

DIGITAL SERVICES IN PUBLISHING: END-TO-END SUPPORT FOR ACADEMIC CONTENT MANAGEMENT

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Abstract: The digital transformation of higher education has increased the need for integrated infrastructures that support the full lifecycle of academic content. Digital publishing services have evolved from isolated tools into end-to-end systems encompassing submission, quality assurance, multi-format production, distribution, analytics, and long-term preservation. This paper conceptualizes digital publishing as a core infrastructural component of the EdTech ecosystem rather than a peripheral technical function. By synthesizing contemporary publishing workflows, interoperability standards, and governance mechanisms, the paper proposes an end-to-end reference architecture for academic content management and maps key services to institutional value creation. The findings highlight how integrated digital publishing infrastructures enhance efficiency, support open science objectives, strengthen the research-teaching nexus, and improve the sustainability of scholarly communication in higher education.

Key Words: Digital publishing, Academic content management, End-to-end publishing infrastructure, Open access

1. INTRODUCTION

Higher education systems are undergoing structural transformation driven by digitalization, regulatory reforms, and increasing demands for accessibility and accountability [1]. Legal and policy frameworks increasingly emphasize transparency, quality assurance, and international visibility of academic outputs [2]. Within this context, traditional publishing models—characterized by long production cycles and limited interoperability—are insufficient to support contemporary academic and professional education.

Digital services in publishing represent a critical infrastructural response to these challenges. By enabling integrated workflows for submission, review, production, and dissemination, they support both institutional missions and broader national strategies for higher education development [3]. As higher education institutions expand digital and professional study programs, publishing infrastructure becomes an essential component of the EdTech ecosystem rather than a peripheral support service.

Digital scholarly communication has increasingly shifted toward platform-based and service-oriented models that emphasize interoperability, speed, and openness, reshaping the role of publishers and institutions alike [1], [2]. Empirical studies show that digital publishing infrastructures are now central to research visibility, impact, and institutional competitiveness in higher education [3]. While prior research has examined the effects of digitalization on journal-level performance indicators—such as impact factor, immediacy index, and citation dynamics—less attention has been paid to the *underlying digital publishing infrastructures and services* that enable these outcomes.

2. BACKGROUND AND CONCEPTUAL FOUNDATIONS

2.1 Evolution of Academic Publishing

Over the past two decades, academic publishing has shifted from print-based dissemination toward digital-first and increasingly platform-based models [2]. This evolution has been shaped by the rise of open access mandates, global research collaboration, and advances in content management technologies. Digital formats, persistent identifiers, and metadata standards have become essential to ensuring discoverability, interoperability, and long-term accessibility of scholarly outputs [3].

However, this transformation has also increased system complexity. Publishers must now manage heterogeneous formats, multiple distribution channels, compliance with funder policies, and growing expectations for transparency and speed [1]. Digital services in publishing emerged as a response to this complexity, aiming to integrate fragmented processes into coherent workflows.

The transition from print-centric publishing to digital-first workflows has been widely documented in the scholarly communication literature, highlighting changes in production processes, cost structures, and stakeholder roles [1], [4]. These transformations have positioned publishers not only as content distributors but as service providers embedded in research and education ecosystems [2].

2.1 Digital Publishing within the EdTech Ecosystem

The EdTech ecosystem comprises interconnected technologies and services supporting teaching, learning, and

research. Digital publishing services occupy a central yet often under-acknowledged position in this ecosystem, bridging research production and educational consumption [2]. They connect authors and institutions with learners, researchers, libraries, and professional communities through interoperable platforms [3].

Key ecosystem actors include academic authors, publishing organizations, technology providers, universities, libraries, and end users. Effective digital publishing infrastructure enables coordination among these stakeholders, aligning research dissemination with institutional strategies and educational platforms.

2.1 End-to-End Digital Publishing Services

To conceptualize this transformation, digital publishing services can be described through a layered reference architecture that integrates technical, organizational, and strategic dimensions. At the core is the content layer, encompassing manuscripts, datasets, multimedia materials, and educational derivatives [2], [9]. This layer is supported by workflow and governance mechanisms that ensure peer review, quality assurance, ethical compliance, and editorial oversight—functions that have become increasingly formalized in digital scholarly communication [1], [8].

Above this, the technology and standards layer enables interoperability through persistent identifiers, structured metadata, and standardized content formats, ensuring discoverability and long-term accessibility across platforms and institutions [3], [11]. Distribution and integration layers connect publishing platforms with external indexing services, libraries, learning environments, and institutional systems, extending the reach and usability of scholarly outputs within the broader EdTech ecosystem [2], [7].

