ORIGINAL ARTICLE



Digital production and new media convergence publishing practice of scientific and technological periodicals based on XML integration: The case of *Acta Scientiae Circumstantiae*

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ABSTRACT

Background: This study aims to systematically summarize the advantages of using a digital publishing platform for scientific and technological journals based on extensible markup language (XML)-integrated production. It also seeks to analyze the effects of the fusion of digital production and new media practices in order to provide a reference for China's digital publication of scientific and technological journals and its combination with new media. **Methods:** Taking *Acta Scientiae Circumstantiae* as an example, this study builds a model of digital production and new media fusion publishing for scientific and technological journals based on XML integration by reviewing the shortcomings of traditional production models. The advantages and practical applications of digital production and new media fusion publishing are analyzed. **Results:** The adoption of an XML-integrated production platform results in producing content once and its diverse publication. Single articles or entire issues can be quickly released, allowing these to be immediately published four months ahead of the network first release and thus shortening the publication cycle. The platform is seamlessly connected with journal websites and WeChat, achieving simultaneous priority publication and full-issue publication on the PC and mobile ends and realizing media convergence and multichannel dissemination. During the initial period, the average downloads per article significantly increased, with single-article downloads reaching 1961 times. **Conclusion:** Using an XML-integrated production platform can optimize the publishing process, improve the level of digitalization, and increase work efficiency. It helps shorten the publication cycle, accelerate the speed of dissemination, and enhance the academic influence of a journal.

Key words: scientific and technological journals, extensible markup language-integrated production, digital publishing, new media convergence, practical effects, publishing model, academic influence

INTRODUCTION

With changes in the reading habits of and methods for science workers in the new media era, the quick dissemination of high-quality information has become a trend. The reengineering and optimization of the digital publishing process are imperative for scientific and technological journals. As important links in journal publication, editing, proofreading, and layout also face great challenges. Traditional editing, proofreading, and layout modes are time consuming, inefficient, and have a single data format that cannot adapt to the current needs of the development of scientific and technological journals.^[1,2]

An extensible markup language (XML)-integrated

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production platform establishes standard specifications to structure and process journal content and style in real time, which is beneficial for integrating information among authors, editorial departments, and layout personnel. It improves editing efficiency, optimizes layout processes, and ultimately achieves the efficient reorganization of journal content and diversified publication.^[3-9] In 2019, China's Science Association, the Propaganda Department, the Ministry of Education, and the Ministry of Science and Technology issued Opinions on Deepening Reforms and Cultivating World-class Scientific and Technological Journals, emphasizing the necessity of building a digital knowledge service platform and exploring new publishing models, such as online first papers, enhanced digital publishing, data publishing, and full-media integration publishing.^[10] Mainstream foreign publishing groups have widely adopted these models to develop collection, editing, proofreading, and publishing modes. However, most domestic journals still use traditional publishing procedures. Although some domestic scientific and technological journals have already adopted an XML production platform, they use XML only for structured creation or for commissioning typesetting companies with XML formatting. Many editorial departments have XML-structured PDF files for printing to adapt to the needs of new media development. Researchers in China have explored the application of XML layout in academic journals,^[11–13] but there is little research on digitalization and integration with new media based on XML-integrated production. Cui et al.^[14] explored medical journals' all-media publishing, while Yu et al.[15] and Han et al.[16] discussed the direction of technological journal development in the context of publication integration. Furthermore, Xiao et al.[17] studied the promotion of scientific communication through magazine-network fusion. Using previous studies as a foundation and combining the practice of Acta Scientiae Circumstantiae, this paper summarizes the shortcomings of traditional layout models and highlights the advantages of XML-integrated production, as well as analyzes the practices and dissemination effects of digitalized production and new media integration of technical journals. The aim is to provide a reference for the digital publishing of technical journals and its integration with new media.

