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Quality Concern in Research: Challenges, Issues and Strategies for Improvement

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Abstract

The quantitative growth of research in India during the past decade is truly commendable, but the only concern is its quality. There are some factors impeding the quality of our research. This paper addresses the issues and challenges faced in Indian research. It suggests strategies to enhance the quality of research by transformative potential of advanced technologies to optimise data collection, analysis, and interpretation. Also, it advocates for open-access publication, replicability, and transparency to boost the credibility and access of research findings. Moreover, it stresses the value of continuous professional development and mentorship programs in fostering a community of skilled, ethical, and innovative researchers. Through the implementation of these strategies, India can strengthen its educational research and contribute to the advancement of knowledge. This study also provides the insight to policymakers, administrators, and researchers to enhance the much needed quality of research so that our country can lead the world in knowledge economy and society.

Keywords: Research Quality, Challenges, Issues, Strategies, Knowledge Economy and Society

1. Introduction

Our country is marching towards the category of developed countries. One of the significant indicators of developed countries is research and development. In this study, research refers to both doctoral work and research paper publication. A report revealed that “in 2021, India's gross expenditure on research and development (R&D) as a share of GDP stood at 0.8%; this was a significant decrease compared to the previous year. The gross expenditure on R&D was forecast to reach 65.2 billion U.S. dollars, a share of 0.65% of the total GDP in 2022 (Rathore, 2024)”. Research is considered one of the highest levels of education, and we are now excelling in research in terms of quantity, as the report of AISHE suggests that in 2019 alone, 38,986 Ph.D. degrees were awarded, and the share of public state universities in this was the highest, followed by Institutions of National Importance, Deemed Universities, and Central Universities (GoI, 2020). Another report from India Today revealed that our country is producing more than 24,000 doctoral degrees per year (Roy, 2022). We are 4th in research output and 9th in citations (Chhapia, 2023). We have also overtaken some countries, like Germany, in terms of research output. In the field of science and technology, there is an increase from the year 2019 in the research conducted in

India. The findings of Abbas and Hugar (2021) revealed that there is an increase of 4.72% per year in research publications. The majority of publications are research articles (81.51%). The Indian government funded most of the research (i.e., 88%). One of the probable reasons might be that in 2016, UGC mandated the research scholars to publish two articles from their Ph.D. work prior to final submission. Similarly, the US government's National Science Foundation (NSF) report (as cited in The Economic Times, Dec. 18, 2019) revealed that India stood 3rd with 1.35 lakh research paper publications in the field of science and engineering. Do publishing mandatorily two research papers before completing the PhD improve the quality of the PhD? The UGC chairman (Prof. Mamidala Jagdesh Kumar) has aptly pointed out the issue in the form of an open question asking, "Does forcing students to mandatorily publish a research paper before thesis submission lead to a high-quality PhD thesis, or does high-quality PhD work lead to publications in good journals (Kumar, 2022)?" Definitely, it is affecting the quality of both, i.e., PhD work and research paper publication. Because, practically most scholars try to get research papers published by hook and crook, consequently, they deviate from the quality of their PhD work and also compromise with the quality of paper publication. Though the idea and intention behind publishing two research papers mandatorily from PhD work was to improve the quality of PhD work, scholars shifted their focus towards publishing the research papers, and this situation enabled predatory and cloned journals to flourish. All these caused inferior research quality in the country. Hence, Kumar (2022) has rightly given stress to focusing on doctoral work primarily instead of publishing a paper during the PhD work. There is a dire need to inculcate and encourage natural curiosity among scholars.

This surge in the quantity of research papers is a matter of pride for Indians, but at the same time, a great concern for academicians is that our research is unable to contribute significantly to the body of new knowledge. Our higher education institutions (HEIs) are lagging behind in infrastructure and facilities as compared to global standards. The low allocation of funds for higher education is one of the reasons behind this. Another reason is the higher ratio of scholars to faculty in our HEIs, which is just double (or even more in some cases) of the global ratio (10:1) for scholars to faculty. The situation is so severe that none of our universities can occupy a place among the globally top 200 research impact universities (Mehta, 2023). All these jointly contribute to low research quality. However, we solved the crisis of research quantity; now it is time to achieve the quality aspect of research by overhauling the whole education system, which the National Education Policy-NEP 2020 (NEP, 2020) advocates. We must instil research calibre among the students at the beginning of the school level. Our education system should provide a favourable environment for research by providing infrastructure and labs with flexibility. This is quite a tough task, but not an impossible one. In order to deal with such challenges, we must strive hard. Therefore, the NEP (2020) has aptly recommended enhancing the fund for research, adopting suitable measures for research collaboration, and suggesting the establishment of the National Research Foundation (NRF). In this article, efforts have been made to highlight some key aspects to enhance the quality of academic research conducted in the Indian context. It will also provide insight to policymakers, administrators, and researchers to enhance the much-needed quality of research.

