

Advancing Trustworthy Science through Evidence Synthesis, Responsible Research Assessment, Open Science, and Responsible AI

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ABSTRACT

The rapid expansion of scientific literature, growing demands for research integrity, and the increasing integration of Artificial Intelligence (AI) are reshaping contemporary research and scholarly communication. This report reflects on a week-long interdisciplinary Faculty Development Programme that examined the convergence of evidence synthesis (systematic review and meta-analysis), bibliometrics, research evaluation, open science, innovation analytics, and responsible AI as complementary foundations of trustworthy science. Rather than viewing these domains as independent methodological traditions, the programme highlighted their evolving integration into a common framework that strengthens methodological rigor, transparency, reproducibility, accountability, and evidence-informed decision making. The discussions also emphasized the importance of structured methodological training in enabling researchers to critically evaluate emerging analytical tools, adopt AI responsibly, and apply robust evidence across diverse disciplinary contexts. The programme illustrates how integrated methodological capacity building can strengthen research integrity, responsible research assessment, and trustworthy knowledge production in increasingly AI-enabled research ecosystems.

Keywords: Bibliometrics, Evidence synthesis, Meta-analysis, Open science, Research evaluation, Research integrity, Responsible artificial intelligence, Responsible research assessment, Scholarly communication, Systematic review, Trustworthy science.

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INTRODUCTION

The accelerating growth of scientific literature, increasing expectations for research integrity and accountability, and the widespread adoption of Artificial Intelligence (AI) are reshaping contemporary research and scholarly communication. These developments demand research that is scientifically rigorous, transparent, reproducible, and ethically governed. They also require researchers to acquire methodological competencies that extend beyond disciplinary expertise. Evidence synthesis (systematic review and meta-analysis), bibliometrics, research evaluation, open science, and responsible AI have therefore become integral components of contemporary research practice. Although these domains have evolved largely as independent

methodological and normative traditions, they are converging in response to concerns about reproducibility, publication malpractice, information overload, metric misuse, and algorithmic opacity.

This convergence has contributed to the emergence of trustworthy science as an overarching framework for responsible knowledge production. In this report, trustworthy science refers to scientific knowledge that is generated, evaluated, communicated, and applied in research, policy, and practice through methodologically rigorous, transparent, reproducible, ethically governed, and accountable research processes. It integrates complementary methodological and normative domains, including evidence synthesis, responsible research assessment, open science, research integrity, and responsible AI governance. Together, these domains strengthen the credibility, transparency, reliability, and societal value of scientific evidence while supporting evidence-informed decision making (Hicks *et al.*, 2015; UNESCO, 2021). Rather than representing a new methodology, trustworthy science offers an integrative framework that aligns methodological rigor with responsible research assessment, open science, ethical AI governance, and research integrity.



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This convergence of methodological traditions formed the intellectual foundation of the week-long Faculty Development Programme on Systematic Review, Meta-analysis, Bibliometrics, and Responsible AI in Scientific Research. The programme was jointly organised by the Institute of Development Studies Kolkata (IDSK), the Indian Statistical Institute (ISI), and Presidency University (PU) during 16–22 February 2026 (IDSK *et al.*, 2026). It brought together an interdisciplinary cohort of doctoral researchers, faculty members, clinicians, psychologists, librarians, and researchers from the health sciences, social sciences, and information science. Through expert lectures, practical demonstrations, and critical discussions, the programme examined emerging methodological developments in research and scholarly communication.

As illustrated in Figure 1, the programme presented these interconnected methodological and normative domains as complementary components of an integrated framework for trustworthy science rather than as isolated areas of expertise. The framework demonstrates how evidence synthesis, bibliometrics, responsible research assessment, open science, innovation analytics, and responsible AI collectively strengthen research integrity, transparent scholarly communication, and evidence-informed decision making. More broadly, this convergence reflects a shift in contemporary research, where methodological excellence alone is no longer sufficient. Trustworthy science depends on integrating rigorous evidence generation, responsible research assessment, open knowledge practices, and ethical AI governance throughout the research lifecycle. The following sections discuss how these interconnected themes emerged during the programme and their implications for research, policy, and scholarly communication.