INTRODUCTION TO ACTA SCIENTIAE CIRCUMSTANTIAE AND ITS TRADITIONAL PRODUCTION MODE

Introduction to Acta Scientiae Circumstantiae

Acta Scientiae Circumstantiae is one of the most influential academic journals in China's environmental science field. A scholarly journal hosted by the Institute of Ecology and Environment, Chinese Academy of Sciences, Acta Scientiae Circumstantiae aims to make timely reports on innovative research results achieved in China's environmental sciences and engineering fields. Formed in 1981, it has published a series of excellent original articles with innovative research results. The editor-in-chief is academician Jiuhui Qu, and there are 39 members on the editorial board, including 13 academicians, accounting for one-third of the total number of editors. Acta Scientiae Circumstantiae has been recognized as one of 100 Outstanding Academic Journals of China for five years. It was selected as an Outstanding S & T Journal of China six consecutive times, won the title of "The Highest International Impact Academic Journal of China" consecutively for four years, named as "The Excellent International Impact Academic Journal of China" consecutively for eight years, and was included in the high-quality science and technology journal classification directory of the environmental sciences field, T1 level. Many articles published by Acta Scientiae Circumstantiae have been selected as part of the 100 Best Domestic Academic Papers with Great Impact and of the F5000 project. According to the ranking of the citation frequency of the first 300 Chinese science and technological journals in 2022,^[18] Acta Scientiae Circumstantiae ranked thirty-fourth among all Chinese science and technological journals. The success of Acta Scientiae Circumstantiae lies not only in its academic quality and influence but also in its valuable experiences accumulated during the process of publishing the journal, which can serve as a reference for other science journals.

Shortcomings of traditional production models

In the 1980s, because of the lack of computers, Acta Scientiae Circumstantiae adopted a traditional typesetting mode in its initial stage,^[19] which was lead-type printing. This took time and effort and resulted in unsatisfactory print quality, sometimes resulting in layout errors. In the 1990s, the journal switched to using traditional Founder Bookmaker for typesetting. Compared to lead-type printing, Founder Bookmaker has more powerful functions, especially its batch processing function, which can process content and format in book and magazine layouts enmasse, thus reducing workload.^[19] As a professional typesetting software program, Founder Bookmaker requires specialized personnel to operate it. Therefore, Acta Scientiae Circumstantiae hired a professional typesetter. This improved the efficiency of typesetting and enhanced the quality of the printed materials. The editorial department sent Word-formatted documents edited by editors to the typesetter, who then provided PDF files for proofreading after typesetting. Editors would perform three rounds of proofreading on paper samples before finally outputting PDF files for publication. These were used for printing periodicals. As all articles published in Acta Scientiae Circumstantiae

covered related research in the environmental science and engineering fields, they contained many complex illustrations, tables, and formulas, making data processing during editing very complicated. Each round of review required extensive redlining and revisions, consuming much time; additionally, a large volume of materials were processed for each issue, and with over 40 articles to be published per issue, this required about two to four weeks of typesetting by the typesetter. During holidays, both the editorial department and the typesetter often had to work overtime to ensure timely journal publication. A clear disadvantage of this traditional typesetting model is its inefficiency, leading to delays in typesetting numerous manuscripts already accepted by Acta Scientiae Circumstantiae and preventing these from being released online immediately. At that time, the time difference between network release and paper publication was only approximately one month when using this traditional typesetting method, leaving little room for advancement. More importantly, the traditional typesetting model cannot meet the demand for diverse data formats of new media, and it is unable to enhance academic dissemination speed or visibility. Traditional typesetting systems also output too few file formats that are not directly generated by web journals. To solve the technical problem of extracting data from files during publication in a web journal, as well as to meet database requirements for file format needs, Acta Scientiae Circumstantiae began producing HTML multimedia papers in 2017. In collaboration with professional data processing service companies, the journal reprocessed printed PDF files, completing the digitalization of journal content. This entailed both financial support and delay time. For these reasons, the editorial department was forced to quickly change production modes.