2. Problems and Issues in Educational Research in India

There are many issues and problems that are deeply rooted in our education system and prevailing in the research programs carried out in India. They are: lack of research ethics in practice, lack of sincerity

among the stakeholders, malpractices in the operational procedure, preference to personal interests, lack of infrastructure, resources and funds, low budget allocation for research, hurdles in official process of approval, lack of sufficient knowledge of research methodology and statistics, lack of innovation, lack of collaborative research, dictatorship of funding agencies and research institutions in identifying the real problem, non-favourable attitude towards research, lack of trust and support from external organizations, non-cooperation in data collection process and hurdles in data accessibility, data analysis dependency, lack of quality criteria implementation, lack of motivation and rewards to best practices, lack of qualified faculty, degree and job oriented research work, lack of sincerity in research evaluation, lack of regulatory bodies for quality check, mushrooming predatory journals, etc. All these issues and challenges affect the research quality adversely, but can be manageable and resolved if properly monitored and guided. For this, a cell for research and development in each institution or university should be established to address and take care of all such issues in a timely manner. In order to create a more conducive environment for conducting quality research and innovation in India, our policymakers, funding agencies, and research institutions should take appropriate measures to enhance the infrastructure, streamline the regulatory process, make the process of approval smooth, build trust and collaboration among research institutions, enhance funding opportunities, instil ethics and morality, facilitate data accessibility, recognize and reward quality research output, and implement quality assurance criteria. In this way, we can develop our society and thereby build our nation as a global knowledge economy. Some concrete suggestions are given here to enhance the research quality in the Indian context.

3. Strategies to Improve the Quality of Research in Indian Context

Although the Indian government has taken several noteworthy steps to improve the quality of research, it should formulate research policies that can promote interdisciplinary collaboration, open-access publications, utilize advanced technology for data analysis, and emphasize replicability in research. It should focus on promoting diversity and inclusion in research teams to bring different perspectives to educational research. Emphasis should be given on inculcating a research culture, starting at the lower levels. Continuous professional development and mentorship in research programs can play a role in establishing a culture of quality educational research in our country. Some of the potential strategies followed by their brief description are discussed below:

1. Research Collaboration
2. Diversity and Inclusion
3. Use of Advanced Technology
4. Continuous Professional Development (CPD) and Mentorship Programs
5. Replicability in Research
6. Open-access Publications

4. Research Collaboration

In our nation, collaborative platforms and networks that bring together researchers from various fields, such as education, psychology, sociology, management, technology, economics, and so forth, can

promote interdisciplinary collaboration in educational research. By facilitating collaborative research, organizing interdisciplinary workshops, seminars, and conferences, and generating funding opportunities for multidisciplinary initiatives, we can promote research collaboration. Our educational institutions should establish the interdisciplinary research centres where scholars from different faculties can work collaboratively on common research goals. By promoting a culture of knowledge sharing and interdisciplinary dialogue, we may simplify complex knowledge and encourage researchers to explore innovative approaches for resolving educational challenges efficiently.

5. Diversity and Inclusion

Fostering diversity and inclusion within India's educational research community is essential for enriching varied research perspectives, allowing multidisciplinary approach, driving innovation, ensuring the findings that reflect and address the needs of a multicultural society. This produces the enhanced research quality. Achieving this requires a proactive, multi-faceted approach.

