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Digital Publishing Practices of *Nature* and *Science*: Implications for Scholarly Communication

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Abstract

Digital publishing has reconfigured the underlying logic of global scholarly communication, and the digital-intelligent transformation of scientific journals has become a core issue in international academic publishing competition. Adopting a technology–institution co-evolution perspective, this paper systematically deconstructs the digital publishing practice mechanisms of *Nature* and *Science*—two general-science flagship weeklies that represent, respectively, publisher-led and learned-society-led governance—across four dimensions: editorial systems, content production, dissemination networks, and the global ecosystem. The analysis draws on official journal pages, parent-organization reports and press releases, and peer-reviewed literature, and treats the two cases as ideal types rather than as a representative sample. The study finds that the core advantages of the two journals lie not in technological tools per se, but in the institutional guarantee of editorial autonomy, the organizational embedding of journalistic professionalism, AI-driven reengineering of editorial workflows, and the platform standardization capabilities that underpin dissemination efficiency—much of which is generated at the parent-organization level and then transferred to individual journals. Confronting the "double digital divide" that journals worldwide face at both the production and dissemination ends under platformization, this paper proposes asymmetric competition strategies for the international journal community: leveraging data sovereignty as a lever to build differentiated platform competitiveness, replacing job fragmentation with capability coupling to restructure editorial teams, using a branded tiered OA strategy to guide authors' choices, and reverse-embedding Altmetrics into topic-selection decisions to achieve a closed loop in dissemination evaluation. It further specifies differentiated and staged implementation pathways for journals with different resource endowments. The study aims to provide theoretical reference for the international journal community to move from "technological catch-up" toward "path innovation," and to help build a more autonomous, pluralistic, and sustainable scholarly communication ecosystem.

Keywords: Digital Publishing; Scientific Journals; Scholarly Communication; Digital-Intelligent Transformation; International Competitiveness; Open Access

1. Introduction

Digital publishing is not a mere change of medium; it is a structural transformation driven jointly by technological innovation, institutional response, and actor adaptation, profoundly reshaping the production, circulation, and evaluation logics of scholarly communication. As academic publishing moves from digitization toward digital-intelligent transformation, artificial intelligence, big data, and platform infrastructures are increasingly embedded in editorial decision-making, content production, and dissemination allocation, restructuring the organizational forms and power relations of scholarly communication. Yet technological evolution has not automatically produced a more open and equitable global academic ecosystem. On the contrary, the platformization of academic publishing is increasingly dominated by a small number of publishing conglomerates whose digital research and publishing infrastructures capture scientific knowledge production in their private interest, imposing structural dominance on academic communities through regimes of marketization, appropriation, and exploitation (Ma, 2023). Rising article processing charges (APCs), uneven peer-review capacity, and highly concentrated platform visibility and indexing resources together constitute an intensifying structural asymmetry in the global journal landscape. In this context, the digital transformation of journals is no longer merely a question of applying technological tools; it is an institutional question of whether editorial systems, organizational capabilities, and platform logics can be reconfigured in tandem.

Existing research has largely focused on the technical features of digital publishing, the business models of open access, or single-journal case experiences, while systematic deconstruction of the digital publishing practice mechanisms of leading international scientific journals remains scarce, and paradigm transformation, mechanism extraction, and structural predicaments have rarely been examined within a unified analytical framework (Silva, et al., 2023; Colangelo, et al., 2026). Against this background, this paper adopts a technology–institution co-evolution perspective and treats *Nature* and *Science* as "ideal types" of digital publishing practice, systematically deconstructing their mechanisms across editorial systems, content production, dissemination networks, and the global ecosystem. It reveals that their core advantages lie not in technological tools per se, but in the institutional guarantee of editorial autonomy, the organizational embedding of journalistic professionalism, AI-driven reengineering of editorial workflows, and the foundational support that platform standardization capabilities provide for dissemination efficiency. On this basis, the paper further examines the "double digital divide" that journals worldwide face at both the production and dissemination ends, analyzes the structural predicament induced by uneven platformization and its self-reinforcing mechanisms, and explores possible pathways for the international journal community to build an autonomous and controllable scholarly communication ecosystem.

