026. IIT Roorkee, IISc, and AcSIR recorded the highest absolute retraction counts, while IIT Madras and IIT Kanpur exhibited the highest average citations per retracted document, a finding with significant implications for citation contamination in the downstream literature. Bradford's Law analysis identified AcSIR's concentration in *Bioresource Technology* and the cross-institutional recurrence of *EESCO 2015* proceedings across six of the ten institutions as particularly salient structural patterns. High international co-authorship in retracted papers, evident in eight of the ten institutions at rates of 20% or above points to accountability challenges in global collaborative research that current retraction protocols are ill-equipped to address.

These findings are not an indictment of the ten institutions under study, all of which remain globally respected research establishments generating enormous volumes of credible, impactful scholarship. They are, however, a call for enhanced institutional infrastructure for research integrity monitoring, authorship ethics training, and post-publication surveillance across India's entire elite research sector. As India continues its trajectory toward becoming a leading global knowledge economy, robust mechanisms for ensuring the integrity of its scholarly output are not merely desirable, they are essential.

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ABBREVIATIONS

AcSIR: Academy of Scientific and Innovative Research; **COPE:** Committee on Publication Ethics; **CRediT:** Contributor Roles Taxonomy; **DST:** Department of Science and Technology; **EESCO:** International Conference on Electrical, Electronics, Signals, Communication and Optimization; **HBNI:** Homi Bhabha National Institute; **IISc:** Indian Institute of Science; **IIT:** Indian Institute of Technology; **NIRF:** National Institutional Ranking Framework; **NP:** Number of Publications; **Scopus:** Elsevier's Abstract and Citation Database; **TC:** Total Citations; **UGC:** University Grants Commission.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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