At the core of this strategy, commitment to diverse recruitment at every level is a key aspect. This includes the intentional inclusion of researchers, mentors, and members of research evaluation panels from a wide spectrum of localities, genders, ethnicities, socioeconomic backgrounds, and academic disciplines. Building teams with such rich diversity ensures a breadth of viewpoints and lived experiences that influence the selection of research topics, methodologies, and the interpretation of results. The perspective of diversity and inclusion have been depicted in the following Figure 1

Figure 1 Perspective of Diversity and Inclusion

Inclusive leadership is essential for cultivating an environment where every team member feels valued and their contributions respected. Leaders must model a commitment to equity, actively solicit diverse perspectives, and create a safe space for open dialogue. Training and awareness programmes play a key role in sensitising the research community as a whole. These programmes should address conscious and unconscious biases, promote cross-cultural understanding, and equip individuals with strategies for fostering inclusion within their research environments.

Support networks and affinity groups provide a vital sense of community and belonging for researchers from traditionally underrepresented groups. Additionally, flexible work policies that offer remote work options, flexible hours, and family-friendly accommodations address the diverse needs of researchers, allowing them to balance their commitments while fully participating as members of the research community. Formal mentorship programmes play a critical role, pairing emerging researchers from diverse backgrounds with experienced researchers who provide guidance, and support, and open doors to professional networks.

Inclusive and equitable research practices extend beyond the composition of research teams. It demands that we interrogate every stage of the research process to ensure a diversity of viewpoints informs the research question, methodology, data analysis, and interpretation. Research environments should also prioritise accessibility, making physical spaces, resources, and activities inclusive for individuals with diverse abilities.

Celebrating diversity in its all forms is vital. We can create a harmonious environment by accepting, respecting and actively sharing the cultural richness, unique experiences, and varied perspectives inherited within the members of research teams, where everyone recognized and empowered to contribute their best. India has an opportunity to set a global standard for inclusive educational research through implementation of integrating the above strategies. This commitment will generate high-quality, relevant, and impactful research that benefits all segments of society.

6. Use of Advanced Technology

The integration of advanced technology into educational research has the potential to revolutionise the designing of effective learning experiences; collecting and analysing the data; interpreting the results and findings. Learning analytics, driven by sophisticated data analysis tools, grants researchers the ability to delve into patterns of student performance and behaviour. This data allows for targeted interventions, in-depth assessment of instructional effectiveness, and the identification of factors impacting student success. Artificial intelligence (AI) and machine learning (ML) algorithms hold the promise of hyper-personalized learning paths, where instruction adapts in real time to the strengths and needs of each individual. Additionally, AI-powered systems can streamline grading processes, freeing up educators and researchers to concentrate on higher-level analysis and mentorship. The different uses of advanced technology for research quality improvement are shown in the following Figure 2

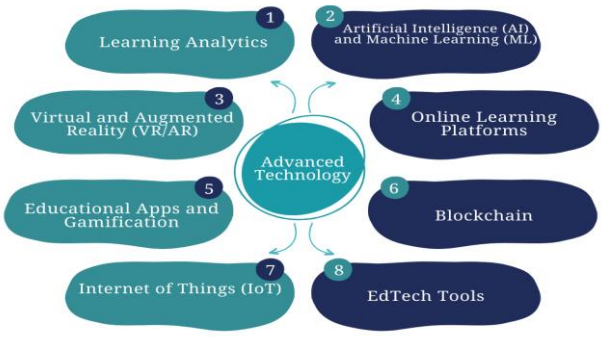

Figure 2 Uses of Advanced Technology for Research Quality Improvement

Virtual and Augmented Realities (VR/AR) break down the limitations of traditional learning environments. Immersive simulations, virtual laboratories, and the recreation of historical scenarios or complex scientific phenomena offer unparalleled opportunities for hands-on engagement and deep conceptual understanding. VR/AR experiences can also be meticulously designed for research purposes, controlling variables and providing rich data sets for analysis. Online learning platforms, especially Massive Open Online Courses (MOOCs), provide access to vast troves of educational content, facilitate global collaboration, and generate enormous datasets ripe for research exploration. Educational apps and gamification principles inject elements of play, reward, and challenge into the learning process, enhancing student motivation and potentially revealing valuable patterns about engagement and learning preferences.

Blockchain technology, with its decentralised and immutable ledger system, offers a secure solution for verifying and safeguarding academic credentials. This ensures the legitimacy of research findings, builds trust within the academic community, and combats the issue of fraudulent qualifications. The Internet of Things (IoT), through the deployment of sensors and connected devices in smart classrooms, facilitates the real-time monitoring of student progress, environmental factors, and resource utilisation. This fine-grained data empowers researchers to optimise learning environments and identify potential barriers to success. A vast array of specialised EdTech tools has streamlined the communication, facilitate formative and summative assessments, and provide dynamic feedback channels. These tools are essential in gathering the qualitative and quantitative data that fuels robust, impactful, and actionable educational research.