CHARACTERISTIC PRACTICES IN THE XML-INTEGRATED PRODUCTION PLATFORM OF ACTA SCIENTIAE CIRCUMSTANTIAE

Work mode of the XML-integrated production platform

After conducting thorough investigation and comparing various production methods, in 2021, *Acta Scientiae Circumstantiae* abandoned the traditional book layout software from Founder Bookmaker and switched to the Founder Academic Publishing Cloud Service Platform. This platform integrates editing and publishing functions, using XML data as the only source of digital production upgrades, while outputting multiple file formats that can meet the needs of current multimedia publication. The production process on this platform is based on a single-article production process, with articles published at any time once they reach academic publishing requirements and without being affected by the entire issue's publication cycle. Therefore, there was immediate release upon completion of production. Figure 1 shows the working mode of the Founder Academic Publishing Cloud Service Platform.

The XML-integrated production process

Considering that Acta Scientiae Circumstantiae handles many articles and needs to publish manuscripts as soon as possible, it did not choose to outsource production to Founder Electronics., Ltd but instead decided to produce independently. This enabled integration between editing and proofreading and reformed publishing processes and production methods. Layout work for Acta Scientiae Circumstantiae is handled by editors-in-chief, who use the *fine-tuning tools* provided by the Founder Academic Publishing Cloud Service Platform while completing content review and approval in order to process manuscripts completely paperless. Currently, Acta Scientiae Circumstantiae has formed an integrated digital publication flow combining layout with editing and publishing, which significantly improves efficiency, shortens the publication cycle, and enhances the effectiveness of publication and information dissemination. The XML-based production workflow for Acta Scientiae Circumstantiae is shown in Figure 2.

XML-integrated production

Automatic layout and fine-tuning of single articles The traditional layout method requires much time and has low work efficiency. With the adoption of the XMLintegrated production platform, as long as one uploads the properly organized Word file into the platform, it can automatically format with one click, taking only 1 min for formatting. One important aspect of selfproduction on the XML-integrated production platform is the meticulous adjustment of automatically typeset manuscripts. For articles automatically formatted by the platform, editors (or typesetters) often need to make some fine adjustments in detail, such as modifying article content or replacing images. The platform provides a comprehensive tool for editing departments to integrate formatting capabilities for texts, images, tables, and formulas. Editors can perform fine adjustments to the automatically formatted articles through a what-you-seeis-what-you-get approach. Currently, most editorial offices delegate the task of fine-tuning production process articles to layout companies. Therefore, the XML-integrated production platform has the benefit of making the task easier for editors and saving time and effort. Considering the large number of papers published in Acta Scientiae Circumstantiae each year-more than 500 annually-if this work were delegated to layout companies, one issue would be timing. Layout companies typically have to simultaneously format many journal articles, thus requiring a substantial amount of time, from days to weeks. Another concern is cost. To



Figure 1. The working mode of the Founder Academic Publishing Cloud Service Platform.



Figure 2. The XML-based production workflow for Acta Scientiae Circumstantiae.

ensure the priority publication of accepted articles, *Acta Scientiae Circumstantiae* decided to assign later-stage editors to conduct fine adjustments to articles after automatic formatting, thereby ensuring immediate priority publication while also reducing production costs. In addition, XML-integrated production platforms can support multiple users working together, eliminating the need for repeated adjustments and verification between editors, typesetters, and proofreaders and thus avoiding errors made during the layout process. After each submission of the refined files, the system automatically saves versions with refinement marks, facilitating subsequent verification. Figure 3 shows the interface for refining articles after automated formatting by the Founder Academic Publishing Cloud Service Platform.

Automatic synthesis and refinement of entire documents

The periodical compilation time is also significantly shortened compared with that in traditional publishing models. The editorial department only needs to select the manuscripts for publication in an issue on the basis of the table of contents, upload them sequentially to corresponding columns, and achieve whole-period compilation with one click. Both Chinese and English tables of contents, as well as annual volume page numbers, are generated instantly, significantly reducing manual intervention and making production no longer a bottleneck for shortening publication cycles. During the process of manuscript uploading, proofreading, compiling, and signing off, all possible modifications and adjustments may occur on complex objects, such as texts, paragraph structures, images, tables, and formulas, which were originally found in the original manuscript, to meet the requirements of publication. Multiple revision content comparisons play an important role in editors' actual business operations. The platform will save all processing records and related data files throughout the entire production process. Through the revision management functions provided by the



Figure 3. The interface for refining articles after automated formatting.

platform, not only can each version's file be quickly located and all its data obtained, but any two different versions of documents can also be compared visually, pinpointing the differences between revisions, tracing the review and editing process, and assisting in the rapid progress of review work. Figure 4 shows the interface of the Founder Academic Publishing Cloud Service Platform for whole-period compilation and comparison across different versions of manuscripts.