The contributions of this paper are threefold. First, it advances digital publishing research from the level of technological application to the level of technology–institution coupling, providing a systematic analytical framework for understanding the digital publishing practices of leading international journals. Second, it connects the mechanism deconstruction of leading journals with the structural predicament of journals worldwide, revealing the internal logic through which inequality in scholarly communication is reproduced under platformization. Third, based on

mechanism analysis, it proposes pathway implications for an autonomous and controllable scholarly communication ecosystem, offering theoretical reference for the digital-intelligent transformation of the international journal community.

2. Analytical Framework, Case Selection, and Evidence Base

2.1. Three Concepts and Their Relationship

Technology–institution co-evolution, at the level of mechanism, explains how a technological affordance such as XML tagging, AI-assisted screening, or DOI-based priority publication is converted into a durable capability only where it is accompanied by institutional arrangements, including editorial autonomy, a professional division of labor, and standardized production workflows. Platform asymmetry, at the level of structure, refers to the concentration of ownership over the infrastructures through which visibility, indexing, metadata standards, and evaluation signals are allocated. The double digital divide, at the level of consequence, denotes the disparities that platform asymmetry generates: insufficient editorial capacity, data standardization, and workflow intelligence at the production end, and limited visibility, indexing coverage, and international participation at the dissemination end.

The three levels are connected sequentially, and the sequence also operates in reverse. Co-evolutionary capability within leading journals enables dominant actors to set standards that others must meet; the standards consolidate asymmetry; and asymmetry reproduces the divide by directing submissions, reviewers, and citations toward the platform core. The three levels correspond to the structure of the argument developed below: Section 2.2 addresses the structural level, Section 3 the mechanism level, and Section 4 the level of agency, at which pathways are derived for the production and dissemination ends of the divide. The framework also yields a proposition that Section 4.5 examines in practical terms: where the institutional complement is absent, the transfer of technology alone is unlikely to reproduce the outcome observed in the two cases.

2.2. Platform Asymmetry and the Self-Reinforcing Double Digital Divide

From the perspective of the international journal community, the development of digital publishing exhibits pronounced “platform asymmetry.” On the one hand, leading journals have moved from “content online” to “intelligent services”: AI tools are embedded in manuscript screening, editorial evaluation, reviewer recommendation, and language polishing, and submission platforms integrate submission, review, production, and publication into a seamless pipeline. On the other hand, many journals outside dominant platform ecosystems remain at the stage of “print thinking plus digital tools”: they adopt online submission systems but retain linear, email-mediated editorial workflows; they maintain social media accounts that function largely as tables-of-contents feeds rather than sites of scholarly community engagement. This gap between “instrumental adoption” and “logical reconstruction” constitutes the root of a double digital divide facing journals worldwide: at the production end, editorial capacity, data standardization, and workflow intelligence remain insufficient; at the dissemination end, platform visibility, indexing coverage, and international participation remain weak.

The consequence is a self-reinforcing "scholarly inner circle." When journals lack the platform visibility and editorial infrastructure to attract internationally competitive submissions, high-quality work migrates to venues with greater perceived legitimacy and reach; the residual submission pool narrows; and the journal's international standing is further weakened. Two feedback mechanisms sustain this structure. In the submission loop, the visibility of a journal attracts more competitive submissions, which in turn increases its visibility. In the standards loop, journals positioned within dominant platforms shape the metadata and evaluation conventions that others are required to follow. The reproduction of the divide therefore requires no deliberate coordination among actors; it follows from the ordinary operation of both loops. The pivotal bottleneck is therefore not any single missing technology but the absence of an integrated, intelligence-driven scholarly communication system capable of linking editorial production, dissemination, and evaluation into a coherent loop. The practices of *Nature* and *Science* thus serve as an "ideal type" whose mechanisms can be deconstructed—not for imitation, but for understanding the institutional and infrastructural conditions that enable a journal to participate in, rather than be subordinated to, the global circulation of knowledge.

