On Establishing a Quality Management System for Post-Print Scientific and Technical E-Books

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Abstract

Technical e-books differ significantly from ordinary e-books in many aspects, imposing more stringent requirements on quality management. This paper addresses the unique characteristics of technical e-books, draws upon practical work experience, and elaborates in detail on the methodology for establishing a quality management system for technical e-books from three dimensions: quality standards, quality inspection processes and tools, and quality inspection team building.

Full Text

A Brief Discussion on Establishing a Quality Management System for Scientific and Technical E-books

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Abstract: Scientific and technical e-books differ significantly from general e-books and require more stringent quality management. This paper examines the characteristics of scientific and technical e-books and, drawing from practical experience, elaborates on methods for establishing a quality management system from three perspectives: quality standards, inspection processes and tools, and quality inspection team building.

Keywords: scientific and technical publishing; e-books; quality standards; quality management; digital processing

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With the growing popularity of e-books in recent years, quality management for e-books has become increasingly important. The publishing industry has already established relatively universal quality management systems that serve as important references for e-book quality control. However, for scientific and technical e-books—which are highly specialized and feature complex formatting structures—these industry-wide systems require further refinement to create practical, implementable quality standard systems. Developing and applying a quality management system for scientific and technical e-books that both complies with industry standards and addresses the unique characteristics of scientific and technical publications is of great significance for enabling publishers to provide high-quality digital professional knowledge services and achieve integrated print-digital development.

This paper is an excellent paper from the 2020 New Era Chief Editor Workshop for Science and Technology Publishing Units.

1. Characteristics of Scientific and Technical E-books

Compared with humanities and social sciences e-books that are primarily text-based, scientific and technical e-books exhibit several distinctive features.

1.1 Strong Professionalism and Authority

The content of scientific and technical books is highly specialized, particularly professional handbooks and dictionaries that possess significant academic research value and authority, representing the collective wisdom of numerous industry experts and scholars. However, such works often require years to compile and publish. Large-format printed scientific and technical books suffer from portability issues and high printing costs and prices. Consequently, scientific and technical e-books serve as an excellent medium for disseminating and accessing technical content, making their development and production essential.

1.2 Numerous Formulas, Tables, Codes, and Special Symbols

Scientific and technical books contain many professional formulas, tables, codes, and special symbols that often constitute crucial content. Due to requirements for full-text retrieval and display precision, these elements cannot be simply converted to images during e-book production. Instead, they must undergo vectorization processing into formats such as MathML, LaTeX, or SVG, which increases the likelihood of errors.

1.3 Complex Formatting and Difficult Digital Processing

Scientific and technical books feature multiple hierarchical levels, inconsistent formatting across different professional fields, and complex text-image layouts with numerous cross-references and citations that require mutual correspondence. Given the accuracy requirements for technical content, e-book production must preserve the original layout to the greatest extent possible, with error rates below one ten-thousandth. Therefore, reflowable e-book formats in particular increase production difficulty and processing costs while demanding higher quality standards.

1.4 Large Volume and Length

Professional manuals, dictionaries, and other major reference works often contain millions of characters. For example, China Machine Press' s *Mechanical Engineering Handbook* comprises 13 volumes and 18 books totaling tens of millions of characters. Producing e-books for such reference works often requires different personnel and organizations to work simultaneously according to unified processing standards, which increases the difficulty of quality management.

These characteristics must be addressed through targeted standards and collaborative work mechanisms to ensure quality control during the establishment of a scientific and technical e-book quality management system.

2. Establishing a Quality Management System for Scientific and Technical E-books

A quality management system for scientific and technical e-books consists of three components: quality standards, process tools, and inspection teams. Quality standards form the core, process tools provide the foundation, and inspection teams serve as the key—none can be dispensed with.

2.1 Establishing Quality Standards for Scientific and Technical E-books

The development of quality standards for scientific and technical e-books must follow relevant industry-wide standards while considering the characteristics of scientific and technical e-books and the personalized operational requirements of individual publishers, resulting in revisions and expansions to industry benchmarks. China Machine Press' s *E-book Quality Processing Standards for China Machine Press* (hereinafter referred to as "CMP Standards") uses relevant industry standards as its foundation, revising and expanding certain sections according to actual needs to impose stricter and higher overall requirements.