There are some advanced technologies that can be utilised in our research to enhance the quality of data analysis significantly (as shown in Figure 3). These technologies may include: The integration of advanced technological tools within data analysis practices holds immense potential to transform educational research, leading to greater depth of insight, robust findings, and actionable recommendations for the field. Machine learning algorithms, with their capacity to process vast datasets, excel at identifying patterns, predicting outcomes, and unveiling trends that might otherwise remain hidden within traditional research methodologies. This refined knowledge base empowers researchers to make informed decisions and tailor interventions with greater precision.

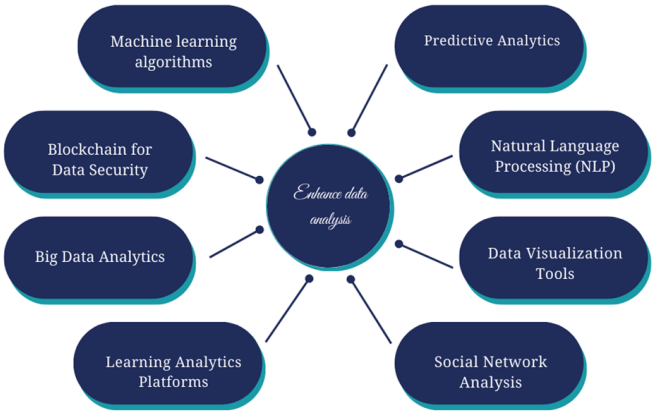

Figure 3 Technologies for Enhancing Research Data Analysis

Predictive analytics, fuelled by machine learning, offers researchers a glimpse into potential future outcomes. By developing predictive models, researchers can anticipate student behaviours, identify those at risk of dropping out, and forecast overall academic success rates. This data allows for proactive remediation, customised learning strategies, and the allocation of support resources where they are most likely to yield a significant impact.

Natural Language Processing (NLP) opens the door to nuanced analysis of qualitative data. NLP algorithms can dissect student essays, research papers, feedback forms, and other text-based sources, revealing language patterns, underlying sentiments, and common themes. These insights offer a window into student mindsets and the overall effectiveness of educational approaches and research instruments.

Data visualisation tools play a critical role in translating complex educational findings into clear, actionable formats. Through intuitive graphics, flowcharts, and interactive representations, researchers can effectively communicate results to diverse stakeholders, ensuring that insights lead to meaningful change. Social network analysis applies an analytical lens to social interactions within educational communities. With these tools, researchers can map connections, identify influential individuals, and understand the social dynamics that impact learning, collaboration, and the overall research environment.

Learning analytics platforms provide a central hub for advanced data collection and analysis. These platforms streamline data integration and provide real-time insights into student engagement, progress, and potential stumbling blocks. Complementing these are big data analytics tools, which allow for the processing of massive, complex datasets to uncover correlations and trends that traditional methods may miss. Blockchain technology provides an immutable and transparent ledger system, safeguarding the integrity of educational research data and building trust among researchers, institutions, and the broader public.

Researchers gain the power to drive evidence-based decision-making in the educational field by strategically weaving these sophisticated analytical technologies into their research practices. This ultimately leads to more targeted interventions, improved learning outcomes, and a stronger, more informed foundation for the continued enhancement of education.

7. Continuous Professional Development (CPD) and Mentorship Programs

Continuous Professional Development (CPD) initiatives and mentorship programmes serve as powerful catalysts for elevating research quality within the educational field. CPD programs not only updates the methodology and content of research but provides on-going support, tailored guidance, and access to the latest knowledge, empower researchers to enhance their skills, embrace best practices, and pursue innovative lines of inquiry. CPD provide numerous opportunities for enhancing research quality some of which presented in Figure 4