2.3. Rationale for Selecting *Nature* and *Science*

The two cases were selected through theory-guided rather than statistical sampling. Because the analysis aims to reconstruct mechanisms, cases were chosen where the practice is most fully developed. Three criteria informed the selection. First, the two journals are functionally equivalent: both are general-science weeklies with in-house editorial teams and dedicated news operations, so that differences between them cannot be attributed to disciplinary scope or publication rhythm. Second, they differ in ownership and governance, one being located within a commercial publisher (Springer Nature) and the other within a learned society (AAAS); this contrast permits mechanisms common to flagship journals to be distinguished from those that depend on a particular ownership form. Third, both are mature and well documented, which allows claims at the level of mechanism to rest on primary sources rather than on secondary commentary. Two qualifications should be noted. Both are English-language journals with substantial resources, and they are treated as ideal types, that is, as constructs that render the logic of a practice visible, rather than as models to be imitated or as a sample from which frequencies may be generalized. What is transferable is the mechanism, not the level of resources at which it is currently operated, a distinction that underlies the differentiated pathways proposed in Section 4.5.

2.4. Sources and Evidence Base

The analysis draws on three categories of sources. Journal-level official pages include *Nature*'s "About the Editors" and *Science*'s "Meet the Editors" (accessed 29 January 2026), editorial policy statements, and journal and portfolio listings; these support the account of editorial composition and editorial autonomy. Parent-organization documents include Springer Nature's Annual Report 2024, its press release of 12 March 2026, and documentation issued by EurekAlert!; these support the account of AI deployment and of the dissemination infrastructure. The conceptual framework and third-party estimates are drawn from the peer-reviewed literature (Ma, 2023; Silva & Prado, 2023; Colangelo et al., 2026; Alex et al., 2025; Smith et al., 2021; Phelan, 2026; Thorp, 2026). The design is a document-based case study of mechanisms; no interviews or survey instruments were

used, and the conclusions constitute analytical generalizations rather than statistical inferences. Three limitations follow from this design. Official pages are institutional self-presentations and are read as evidence of how a journal defines its practice rather than as neutral descriptions. Web-based figures are time-sensitive and are reported as of the access dates indicated. Estimates of effect are reported together with their source, context, and design, and are interpreted as associations (Section 3.4).

3. Digital Publishing Practice Mechanisms of *Nature* and *Science*

3.1. The "Dual-Layer Governance" of Editorial Systems: Academic Autonomy and Professional Division of Labor

Nature's construction of an "elite" editorial corps carries significant institutional design implications. Its full-time research editors all hold doctoral degrees, and most have postdoctoral experience in top-tier laboratories (2026). The deeper logic lies in the fact that the professionalism of academic publishing is reflected not only in editorial norms but also in a keen judgment of disciplinary frontiers; as "academic gatekeepers," editors' stock of academic capital directly determines the frontier character of topic selection and the precision of peer review. *Nature* operates a strict "academic exit" mechanism: upon joining, editors must relinquish their prior research identities and devote themselves full-time to publishing, achieving "identity purification" to avoid conflicts of interest while ensuring capability renewal through continuous professional training (2026). *Science*, by contrast, adopts "hybrid governance": its core editorial team remains lean while building a review editorial board composed of hundreds of leading scientists, forming a flexible "small core plus large network" structure (2026). What the two journals share is a deep coupling of disciplinary expertise and publishing professionalism, rather than the binary separation of "academic editor" and "copy editor."

The effectiveness of their editorial systems is rooted in the institutional separation of editorial authority from business operations. Editorial departments and publishing business departments are strictly separated, and editorial decisions are insulated from advertising, distribution, and other commercial interventions, enabling academic capital to be genuinely converted into gatekeeping quality. At *Nature*, this separation is codified at the level of the parent organization rather than left to journal-level custom: Springer Nature's editorial policy states that editorial decision-making "should be independent of all commercial concerns" and that no one from the commercial or executive side "can get involved in, interfere with, or even comment on editorial decisions." The organizational embedding of journalistic professionalism constitutes another institutional foundation: in *Nature*'s editorial team, news editors are comparable in number to discipline editors, and most have mainstream media experience; *Science*'s news team is even larger than its science editorial team. The public communication of academic outputs is thus an independent procedure performed by professional journalists rather than an "extra task" assigned to editors. In 2026, Springer Nature launched the Nature Progress series, whose editorial design combines "the expertise of internal Nature Portfolio editors with the research-community expertise of external editorial boards"—in essence, an attempt at "editorial capability reconfiguration": internal editors

ensure process efficiency and unified quality standards, while external board members provide frontier disciplinary judgment.