Research Integrity and Evidence Synthesis

The programme opened with discussions on research integrity and scientific accountability, establishing the broader context for scientific integrity in contemporary research. Bysdeb Dasgupta (IDSK) addressed contemporary challenges in scholarly communication and research integrity. Swagatam Das (ISI, Kolkata) highlighted the importance of transparency, human oversight, and ethical responsibility in AI-enabled research, while Achal Agrawal (India Research Watch) examined publication malpractice, citation manipulation, predatory publishing, and related threats to the credibility of scholarly communication. Together, these discussions underscored that technological innovation must be accompanied by robust governance mechanisms that safeguard research integrity, transparency, and public trust.

Evidence synthesis formed a major focus of the programme. Rabishankar Giri (Presidency University) introduced the complementary roles of systematic review, meta-analysis, and bibliometric analysis in organising, evaluating, and synthesising

rapidly expanding bodies of scientific literature. Building on these conceptual foundations, Jiban K. Pal (ISI) demonstrated practical approaches for developing comprehensive, transparent, and reproducible search strategies, emphasising their importance for evidence synthesis methodologies.

Quantitative evidence synthesis was addressed through sessions led by Kajori Banerjee (ISI, Kolkata) and Rahul Rajak (IDSK). The discussions covered effect size estimation, heterogeneity assessment, fixed-effect and random-effects models, PICO-based question formulation, PROSPERO registration, quality appraisal, risk-of-bias assessment, and the PRISMA 2020 reporting guidelines. Practical demonstrations introduced participants to forest plots, funnel plots, subgroup analysis, meta-regression, sensitivity analysis, and trim-and-fill procedures. Together, these methodological components reinforced the importance of transparency, reproducibility, and robust statistical inference in evidence synthesis (Page *et al.*, 2021).

The programme also examined the growing role of AI in evidence synthesis. Shri Ram Pandey (Central University of Haryana) discussed recent developments in AI-assisted systematic reviews, while Sanjoy Kar (IDSK) demonstrated ASReview, an open-source machine-learning platform for literature screening. These sessions illustrated how AI can improve the efficiency and scalability of evidence synthesis while also raising important methodological and ethical considerations. Discussions emphasised that AI-assisted workflows require transparent reporting, rigorous validation, and meaningful human oversight to ensure the credibility, reliability, and integrity of review findings.

Bibliometrics, Research Evaluation, and Policy Intelligence

A second major theme examined the evolving role of bibliometrics in research evaluation, research governance, and science policy. Vivek Kumar Singh (NITI Aayog) discussed scholarly communication systems, citation indicators, and research metrics within the broader context of research assessment. The keynote highlighted both the strengths and limitations of citation-based indicators and emphasised the need for multidimensional approaches capable of recognising diverse forms of scientific contribution.

The discussions were further extended by Bidyarthi Dutta (Vidyasagar University), who examined the transition from journal-based indicators, particularly the Journal Impact Factor, towards broader measures of research quality, influence, and societal impact. These perspectives aligned with international initiatives advocating responsible research assessment and context-sensitive use of research metrics (Hicks *et al.*, 2015; Wilsdon *et al.*, 2015). They also reflected growing concerns that evaluation indicators now shape research behaviour rather than simply measure scientific performance (Bhattacharya, 2026).

Similar debates have emerged in India, where research evaluation is progressively shifting towards more balanced approaches that combine quantitative indicators with qualitative and contextual assessments of research quality (Kar, 2025).

The practical applications of bibliometric analysis were explored through sessions by Shakil Ahmed (Imam Abdulrahman Bin Faisal University, Saudi Arabia) and Swapan Kumar Patra (Sidho-Kanho-Birsha University). These sessions introduced bibliometric workflows, science mapping, citation network analysis, and visualisation techniques as tools for understanding the structure and evolution of scientific knowledge. Beyond research evaluation, the discussions demonstrated how bibliometric methods support research management, strategic planning, and knowledge discovery across disciplinary and institutional contexts.

The policy relevance of bibliometric intelligence was further illustrated by Prashasti Singh (Shri Ram College of Commerce, University of Delhi), who demonstrated how scholarly databases and bibliographic intelligence can support evidence-informed policymaking. The session highlighted the growing role of bibliometric infrastructures in identifying emerging research areas, mapping scientific capabilities, and informing strategic research priorities. These discussions positioned bibliometrics not only as a tool for research evaluation but also as an important component of research governance, policy intelligence, and trustworthy decision making.