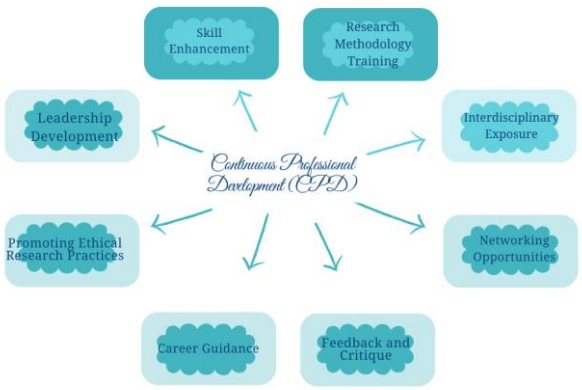

Figure 4 CPD Program Opportunities

CPD programmes offer researchers structured opportunities to expand their methodological toolkit, stay abreast of the latest theoretical frameworks, and learn cutting-edge analysis techniques. This commitment to lifelong learning translates into more rigorous research designs and the confident application of sophisticated analytical methods, both of which underpin high-quality findings. Specialized CPD workshops in quantitative and qualitative methodologies, statistical software training, and sessions on ethical research practices are particularly valuable for maintaining standards of excellence as methodologies evolve.

Interdisciplinary exposure, often facilitated through CPD programs, sparks innovation. By engaging with scholars from diverse fields, researchers gain fresh perspectives on complex educational issues. This cross-pollination of ideas can lead to the development of more nuanced, multifaceted research questions and novel analytical approaches.

Mentorship programmes create a dynamic network of support for researchers. The pairing of emerging researchers with experienced mentors promotes the sharing of knowledge, fostering a collaborative environment conducive to high-quality scholarship. Mentors offer constructive feedback, challenge assumptions, and open doors to new possibilities, thereby refining research methodologies and strengthening the overall output. Additionally, mentorship offers invaluable career guidance. Mentors empower mentees to make informed choices that align with their long-term research goals by helping researchers navigate professional pathways.

Both CPD and mentorship programmes play a critical role in reinforcing ethical research standards. Modules on responsible conduct, human subject protections, and ethical publication practices equip researchers with the knowledge to make ethical decisions at all stages of the research process. Leadership development is another key feature of mentorship programs. Cultivating leadership qualities in researchers empowers them to shape the direction of research within their institutions and at the national level. This creates a cascading effect, promoting a culture of research excellence.

India's institutions can nurture a thriving community of skilled, ethical, and innovative educational researchers by their planned and carefully investment in continuous professional development and robust mentorship programs. This investment translates into robust, insightful, and impactful research findings

that can directly contribute to advancing educational practices and elevating the nation's education system to new heights. The suggestion of establishing NRF by NEP-2020 has given a ray of hope for the improvement of quality in higher education. The NEP states that the NRF will function to help enable and support such a vibrant research and innovation culture across HEIs, research labs, and other research organisations (NEP, 2020).

8. Replicability in Research

Indian research can be achieved credibility through a commitment to transparency, rigorous methodology, and collaboration thereby ensuring research reliability and replicability in various aspects as depicted in Figure 5, but this require a systemic reform, institutional support, ethical governance, and a willingness to confront the structural obstacles that inhibit many Indian researchers. One foundational step is to meticulously document every aspect of the research design in published work. This includes clearly outlining the research question, theoretical framework, data collection instruments and procedures, and the specific analytical techniques employed. Such transparency allows independent researchers to follow the same methodological path, increasing the likelihood of replicating the original findings.

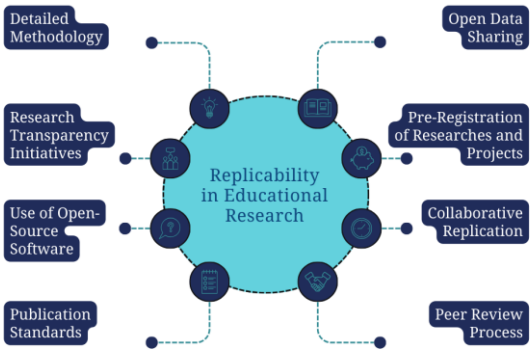

Figure 5 Replicability and Research Quality

Open data sharing, while requiring careful safeguards against misuse, plays a vital role in driving replicability. Making raw data, code, and other relevant materials freely available facilitates independent analysis and verification. The practice of selective reporting and the post-hoc modification of research design to fit the research findings may be reduced when research studies are pre-registered, with the proposed objectives, hypotheses, sampling technique, research design, and analysis methods, all of which are practiced strictly. This promotes transparency and underscores the integrity of the research process.