Two levels of arrangement should be distinguished, since their implications differ for journals without a parent organization. The size and composition of the editorial team, the recruitment of editors with research experience, and the ratio of news to discipline editors are choices made at journal level. The editorial-independence policy, the production and platform infrastructure, and the shared AI services are arrangements provided by the parent organization and used by the journal. These arrangements operate through three channels: legitimacy, in that a group-level policy provides editors with a formal basis for resisting commercial interference; scale, in that shared services are supplied at a cost that no single title could bear; and labor, in that recruitment, training, and career structures are organized across the portfolio. Such resources enable rather than determine journal performance, since the editorial choices through which they are converted into advantage remain specific to the individual title. A journal without a parent organization cannot reproduce this scale, but it may reproduce the function through association-level policy, consortium arrangements, or public funding (Section 4.5).

3.2. Enhanced Content Products: From "Articles" to "Knowledge Service Units"

Nature's enhanced publishing strategy employs XML structural tagging to achieve modular recombination of content and provides rich supplementary information, diversifying the forms in which publications are presented. *Science*'s enhanced publishing strategy is more radical: around a single main paper, the editorial office coordinates the production of multiple associated outputs—"Research Highlights" for mass media and "Policy Forums" for decision-makers—treating published academic content as intellectual property and maximizing dissemination value through scenario-adaptive packaging.

The content-form innovations of both journals have moved beyond the technical scope of enhanced publishing into a strategic phase of a "knowledge product matrix." *Nature*'s podcast runs as an independent product featuring research-story interviews; *Science*'s homepage features an Editor's Picks section in which editors recommend the most worthwhile recent articles, helping readers locate high-value content amid information overload. This dual mechanism of "manual editorial curation plus algorithmic recommendation" shifts scholarly communication from "passively awaiting retrieval" to "actively curated push." The deeper meaning of enhanced publishing is therefore not "adding attachments to papers" but producing multiple forms of independent dissemination units around academic outputs, so that the same research can find an appropriate content form across different scenarios.

The sub-journal matrix assumes the functions of disciplinary coverage and brand stratification. *Nature* now has more than 150 sub-journals, forming a four-tier pyramid of "flagship journal + comprehensive sub-journals + specialty sub-journals + review journals," with manuscripts transferable within the system in a "one-click" manner—preserving the flagship's ultra-high-end positioning while retaining high-quality submissions. *Science*'s sub-journal system is smaller but more focused, embodying a "precision positioning" strategy. The 2026 launch of the Nature Progress series further reinforces the brand stratification logic: the flagship journal maintains a

hybrid model, comprehensive OA journals offer full openness, and specialty OA journals use brand credibility to lower authors' selection costs. This "branded OA product line" strategy offers greater strategic depth than simply "increasing the number of OA journals."

3.3. The "Structural Reconstruction" of Technological Embedding: AI-Driven Reengineering of Editorial Workflows

Priority publication constitutes the core mechanism of temporal competition. DOI-based advance digital publishing has been widely adopted by international academic publishing groups, with *Nature*'s "Advanced online publication" and *Science*'s "Express" both enabling single-article priority publication. Both journals maintain a weekly publication rhythm while achieving continuous online updating through single-article priority publication, typically releasing articles about two weeks ahead of formal issue compilation. This extreme speed of "single-article priority plus weekly frequency" depends not only on process optimization but on the standardization capacity of the underlying publishing platform: both journals' submission platforms integrate submission, production, and publication into a unified pipeline, compressing the time from acceptance to online publication to within two weeks. This "produce once, distribute across multiple endpoints" technical architecture makes priority publication a standardized capability rather than an exceptional operation.