Finally, analytics and intelligence layers provide feedback mechanisms through usage metrics, citation tracking, and emerging artificial intelligence-based services. These capabilities support evidence-based decision-making at editorial and institutional levels, informing publication strategies, resource allocation, and research evaluation processes [6], [8]. This architectural view reinforces the understanding of digital publishing as a strategic infrastructure rather than a collection of isolated tools [4], [9].

Prior research on academic journal digitalization has largely focused on feature-level adoption, such as online availability, open access options, and format transitions. Building on these insights (e.g. [13]), Figure 1 conceptualizes digital publishing as an integrated, end-to-end infrastructure that combines workflows, standards, governance, analytics, and ecosystem integration across the full content lifecycle.

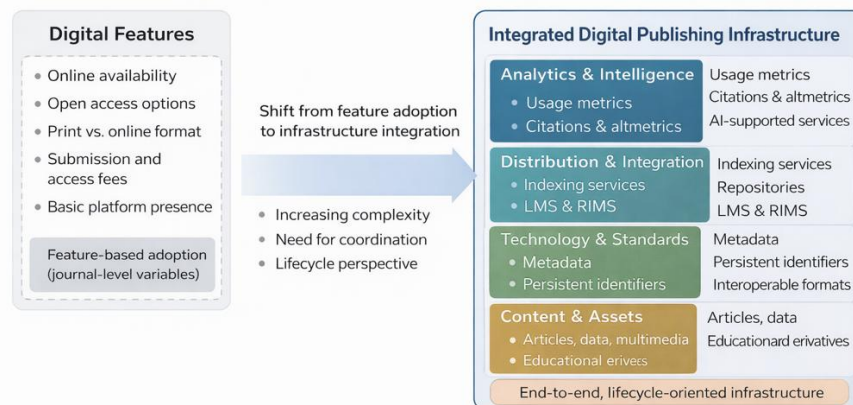


Figure 1. From digital features to integrated publishing infrastructure [13]

2.2 Core Components of Digital Publishing Services

Prior research conceptualizes digital publishing services as modular infrastructures combining content management, workflow automation, and dissemination platforms, rather than standalone tools [5]. Such infrastructures enable scalability and reuse across journals, conferences, and educational content streams [3].

Digital publishing services can be conceptualized as modular yet integrated systems combining several functional layers. Digitization remains essential for converting legacy print content into reusable digital assets. Optical character recognition, structured markup, and metadata enrichment enable archival materials to be integrated into modern platforms. Beyond text, contemporary academic content increasingly incorporates multimedia and data-driven elements, requiring publishing services to manage heterogeneous content types in a consistent manner [2].

Submission management systems form the operational core of academic publishing. These platforms coordinate author submissions, peer review, editorial decision-making, and communication among stakeholders. Automation of routine tasks—such as reviewer assignment, deadline tracking, and metadata validation—reduces administrative burden and shortens publication cycles while maintaining editorial quality [1].

Digital publishing services support the transformation of manuscripts into multiple output formats, enabling access across devices, platforms, and user needs. Structured, XML-based workflows facilitate content reuse, indexing, and long-term preservation. Increasingly, accessibility compliance is embedded into production pipelines, reflecting both regulatory requirements and inclusive design principles [3].

Distribution platforms ensure that published content is discoverable and accessible at scale. Integration with

academic indexing services, library systems, and institutional repositories extends global reach. At the same time, access control mechanisms and licensing frameworks support diverse publishing models, including open access and subscription-based dissemination [5].

To clarify the relationship between operational publishing functions and institutional benefits, Table 1 presents a structured mapping of key digital publishing services to their corresponding institutional functions and value-creation mechanisms. Rather than treating publishing activities as isolated technical processes, the table illustrates how specific services—such as submission management, metadata enrichment, distribution, and analytics—directly support broader institutional goals, including quality assurance, visibility, governance, and sustainability.

Table 1 – Mapping Publishing Services to Institutional Value Creation

Publishing Service	Institutional Function	Strategic Value
Submission systems	Research QA	Reduced cycle time
Metadata enrichment	Visibility	Global discoverability
OA compliance	Governance	Policy alignment
Analytics & metrics	Management	Evidence-based decisions
Preservation	Sustainability	Long-term knowledge retention

3. WORKFLOW INTEGRATION AND ECOSYSTEM-LEVEL INTEROPERABILITY

End-to-end digital publishing relies on workflow integration across organizational and technical boundaries. Interoperability standards and application programming interfaces enable data exchange between submission systems, production tools, repositories, and analytics platforms [5]. This integration minimizes duplication, improves data consistency, and supports scalable operations.