ADVANTAGES AND DISSEMINATION EFFECTS OF DIGITAL PRODUCTION INTEGRATED WITH NEW MEDIA

In daily editing and publishing, Acta Scientiae Circumstantiae has always strictly adhered to the system of "three peer reviews and three revisions". The journal strives to focus on content production and continuously improve editing and publishing quality. Publishing ethics and integrity norms, as well as research integrity, are topics that have been relatively focused on by academic publishing industries in recent years. Acta Scientiae Circumstantiae gives great importance to issues related to academic misconduct and resolutely opposes and prevents such behavior. The journal uses intelligent review systems, academic misconduct detection systems, and other systems to double-check manuscripts by machines and humans, thus maximizing the avoidance of academic misconduct problems and ensuring publication quality.

Advantages of digital production and new media integration

Acta Scientiae Circumstantiae introduced its XML-

integrated production platform in 2021. By March 2024, more than 1000 articles in a total of 27 issues had been published with its XML-integrated production platform. The use of the platform achieved relatively good results, and its specific advantages are as follows.

Improved production efficiency and shortened publication cycle

This publishing model, which integrates digital production and new media, not only improves publication efficiency but also shortens the publication cycle of manuscripts based on ensuring manuscript quality. The XML-integrated production platform can instantly generate manuscripts to facilitate online first release. The one-click intelligent layout function for single articles can automatically generate a layout file by XML typesetting in 1 min according to academic publication standards and output multiple-format files, such as Word, PDF, HTML, XML, etc.; these are both suitable for content proofreading and for quickly achieving the network first release of individual documents, thus effectively guaranteeing authors' right to publish first. After processing by XML integration, Acta Scientiae Circumstantiae will immediately conduct an online first release for accepted manuscripts, fully embracing the importance of this release. The entire journal is rapidly synthesized, improving publication timeliness. Once the editorial department completes the fine-tuning of the entire issue, the platform will automatically extract the table of contents and page number information in both Chinese and English and then synthesize the entire issue according to the publishing schedule. This innovative production method helps reduce the complexity of synthesizing an entire issue, which significantly improves work efficiency, and after



Figure 4. The interface of the Founder Academic Publishing Cloud Service Platform for whole-period compilation (a) and comparison across different versions of manuscripts (b). Colored content marked as modified.

synthesis, the manuscript can still be refined before printing.

Support for multiple finished formats to facilitate the multichannel dissemination of literature

The XML-integrated production platform can synchronously generate high-quality PDF, HTML, Word, and full-text XML files in multiple formats. It meets the needs of traditional printing, online publication, and mobile reading, to name a few. In 2022, Acta Scientiae Circumstantiae upgraded its official website, which was seamlessly connected with the XML production platform after upgrading. The upgraded website realized functions such as priority publishing, virtual albums, and online publication. After being processed by XML production, manuscripts were published on the journal's official website with one click while also connecting to WeChat public accounts. This facilitated simultaneous priority publishing and wholeissue publication between the PC and mobile ends, thus realizing media integration and multichannel dissemination.

Figure 5a shows the output format of all articles in the

second issue of *Acta Scientiae Circumstantiae* in 2024. The PDF file generated for printing is used for paper publications. The HTML format is a sophisticated reading mode that can be combined with mobile internet, and XML files can directly generate multimedia papers based on XML documents to be read on mobile devices. XML files are also used for third-party operation platforms and database releases, while Word documents are used for text storage. Figure 5b shows the micro-journal *Acta Scientiae Circumstantiae* issue No. 2 in 2024.