AI automation, meanwhile, is deployed for task reallocation within editorial workflows. Since 2019, *Science* has used the MDAR framework to assess life-science research papers, but the completeness of authors' MDAR checklists varies considerably, and it is difficult to verify whether the checklists cover all materials, data, and code (Phelan, 2026). In 2025, *Science* partnered with DataSeer to use AI to scan manuscripts and generate pre-filled (Thorp, 2026), reproducibility-oriented MDAR checklists for authors to confirm and amend, greatly saving authors' and editors' time and ensuring completeness and uniformity. *Science*'s choice to automate this step in effect frees editorial resources from "format-compliance checking" for higher-value academic judgment. The implication is that a platform's core competitiveness lies not in "replacing" a given submission system but in using AI to reconfigure task allocation within editorial workflows—releasing human effort from automatable steps to focus on irreplaceable academic judgment and dissemination planning. Springer Nature's 2025 deployment illustrates the scale of this shift: nearly 60 AI tools supported over 1.5 million papers, with the Editor Evaluation tool used across nearly half a million manuscripts and the Peer Reviewer Recommender generating more than 400,000 recommendations, all within workflows under explicit human oversight (2026).

The two examples operate at different levels. The integration of MDAR and DataSeer was decided within the *Science* family of journals, whereas the deployment of approximately 60 AI tools is a group-wide program covering the entire Springer Nature portfolio, of which *Nature* is one beneficiary. The program provides four inputs that a single title cannot generate: engineering and product capacity; leverage in negotiations with vendors; a corpus of 1.5 million manuscripts sufficient to validate and monitor the performance of the tools; and a common framework of compliance and human oversight. The advantage of *Nature* in AI-assisted workflows is therefore partly an externality of organizational scale rather than a journal-level innovation. For journals

without such a parent organization, the relevant question is consequently not which tool to adopt but whether to build, purchase, or share capacity, a question taken up in Section 4.5.

3.4. The "Infrastructuralization" of the Dissemination Ecosystem: From Social Media to News Service Networks

Both *Nature* and *Science* maintain dedicated social media editor positions and have accounts on Facebook, X, LinkedIn, YouTube, and Instagram, with official accounts each commanding follower counts in the millions. Yet the deeper advantage of their dissemination ecosystems lies in the institutional connection between academic publishing and the news media. EurekAlert!, operated by AAAS, *Science*'s parent organization, is a news-distribution infrastructure reaching media in more than 60 countries, through which institutional users post papers and journalists identify findings for reporting. An observational study of U.S. media coverage of archaeology articles reports that articles accompanied by a EurekAlert! press release were approximately four times more likely to be covered in major outlets (71% versus 22%), indicating that the platform functions as an institutional conduit rather than a mere noticeboard (Alex, et al., 2025). Two qualifications attach to this estimate: the study covers a single discipline and a single national media system, and release status is self-selected, since articles selected for a press release differ systematically from those not selected in novelty, institutional press capacity, and author seniority. The difference is therefore consistent with an amplification effect but does not demonstrate one, and associations of this kind should not be interpreted as direct causal effects. The asset is organizational rather than editorial. EurekAlert! was established for the scientific community as a whole, serves journals beyond the Science family, and benefits Science because Science is positioned within a network operated by AAAS. Participation in such an intermediate layer is less costly than its construction, which requires collective action among many titles or the commitment of a funder or association. Dissemination capacity is consequently not adequately measured by the follower counts of a journal's own accounts, since the functions performed in this network, namely credentialing, embargo arrangements, and journalist lists, are located in the intermediate layer rather than in the account itself.

Open access, meanwhile, functions as a multiplier of dissemination effectiveness. Since 2021, both *Nature* and *Science* have offered OA options, allowing authors to choose gold OA or subscription models according to funder requirements or preference. Springer Nature's 2024 annual report cites data showing that OA articles receive 1.6 times as many citations and six times as many downloads as non-OA articles (2024). The figure is a publisher-reported, portfolio-level comparison covering the whole Springer Nature list; it is not adjusted for discipline mix, article age, author reputation, or journal tier, and open-access status is self-selected. Downloads are further inflated by the absence of a paywall. The association should not be read as a direct causal effect, and open access is accordingly treated as conditionally rather than uniformly advantageous. Yet the equity dimension of this multiplier must be acknowledged: APCs in high-profile journals often range from $1,500 to over $5,000 per article, and authors from the less-funded institutions may find such fees an insurmountable barrier, effectively pricing them out of the same venues (Smith, et al., 2021). OA is thus both a dissemination multiplier and a site where the core–periphery structure of global academic publishing can be either mitigated or entrenched.