Open Science, Innovation Analytics, and Research Governance

The programme also examined the normative dimensions of scientific knowledge production by situating methodological rigor within broader principles of openness, inclusivity, and responsible research governance. Sujit Bhattacharya (Amrita Vishwa Vidyapeetham) discussed how evidence synthesis and research evaluation should be understood within the broader framework of open science. The discussions emphasised that scientific excellence depends not only on research quality but also on transparency, accessibility, equity, and societal relevance. These perspectives align with international efforts to promote responsible research assessment and more inclusive systems of knowledge governance (Bhattacharya, 2026; UNESCO, 2021).

The programme further broadened the scope of scientometrics by incorporating perspectives from innovation analytics and intellectual property research. Sabuj K. Chaudhuri (University of Calcutta) examined the implications of AI-driven inventions for responsible innovation and evolving intellectual property systems. Complementing this perspective, Anurag Kanaujia (CSIR-NIScPR) demonstrated how patent metadata can be systematically analysed to assess research and development activity, technological evolution, knowledge diffusion, and innovation performance.

These discussions illustrated that bibliometric and patent-based indicators provide complementary perspectives on scientific and technological development. By extending scientometric analyses

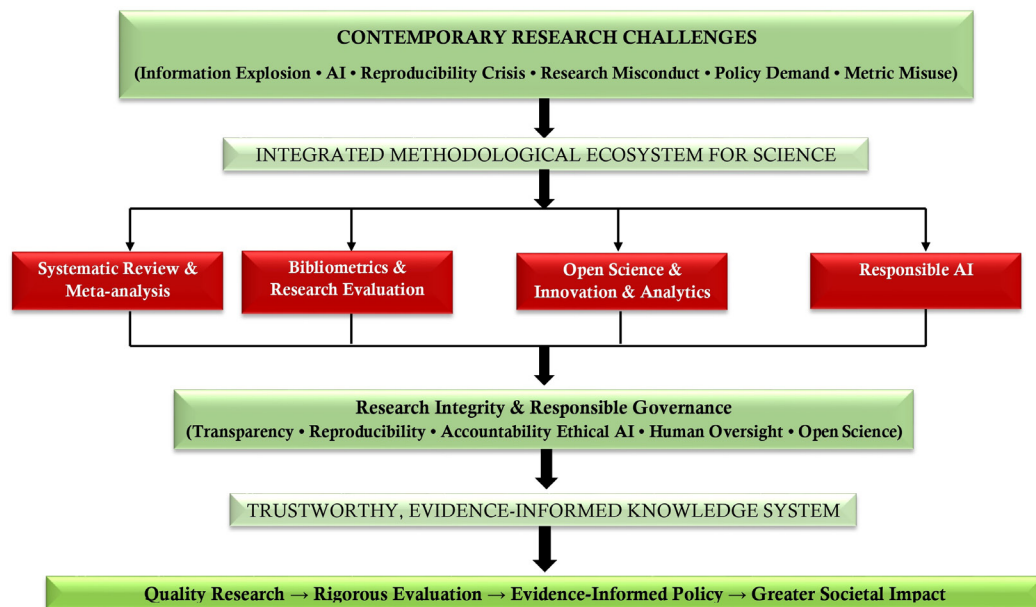


Figure 1: Conceptual Framework for Trustworthy Science.

beyond scholarly publications to innovation systems, technology transfer, and knowledge commercialisation, innovation analytics offers a more comprehensive understanding of how scientific knowledge generates societal and economic value. Together, these perspectives reinforced the importance of integrating open science, responsible governance, and innovation intelligence within broader frameworks for trustworthy science.

Responsible AI and Research Integrity

A defining feature of the programme was its sustained focus on the responsible and ethical use of Artificial Intelligence (AI) in scientific research and scholarly communication. Ujjal Marjit (University of Kalyani), Sanoar Hossain (University of Calcutta), and Parthasarathi Mukhopadhyay (University of Kalyani) examined the integration of AI across the research lifecycle, spanning idea generation, literature discovery, evidence synthesis, scholarly writing, publication, and research dissemination. The sessions introduced emerging applications, including AI-assisted systematic reviews, Retrieval-Augmented Generation (RAG), prompt engineering, AI-supported academic writing, and AI-enabled reference management.