Studies in publishing operations demonstrate that integrated, end-to-end workflows reduce time-to-publication, improve metadata quality, and enhance compliance with indexing and preservation requirements [4], [6]. Workflow automation is particularly critical for small and mid-sized academic publishers operating under resource constraints [5].

Digital publishing services increasingly support post-publication activities such as versioning, updates, and impact tracking [1]. Usage analytics, citation monitoring, and alternative metrics provide feedback loops that inform editorial strategies and institutional reporting. Long-term preservation services ensure durability of scholarly records despite technological change.

Analytics play a dual role in digital publishing: measuring content impact and optimizing internal workflows. Metrics on submission volumes, review timelines, and access patterns enable publishers to identify bottlenecks and improve service quality, while also supporting transparency toward authors and institutions.

The convergence of publishing platforms with learning management systems and research information systems reflects a broader trend toward ecosystem-level integration in higher education technologies [7]. Such integration supports the reuse of scholarly content in teaching and professional education while strengthening the research–teaching nexus [2]. Digital publishing services increasingly intersect with other EdTech platforms. Integration with learning management systems enables academic publications to be embedded directly into teaching contexts, strengthening the research–teaching nexus. Connections with research information management systems automate institutional reporting and compliance with funder mandates [2], [3]. Libraries remain key intermediaries in scholarly communication. Metadata exchange, link resolver integration, and discovery service compatibility ensure that digital publications are visible and accessible through institutional channels [1]. Publishing workflows increasingly interact with collaborative authoring tools, reference managers, and professional networks. These integrations reflect a shift toward more open, networked, and participatory models of scholarly communication.

Beyond technical integration, digital publishing services generate value at multiple institutional levels. Prior research demonstrates that integrated publishing infrastructures support operational efficiency by automating workflows and reducing time-to-publication, while simultaneously enhancing research visibility and compliance with open access and open science policies [1], [5], [12]. Importantly, these value-creation mechanisms extend beyond publishers to universities, libraries, and policy actors, positioning digital publishing services as shared infrastructures within the higher education ecosystem [9], [10]. Their contribution to sustainability is particularly significant, as long-term preservation, metadata standardization, and platform interoperability help safeguard scholarly records against technological obsolescence and organizational change [4], [11]. Understanding how specific publishing services align with institutional objectives is therefore critical for informed investment, governance, and digital transformation decisions in higher education [12].

4. CHALLENGES AND INNOVATION OPPORTUNITIES

Despite technological advances, digital publishing faces persistent challenges related to legacy systems, skills gaps, and resource constraints. Smaller publishers and institutions often struggle to adopt comprehensive end-to-end solutions, leading to fragmented workflows and limited scalability [1]. Open access mandates, copyright complexity, and data protection regulations impose additional requirements on publishing infrastructure. Aligning compliance

with sustainable business models remains a central tension in digital scholarly communication [5].

Advances in artificial intelligence, enhanced content formats, and distributed technologies offer opportunities to reconfigure publishing workflows. Automated metadata generation, intelligent reviewer matching, and interactive publications illustrate how digital services can move beyond efficiency gains toward new forms of scholarly value creation [2]. Recent literature emphasizes the growing role of artificial intelligence in scholarly publishing, particularly in reviewer recommendation, metadata enrichment, and research analytics [5], [8]. These developments signal a shift toward data-driven and service-oriented publishing models aligned with open science principles [2].

The findings reported by Klus and Dilger [13] indirectly support an infrastructure-centric view of digital publishing, as journals’ long-term success appears to depend less on isolated digital features and more on coherent service configurations and governance models.

5. CONCLUSION

Digital services in publishing constitute a foundational layer of the EdTech ecosystem, enabling end-to-end management of academic content in an increasingly digital and open higher education landscape. By integrating digitization, submission management, multi-format production, distribution, analytics, and preservation, these services support more efficient, accessible, and scalable scholarly communication.

The transformation of academic publishing is not solely a technical process but an organizational and systemic one, requiring alignment among publishers, institutions, technology providers, and policymakers. As digital publishing services continue to evolve, their role in shaping how knowledge is produced, shared, and reused in higher education will become even more central. Strengthening end-to-end digital publishing infrastructure is therefore essential to realizing the broader goals of digital transformation, open science, and global knowledge dissemination.

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