The CMP Standards primarily reference the *Book Digital Processing Quality Requirements* from the *Central Cultural Enterprises Digital Transformation and Upgrading Project Standards (GC/ZX 15-2014)* issued by the former State Administration of Press, Publication, Radio, Film and Television in 2015 [1]. This

standard provides detailed descriptions of e-book quality requirements and evaluation methods from four perspectives: completeness, standardization, effectiveness, and accuracy. The CMP Standards revise and expand upon this standard to address the characteristics of scientific and technical e-books. The main revisions and expansions are summarized in the table below:

GC/ZX 15-2014	CMP Standards
4.5.1 Error-Free Requirements	**Added 1 item:** Terminology glossaries and appendices in scientific and technical reference books.
4.5.2 a) Text Accuracy: Error rate must be below 0.03%	**Revised to:** Text accuracy—error rate must be below 0.01%.
4.5.2 d) Link Accuracy: Error rate must be below 0.3%	**Revised to:** Link accuracy—error rate must be below 0.03%.
4.5.2 e) Style Accuracy: Error rate must be below 0.03%	**Expanded to:** Style accuracy—error rate must be below 0.03%, with formula and chart style accuracy requiring error rates below 0.01%.
4.5.2 General Requirements	**Added 1 item:** Folder and file naming conventions must follow the *China Machine Press E-book Data Processing Standards*, with error rates not exceeding 0.03%.
4.5.2 General Requirements	**Added 1 item:** Formula vectorization processing must comply with MathML format standard requirements.

2.2 Quality Inspection Processes and Tools

2.2.1 Inspection Process The inspection process is designed as a three-round detection system, with each round employing different methods and focuses [2], as illustrated in the flowchart below:

[Figure 1: see original paper] Scientific and Technical E-book Quality Inspection Process

2.2.1.1 Self-Inspection by Processors
Processed products are examined by the processor' s quality inspectors through comprehensive full-volume checks covering completeness, standardization, effectiveness, and accuracy. Completeness verification includes ensuring consistent page counts, resolution, dimensions, and that all finished components belong to the same book. Standardization checks focus on whether all folders are complete, whether finished files are accurately named, and whether all files are processed according to specifications. Effectiveness verification examines whether various file types can be opened, parsed into databases, and read without garbled text

or image distortion. Accuracy checks primarily verify the precision of e-book metadata, text and images, links, and styles. After passing inspection, finished files are assigned by the publisher to third-party inspectors.

2.2.1.2 Third-Party Blind Inspection

The publisher commissions professional third-party e-book quality inspection organizations to conduct the second round of inspection, still covering the full volume. In addition to completeness, standardization, effectiveness, and accuracy checks, this round focuses on formulas, icons, and personalized processing requirements. Blind inspection is employed, meaning the third-party organization does not know which processing institutions are involved or which organization produced the e-book under inspection, ensuring maximum objectivity and impartiality in quality inspection results.

2.2.1.3 Publisher' s Final Inspection

After passing third-party inspection, finished products undergo final inspection by the publisher. This final inspection primarily involves sampling key e-books at a rate of no less than 30% of the total volume. In addition to the content checked in the first two rounds, this inspection uses various publishing terminals to examine user experience, particularly regarding formula, chart, and code compatibility across different terminals, and proposes improvement suggestions.

2.2.1.4 Processing and Inspection Evaluation Mechanism

A corresponding evaluation and assessment mechanism for processors and third-party inspectors should be established alongside the inspection process. China Machine Press has formulated the *Evaluation and Management Measures for Data Processing and Quality Inspection Companies of China Machine Press (Trial)* (hereinafter referred to as the "Measures") to assess and evaluate partners. In addition to stipulating contractual responsibilities when substandard products are detected, the Measures also specify quantitative evaluation and assessment based on actual inspection quality. According to assessment results, processing and inspection tasks assigned to a partner may be increased or decreased over a period as rewards or penalties. For partners whose quality fails to improve continuously, the Measures even specify a "circuit breaker" mechanism of temporarily suspending all task assignments and an "exit" mechanism for complete elimination. The Measures stipulate that the inspection process must consistently follow strict and uniform inspection standards, with any failure in any round requiring return to the digital processor for correction until every item in every round passes inspection, at which point the publisher can accept the product into inventory. This maximally ensures the quality level of finished files.