In terms of ecological globalization, both journals emphasize regional and institutional cooperation. *Nature* operates regional portal websites with local editorial teams responsible for selecting outstanding local papers, organizing regional academic conferences, and publishing analyses of local research policy—in essence transforming the journal from a "content exporter" into an "embedder in regional research ecosystems," exchanging localized value-added services for global influence. *Science*'s globalization pathway relies more on institutional cooperation: its Science Partner Journal (SPJ) program requires partner journals to be co-published by AAAS with international research institutions, foundations, funders, and learned societies, featuring online open access and subject to AAAS assessment.

4. Transformation Pathways for the International Journal Community

The four pathways discussed below are derived from two exceptionally well-resourced journals and should not be applied as a uniform checklist. Section 4.5 restates them according to resource endowment.

4.1. Institutional Level: Activating Agency through Editorial Autonomy and Governance Separation

The institutional obstacles facing the international journal community are not unique to any single country; they manifest universally as tensions between editorial decision-making authority and business logic. The experience of leading journals shows that strictly separating editorial departments from publishing business departments—insulating editorial decisions from advertising and distribution—is the institutional precondition for converting academic capital into gatekeeping quality. For journals outside dominant platform ecosystems, the core of institutional reconstruction lies not in simply adding doctoral editors but in establishing institutional safeguards for editorial autonomy: clarifying the final authority of editorial boards over topic selection and acceptance, establishing mechanisms for continuous editorial training, and balancing process efficiency with frontier disciplinary judgment through a collaborative structure of "internal editors plus external board members".

4.2. Technological Level: Building Differentiated Platform Competitiveness through Data Sovereignty

The deep dependence of journals worldwide on a small number of commercial submission systems is not merely a matter of economic cost; it also constitutes a risk to scholarly data sovereignty, as peer-review comments, author information, and rejection reasons are stored on third-party servers. If the goal is merely to "replace system X," journals will remain permanently in catch-up mode. A more innovative strategy is to treat data sovereignty as the core competitiveness and AI empowerment as the differentiated selling point, building an integrated "submission plus knowledge services" platform. Specifically: sedimenting structured peer-review process data (review comments, revision trajectories, rejection rationales) as core assets to build an "academic judgment database"; introducing AI-assisted review-quality assessment and similarity detection, converting unique data generated in specific scholarly-community contexts into technical barriers; and ensuring code controllability through open-source architecture while attracting journal

migration through “zero migration cost plus data-community governance.” The platform should comprise four modules: a submission and peer-review system; an XML-based structured production system; a dissemination and distribution system interfacing with major databases; and a full-chain data dashboard.

4.3. Talent Level: Replacing Job Fragmentation with Capability Coupling

The traditional “small editorial office” model can no longer meet digital-intelligent demands. A modern scientific journal team should encompass at least three sets of capabilities: scientific editing (doctoral degrees in STEM fields and research experience), data editing (data archiving, structured annotation, enhanced-publication production, with proficiency in tools such as Python and R), and dissemination editing (social media operations, new-media content production, academic brand event planning). More critical than job design, however, is the mechanism of capability coupling. The practice of leading international journals shows that editors’ “academic judgment” and “dissemination sensitivity” are not assigned to separate positions but integrated within the same editor. Dissemination-effect indicators (such as Altmetrics performance and media coverage) can be incorporated into scientific editors’ assessment to incentivize their active participation in dissemination planning, while dissemination editors should possess basic academic literacy sufficient for “academic dialogue” with scientific editors. The essence of a composite team is not “three kinds of people” but “three capabilities in one person.”

4.4. Dissemination Level: Building a Multidimensional Dissemination Matrix and Impact Evaluation System

The temporal dimension involves a “first-release plus long-tail” strategy. Drawing on *Science*’s “First Release” mechanism, journals can establish a rapid channel: for papers of major originality, a preprint version can be published online following external expert review to secure priority, with complete peer review completed subsequently. Published papers can then undergo “long-tail dissemination”—periodic screening of high-impact papers based on Altmetrics data, production of “research progress review” features, and re-push.