Effect of digital production and new media integration on communication

As of March 25, 2024, the number of articles published online in advance on *Acta Scientiae Circumstantiae* is shown in Table 1. As can be seen from Table 1, between 2017 and 2020, the manual layout efficiency was low because of the influence of the production mode, resulting in a small number of articles published online first. In total, only 170 articles were published online during these four years, with most of them printed after publication. Between 2017 and 2020, an average of 42 articles were published online per year; between 2021 and 2023, after the use of the Founder Academic

Year	The number of articles published online in advance	The number of articles printed after publication	The number of articles published online in advance each year
2017-2020	170	440	42
2021	585	585	585
2022	585	585	585
2023	468	468	468

Table 1: The number of articles published online in advance on Acta Scientiae Circumstantiae



Figure 5. The output format of all articles in the second issue of *Acta Scientiae Circumstantiae* in 2024 (a) and the micro-journal *Acta Scientiae Circumstantiae* issue No. 2 in 2024 (b).

Publishing Cloud Service Platform, an average of more than 500 articles were published online each year, which was over 10 times more than previous numbers.

The production method has a significant impact on download volume during the online debut period. Before 2021, because of the low efficiency of manual layout, there were few articles for online debut and thus fewer downloads. In 2020, the average number of downloads per article was only 69 times. After the implementation of XML-integrated production, the average number of downloads increased significantly, reaching more than 100 times. In 2021, manuscripts were immediately published online at the time of debut, with an average of 110 downloads; in 2022, all articles were implemented via XML production and debuted online, truly achieving integration between production and dissemination, with an average of 171 downloads. In 2023, the average was 163 downloads, and the highest single-article download record reached 1961 times during the debut period.

Table 2 presents the time of online publication ahead of print for *Acta Scientiae Circumstantiae*. As shown in the

table, before the XML layout, online publication was advanced by only 39.5 days compared to print publication. After the implementation of XMLintegrated production in 2022, single-article online publication has been advanced by 124.6 days, on average (about four months), compared to print publication, with a significantly shortened publishing lag.

Table 2: The time of online publication ahead of p	rint for
Acta Scientiae Circumstantiae	

Year	The time of online publication ahead of print/day
2020	39.5
2021	48.5
2022	124.6
2023	93.8

CONCLUSION

Acta Scientiae Circumstantiae optimized the process of academic journal publishing by using an integrated production platform based on XML, achieving fullprocess digital publication that integrates editing, layout, proofreading, and dissemination. The integration of XML-based production met the needs for network priority publication of Acta Scientiae Circumstantiae and shortened the publication cycle, with manuscripts being published online about four months ahead of paper publications; this has improved work efficiency and publication quality and enhanced the level of digitalization. Through a combination of digital publication and new media, which achieved multichannel dissemination, accelerated the speed of dissemination, and improved the dissemination level and academic influence of Acta Scientiae Circumstantiae. It is hoped that the practice of Acta Scientiae Circumstantiae can serve as a valuable reference for China's scientific and technological journals to achieve digitization and fusion development in new media.

Driven by the digital wave, the publishing industry of scientific and technological journals is undergoing unprecedented changes. The production model based on XML technology for the digitization of scientific and technological journals, as well as the integration with new media, has not only changed the way academic results are disseminated but has also exerted a profound impact on peer review, editing, publication, and even reading processes. Although digital publishing brings convenience, some technical shortcomings still exist in practice. In actual operations, handling nonstandardized data remains a challenge. Looking ahead, there is a need to continuously optimize the integrated production process based on XML to improve the journal's ability to handle nonstandardized data and ensure accurate content. At the same time, leveraging advanced technologies, such as artificial intelligence, can enhance editorial efficiency, identify problems in practice, solve them, and provide beneficial assistance for the continuous development of scientific and technological journals.

DECLARATIONS

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Author contributions

Yang GH: Conceptualization, Data curation, Writing— Original draft, Writing—Review and Editing, Project administration. Bu QJ: Writing—Review and Editing. Wang H: Resources. Li YH: Resources. All authors have read and approved the final version of the manuscript.

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