Rather than focusing solely on technological innovation, the discussions critically examined the methodological, ethical, and epistemological implications of AI-mediated scholarship. Particular attention was given to fabricated citations, hallucinated content, algorithmic bias, copyright and intellectual property, disclosure practices, traceability, and accountability of AI-generated outputs. These concerns have assumed greater significance as growing evidence shows that large language models can generate fabricated references, inaccurate factual claims, opaque outputs, and biased responses, thereby challenging the reliability, transparency, and integrity of scholarly communication (Walters and Wilder, 2023; Hsu *et al.*, 2025).

The sessions consistently emphasised that AI should augment, rather than replace, scholarly expertise and critical judgement. Although generative AI can substantially improve literature discovery, evidence synthesis, and academic writing, its responsible application requires transparent disclosure, rigorous verification, meaningful human oversight, and clearly defined accountability throughout the research process (Flanagin *et al.*, 2023; Nature, 2023; COPE Council, 2023). Responsible AI was presented as a governance framework for ensuring that AI-enabled research remains transparent, accountable, reproducible, and aligned with established principles of research integrity.

Beyond AI applications, the programme reinforced the importance of informed methodological judgement in an increasingly complex research environment. Through expert lectures, practical demonstrations, and interactive discussions, participants were encouraged to evaluate methodological choices in relation to the objectives, assumptions, strengths,

and limitations of different research designs rather than treating analytical techniques as isolated procedures. The discussions highlighted that contemporary research capacity depends on the ability to integrate diverse sources of evidence, critically assess emerging analytical technologies, and adapt research practices to evolving scholarly environments. Such interdisciplinary methodological training provides a strong foundation for strengthening research integrity, methodological resilience, and trustworthy science.

CONCLUDING PERSPECTIVE

The programme highlighted a significant shift in the methodological foundations of contemporary research. Evidence synthesis, bibliometrics, research evaluation, open science, innovation analytics, and responsible AI have traditionally been developed and applied as distinct methodological and normative domains. The discussions demonstrated that these approaches are increasingly interconnected and collectively contribute to trustworthy science. Rather than relying on individual analytical methods, trustworthy science depends on integrating rigorous evidence generation with responsible research assessment, open science, ethical governance, innovation intelligence, and meaningful human oversight of AI-enabled research. Together, these complementary domains strengthen scientific rigor, research integrity, transparency, reproducibility, and evidence-informed decision making across the research lifecycle.

An equally important outcome of the programme was the recognition that research capacity building must evolve alongside rapidly changing scholarly practices. Researchers increasingly require competencies that extend beyond disciplinary expertise to include evidence synthesis, responsible interpretation of research metrics, open science practices, innovation analytics, and the responsible use of AI. Such competencies enable researchers to critically evaluate emerging analytical technologies, integrate diverse sources of evidence, and make informed methodological decisions within increasingly complex research environments. Structured interdisciplinary training therefore represents an important mechanism for strengthening methodological literacy, adaptive research capacity, and responsible scholarship across disciplines.

As scholarly ecosystems continue to evolve, future research and capacity-building initiatives should continue fostering evidence synthesis, responsible research assessment, open science, innovation analytics, and responsible AI as complementary foundations of trustworthy science. In an era characterised by accelerating scientific production, AI-enabled research, and growing demands for accountability, scientific progress will depend less on individual methodological advances than on their responsible integration within transparent, reproducible, and ethically governed research ecosystems.

ABBREVIATIONS

AI: Artificial Intelligence; **IDSK:** Institute of Development Studies Kolkata; **ISI:** Indian Statistical Institute; **PU:** Presidency University; **PICO:** A framework used for structuring research question formulation; **PROSPERO:** A registry for systematic reviews; **PRISMA 2020:** An updated reporting guideline for systematic reviews; **CSIR-NIScPR:** Council of Scientific and Industrial Research-National Institute of Science Communication and Policy Research; **RAG:** Retrieval-Augmented Generation; **COPE:** Committee on Publication Ethics; **UNESCO:** United Nations Educational, Scientific and Cultural Organization.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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