Collaborative replications, with multiple research teams independently conducting similar studies, provide a powerful means of verifying findings and exploring whether results generalise across different settings. A robust peer review process is indispensable. Here, qualified peers meticulously scrutinise all stages of the research, from problem formulation and methodology to analysis and interpretation. This critical feedback loop helps ensure the soundness of the study before wider dissemination.

Publication platforms, including academic journals, play a pivotal role in upholding research quality. It's imperative that they adhere to rigorous publication standards emphasising transparency, objectivity, and ethical research practices. These standards should include clear guidelines on data sharing and instructions for ensuring replicability. The use of open-source statistical software and analysis tools eliminates a potential roadblock to replication, allowing researchers to recreate analyses without proprietary software constraints.

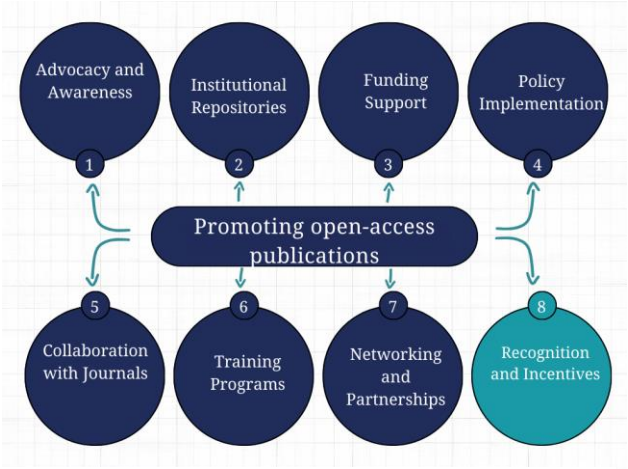

Figure 6 Role of Open Access Publications

India's educational research community can strengthen replicability through actively participating in international transparency initiatives like the Transparent and Open Promotion (TOP) Guidelines. These initiatives provide a framework for best practices and foster a global commitment to the open sharing of data and research methodologies. By systematically integrating these practices into the fabric of research practice, educational researchers in India can bolster the trustworthiness of their findings and meaningfully contribute to evidence-based advancements within the field, both locally and globally.

Open-access Publications

Open-access publications can be promoted in multiple ways as shown in Figure 6. Promoting open-access publications in India's educational research landscape requires a multifaceted approach grounded in advocacy, infrastructure development, policy alignment, and strategic collaboration. At the forefront of this effort is a concerted campaign to raise awareness of the significant benefits of open access among researchers, institutions, and policymakers. Research sponsors can change attitudes, enhance the research quality and bring revolution in research dissemination thereby transform the society by extending support in research review, monitoring, and publication; highlighting the increased visibility, accessibility, and potential impact of research findings; and removing the barriers to access.

The establishment of institutional repositories plays a vital role in driving open access. These repositories provide a centralised platform for researchers to deposit and share their publications, ensuring long-term preservation and global access to Indian educational research. Encouraging rather than mandating the use of these repositories are keys to fostering acceptance and long-term participation from the research community. To further expand the reach of open-access practices, it's imperative that

funding agencies champion this initiative. By encouraging or requiring grantees to choose open-access publication routes, and financially supporting open-access initiatives, these agencies can be powerful drivers of change. The Shodhganga repository hosts Ph.D. theses in various disciplines, and various government institutions like NCERT, IGNOU and others host their journals on their websites. Academicians write blogs and post their academic activities on websites like ResearchGate and Academia, which are some of the efforts in these directions. These are individual efforts, that lack credibility, but policy formulation goes a long way.

Clear, well-defined institutional policies that align with national and international open-access mandates are essential. These policies provide a roadmap for researchers and ensure the institution's commitment to open knowledge sharing aligns with global best practices. Additionally, India's institutional publications should forge strategic collaborations with national and international journals. This could involve transitioning existing journals to hybrid open-access models or launching entirely new open-access publications.

Training, support, and guidance are critical for researchers navigating the evolving landscape of open-access publishing. Institutions should offer workshops and training programmes that address researcher concerns, explain licensing options, and provide practical guidance on selecting reputable open-access journals. Fostering a strong network of partnerships with international open-access organisations and platforms expands the reach of Indian research and exposes the local community to global best practices. Research sponsors and publishing agencies can provide incentives that align with the broader goal of disseminating research by means of recognising and rewarding researchers with open-access publishing and incorporating this commitment into institutional evaluation criteria.