The spatial dimension involves a layered dissemination network. Academic circles can be reached through precise pushes on ResearchGate and Academia.edu; industry circles through discipline-based author groups on LinkedIn and similar platforms for word-of-mouth diffusion; and public circles through collaboration with science communication media to rewrite papers as in-depth reports. Video transformation deserves particular attention, with animated abstracts and other multimedia formats produced for important papers.

The feedback dimension involves an Altmetrics-driven evaluation loop. The traditional impact factor can no longer capture academic influence in the digital age. A dual-track evaluation system should be established: SCI/SSCI impact factors continue to be tracked as a measure of academic normativity, while Altmetrics indicators (downloads, social media mentions, policy document citations, media coverage, preprint downloads) are introduced as measures of societal impact. Altmetric data can also inform journal scope decisions, collection and special-issue curation, and the identification of potential authors and topics.

The infrastructural dimension involves building an intermediate-layer academic news platform. Drawing on the EurekAlert! model, journals and publishers can build or participate in an intermediate infrastructure connecting academic publishing and public media, with functions including real-time notification of partner-journal papers to institutional users, rapid screening and reporting channels for mainstream journalists, and multilingual news release with dissemination-effect tracking—so that high-quality outputs are captured and amplified by professional news production networks rather than depending solely on a journal's own account reach.

4.5. Differentiated and Staged Implementation Pathways

Implementation capacity varies along three dimensions: financial resources, in-house technical capacity, and the availability of an organizational sponsor, whether a publisher group, a learned society, or a public funder. Three configurations may be distinguished. Journals located within a well-resourced group or major society are in a position to use existing infrastructure rather than duplicate it at title level, to formalize editorial autonomy, and to pool review data across titles, since a single title rarely accumulates sufficient cases to support a judgment database. Standalone titles with institutional support may participate in an existing news layer, rely on public metadata infrastructure, join shared editorial training programs and peer networks, and negotiate data portability when contracting submission or production systems. Resource-constrained titles, including in many non-English-language journals, may pursue a minimum viable system comprising four low-cost measures: a written editorial-independence compact; metadata discipline, including consistent DOIs, structured references, and machine-readable abstracts; shared databases developed with partner titles; and use of existing repositories, preprint servers, and social media platforms in place of a purpose-built integrated platform.

Sequencing is as consequential as selection. A first stage, requiring little or no investment, establishes autonomy rules, board structure, and metadata discipline; a second stage, over one to three years, adds participation in a news network, Altmetrics tracking, and training in capability coupling; a third stage, generally feasible only through coalition, addresses shared platforms, AI-assisted screening, and a consortium judgment database. The reverse order, in which tools are procured before autonomy is secured and data are standardized, is the most common pattern of failure among late-starting journals, for the reason the framework identifies: absent the institutional complement, technology has no basis on which to operate. Two limitations of these pathways should be noted. They specify sequence rather than budget, since costs depend on local vendor markets and consortium terms; and several of the measures are collective goods that associations, funders, and regional journal platforms are better placed to provide than individual titles.

5. Conclusion

The global scholarly communication system is undergoing profound transformation. Preprint platforms challenge traditional peer review, AI tools reconfigure research paradigms, and the open science movement unsettles commercial publishing models. Amid this transformation, the digital-intelligent practices of *Nature* and *Science* offer a model of "innovation upon tradition"—upholding academic quality as the lifeline while actively embracing technological change to expand the

boundaries of dissemination. For the international journal community, digital-intelligent transformation is not a matter of choice but of survival. Only by releasing editorial autonomy through institutional reconstruction, cultivating composite editorial teams through capability coupling, and building infrastructure grounded in data sovereignty and platform standardization can a more autonomous, pluralistic, and sustainable scholarly communication ecosystem gradually take shape. The pathways proposed here follow this sequence, beginning with institutional guarantees and data standards that entail little cost and reserving platform development and AI investment for later stages and larger coalitions. In a mediatized society, the value of a scientific journal ultimately lies in "connection" and "empowerment"—connecting researchers, institutions, and resources, and empowering knowledge discovery, validation, and application. The digital-intelligent pathway for the international journal community is, in essence, a transition from "literature indexer" to "architect of the scholarly ecosystem."

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