2.2.2 Inspection Tools During the inspection process, developing auxiliary inspection tools using technical means can yield multiplier effects. The following three tools are particularly important.

2.2.2.1 Full-Process Information Management Tool for Processing and

Inspection
China Machine Press independently developed the "E-book Processing Management System," which interfaces with the company' s ERP system and digital resource management system to enable data and file sharing. This system provides information management for the entire e-book processing and inspection workflow, including functions for task assignment, file distribution, progress monitoring, workload statistics, error rate calculation, and cost settlement, thereby improving the efficiency and management level of processing and inspection work. The system is illustrated below:

[Figure 2: see original paper] E-book Processing Management System

2.2.2.2 E-book Comparison Tool
Using image recognition technology, finished e-books can be automatically compared with print-ready PDF files or scanned PDF files from printed books for text and layout verification, automatically detecting errors and calculating statistics. This significantly improves recognition rates for formulas, charts, and codes, substantially increasing inspection speed and accuracy.

2.2.2.3 Reflowable E-book Tag Inspection Tool
An Epub and other reflowable e-book tag inspection tool has been developed to automatically validate tags in reflowable e-book XML files against Schema files, with particular focus on formula and chart tags, automatically calculating error rates. This improves the correctness of reflowable e-book tags and reduces display errors.

[Figure 3: see original paper] XML Tag Inspection Tool

2.3 Quality Inspection Team Building

Whether a comprehensive quality management system can be established and whether standards and processes can be fully understood and implemented depends critically on the competency of the inspection team. Team building should focus on the following aspects.

2.3.1 Staffing of Inspection Personnel Scientific and technical e-book quality inspection requires collaboration between external and internal teams [3]. Processors and external inspection organizations should assign experienced quality inspection managers and relevant professionally backgrounded inspectors based on project scale. The publisher' s internal inspection team primarily consists of digital editors with years of publishing industry experience and relevant technical knowledge, along with related technical personnel.

2.3.2 Definition of Inspection Responsibilities Comprehensive quality inspection job responsibilities should be defined for personnel in different positions. Specific responsibilities may be divided as follows:

1. **Quality Inspection Manager:** Responsible for overall project quality inspection planning, developing inspection plans, communicating and coordinating inspection task assignments, and resolving issues encountered by inspection personnel.
2. **Quality Inspector:** Responsible for comprehensive checks of e-book completeness, standardization, effectiveness, and accuracy.
3. **Senior Quality Inspector:** Responsible for inspecting key e-books and personalized content sections.
4. **Publisher' s Digital Editor:** Responsible for reviewing key content and layouts of finished e-books.
5. **Publisher' s Technical Personnel:** Responsible for technical and user experience review of finished e-books.

2.3.3 Strengthening Pre-Inspection Training Corresponding quality inspection training should be enhanced for inspection teams. In addition to training processing parties, third-party inspection organizations, and the publisher on industry-wide standards and inspection tools, the publisher should also provide training on the particularities and personalized standard specifications of scientific and technical e-books. The training aims to help inspectors understand how to categorize identified issues, which errors should be included in error rate calculations, and which items should be prioritized at each stage, thereby establishing a long-term, stable, and efficient inspection team.

3. Conclusion

Due to their content professionalism and format particularities, scientific and technical e-books present increased difficulty and cost in processing and production. Simultaneously, the rigorous nature of technical content demands higher quality management standards. A comprehensive quality management system is crucial for producing excellent e-books and improving users' digital reading experience. Publishers should continuously refine and optimize their quality management systems for scientific and technical e-books through practice, thereby consistently providing high-quality digital publishing services to readers in scientific and technical fields.

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Note: Figure translations are in progress. See original paper for figures.