9. Conclusion

Despite the challenges of conducting research, Indian government has committed to enhancing the quality of the research. The nation is now progressing towards research quality improvement gradually and transforming towards a knowledge society. The Indian government has shown its intent towards facilitating funds for quality research by recommending establishing the National Research Foundation (NRF) in its landmark policy, NEP 2020. NEP has also advocated establishing the Research-Intensive Universities and promoting interdisciplinary research among the institutions. The UGC has already declared to review the quality of theses among all the universities in India. But, along with the measures taken by the Indian government, collective efforts should be made to improve quality research by all the stakeholders in the research program. However, in this paper, the authors tried to suggest some technology enabled strategies for research quality improvement in the Indian context. Throughout the paper, the authors explored the ways in which technology, diversity, openness, and on-going professional development hold the key to enhancing the quality and impact of educational research within India. The integration of advanced technologies offers unprecedented tools for data collection, analysis, and the creation of immersive learning experiences. A deliberate commitment to diversity and inclusion ensures research reflects the nation's rich tapestry and generates insights relevant to all its communities. Transparency, open-access publication, and replicability establish trust and build an enduring knowledge base. Investing in continuous professional development and robust mentorship

programmes ensures that India's researchers remain at the forefront of innovation and ethical rigour. Hence, the strategies suggested should be considered by Indian policymakers and administrators. Our higher education institutions should also come forward to implement these strategies. India's educational research ecosystem can contribute significantly to the advancement of knowledge within the nation and globally by incorporating and implementing the above discussed strategies.

References

1. Abbas, S. M., & Hugar, J. G. (2021). Growth of Indian Research in Science and Technology: A Scientometric Analysis. Library Philosophy and Practice (E-Journal). Retrieved from https://digitalcommons.unl.edu/libphilprac/5498
2. Chhapia, H. (2023, March 23). India is world's 4th in research output, but ranks 9th in citations. The Times of India. Retrieved from https://timesofindia.indiatimes.com/india/india-is-worlds-4th-in-research-output-but-ranks-9th-in-citations/articleshow/98924312.cms
3. GoI. (2020). All India Survey on Higher Education 2019-20. In www.education.gov.in (pp. 1–290). New Delhi: Department of Education, Ministry of Education, Government of India. Retrieved from Department of Education, Ministry of Education, Government of India. website: https://www.education.gov.in/sites/upload_files/mhrd/files/statistics-new/aishe_eng.pdf
4. Kumar, M. J. (2022, October 18). Focus on PhD quality, not publications: We need to encourage scholars to become inquisitive explorers, papers. Retrieved September 22, 2024, from Times of India Blog website: https://timesofindia.indiatimes.com/blogs/toi-edit-page/focus-on-phd-quality-not-publications-we-need-to-encourage-scholars-to-become-inquisitive-explorers-published-papers-will-naturally-result-from-this/
5. Mehta, A. C. (2023, November 12). The Crisis of Quality in Higher Education in India (2023) | Education for All in India. Retrieved from www.educationforallinindia.com website: https://educationforallinindia.com/the-crisis-of-quality-in-higher-education-in-india-2023/
6. NEP. (2020). National Education Policy 2020, Ministry of Human Resource Development Government of India. In https://www.education.gov.in/ (pp. 1–65). New Delhi: Ministry of Education. Retrieved from Ministry of Education website: https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
7. Rathore, M. (2024, March 13). India: gross expenditure on R&D as a share of GDP 2022. Retrieved from Statista website: https://www.statista.com/statistics/1350227/india-gross-expenditure-on-randd-as-a-share-of-gdp/
8. Roy, S. (2022, June 2). PhD, research and its upshot: How much quality do we produce? Retrieved from India Today website: https://www.indiatoday.in/news-analysis/story/phd-research-and-upshot-how-much-quality-do-we-produce-1957277-2022-06-02?onetap=true
9. The Economic Times. (2019, December 18). India is world's third largest producer of scientific articles: Report. The Economic Times. Retrieved from https://economictimes.indiatimes.com/news/science/india-is-worlds-third-largest-producer-of-scientific-articles-report/articleshow/72868640.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst