Postprint: Interpretive Structural Model Analysis of Quality Influencing Factors for Archival Document Compilation Outcomes in the Digital Era

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Abstract

[Purpose/Significance] To improve the quality of archival document compilation outcomes in the digital era, this study investigates the influencing factors and proposes quality enhancement strategies.

[Method/Process] The Interpretive Structural Modeling (ISM) method is employed to construct and analyze an interpretive structural model of factors influencing the quality of archival document compilation outcomes in the digital era.

[Results/Conclusion] Through comprehensive analysis of the hierarchical relationships among 19 factors influencing the quality of archival document compilation outcomes in the digital era, an interpretive structural model is established. Rational strategies and recommendations for quality improvement are proposed from the perspectives of compilation materials, compilation personnel, compilation process, and other relevant aspects.

Full Text

Preamble

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An Interpretive Structural Modeling Analysis of Factors Influencing the Quality of Archival Document Compilation Products in the Digital Age

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Abstract: [Purpose/Significance] To improve the quality of archival document compilation products in the digital age, this study examines the factors influencing their quality and proposes strategies for quality enhancement. [Method/Process] Using interpretive structural modeling, we construct and analyze a hierarchical model of these influencing factors. [Result/Conclusion] Through comprehensive analysis of the hierarchical relationships among 19 influencing factors, we establish an interpretive structural model that reveals how compilation materials, personnel, and processes affect product quality, offering targeted recommendations for improvement.

Keywords: archival document compilation; compilation product quality; influencing factors; interpretive structural modeling

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Archival document compilation, also known as archival historical material compilation or archival document publication, refers to the systematic organization and publication of archival materials. This involves selecting documents according to specific themes, scientifically processing and arranging original archival texts (either wholly or partially), and incorporating research findings such as textual criticism, annotations, and evaluations by compilers. The rapid development and widespread application of information technology have profoundly transformed the production methods and processes of archival compilation products. As society progresses and digital media channels proliferate, these products are increasingly visible and accessible to the public, expanding their reach and influence. Consequently, systematic analysis of quality-influencing factors in the digital age is essential for proactive control and whole-process management of compilation quality. Multiple factors comprehensively affect the quality of archival compilation products in the digital era. While some factors maintain stability and typicality across time periods, their interpretation has evolved in the digital context, and new factors have emerged due to digital technology applications. This study constructs an interpretive structural model to analyze these factors, explore their deep-level relationships, and provide recommendations for enhancing product quality and social impact.

Literature Review

Searches in CNKI, Wanfang, and VIP databases using terms such as “archival document compilation product quality,” “archival compilation product quality,” and “influencing factors” reveal that domestic research concentrates in three main areas:

2.1 Strategies for Improving Archival Compilation Quality

As a means of developing information resources and providing utilization services, archival compilation has garnered increasing attention from archival in-

stitutions and society. Scholars have proposed various strategies: in terms of compilation philosophy, some advocate for human-centered approaches, innovative thinking, and research-based, user-oriented principles; regarding compilation personnel, recommendations include enhancing professional competence and strengthening talent cultivation and recruitment; concerning compilation procedures, scholars emphasize quality control in topic selection and editorial review. Additionally, some propose strategies from the perspectives of modern technology application and collaborative compilation.

2.2 Quality Evaluation of Compilation Products

Quality standards exist to distinguish superior compilation products. Lu Dongqing suggests evaluation should consider five dimensions: practicality, benefit, substance, distinctiveness, and dissemination. Yang Yulian argues that contemporary quality requirements include authenticity, systematic organization, accurate topic selection, substantial content, and timeliness. The *Military Records Review Quality Standards* specifies six criteria: political orientation, policy compliance, completeness, standardization, regional relevance, and stylistic conventions. Compilation work should adhere to established quality standards.

2.3 Influencing Factors on Compilation Quality

Multiple factors affect compilation work and product quality. Some scholars attribute poor quality in hospital archival compilation to inadequate personnel quality, shortage of skilled professionals, and insufficient understanding of compilation work. Others examine the impact of information technology from perspectives of university photo archive management and digital publishing. Topic selection quality is identified as a crucial factor, with compilation, review, and verification stages all affecting final quality. The richness of archival collections, standardization of compilation, and rigor of review are deemed essential. Mu Cuifeng argues that the philosophy of "emphasizing compilation over research" and "quantity over quality" significantly impacts outcomes.

Existing research, while abundant, relies primarily on qualitative methods with limited quantitative analysis. Most scholars discuss improvement pathways from procedural and philosophical perspectives without systematic investigation of influencing factors. This study addresses this gap by constructing a factor model using interpretive structural modeling to analyze deep-level influences and provide practical recommendations.

Model Construction

3.1 Factor Extraction and Relationship Analysis

Interpretive Structural Modeling (ISM), proposed by J. Warfield in 1973 and discussed by D. Malone in 1975, has been widely applied across various fields.

ISM leverages human expertise and computational power to clarify complex factor relationships through hierarchical structuring. Based on binary matrices and directed graphs representing one-to-one factor relationships with transitivity as its core, ISM offers simple procedures, clear visualization of hierarchical structures, and integration of qualitative and quantitative analysis.

Through literature review, we initially identified 19 influencing factors. A questionnaire survey was administered to a panel of 12 experts, including archival compilation practitioners and university researchers, using a five-point Likert scale. The reliability coefficient was 0.925, indicating high data quality. No items showed improved alpha upon deletion, confirming all 19 factors should be retained. After merging synonyms, the final factors are listed in Table 1 .

To clarify inter-factor relationships, the same experts evaluated pairwise connections through a questionnaire with options: mutual influence, one-way influence, or no influence. Statistical analysis yielded the binary relationship matrix shown in Table 2 , where: V indicates Si affects Sj; A indicates Sj affects Si; X indicates mutual influence; O indicates no influence.

3.2 Adjacency and Reachability Matrices

Treating the factors as a system with components Si (i=1,2,…,19), we constructed adjacency matrix A=[aij] where aij=1 if Si directly influences Sj, and 0 otherwise:

$$a_{ij} = \begin{cases} 1 & \text{when } S_i \text{ directly influences } S_j \\ 0 & \text{when } S_i \text{ does not directly influence } S_j \end{cases}$$

The adjacency matrix A is shown in formula (2). While the adjacency matrix represents direct relationships, the reachability matrix M represents both direct and indirect connections, showing whether a path exists between factors. The reachability matrix is obtained through Boolean operations on (A+I) until convergence:

$$(A+I)^{k-1} \neq (A+I)^k = (A+I)^{k+1}$$

$$M = (A+I)^k$$

Boolean operations follow these rules: logical AND takes the minimum ($0\$\times 0 = 0, 0\times 1 = 0, 1\times 1 = 1); logicalORtakesthemaximum(0+0=0, 0+1=1, 1+1=1). UsingMATLAB2018, wecalculatedK = 3, where(A+I)^{2}= (A+I)^{4}, yieldingreachabilitymatrixM = (A+I)\{3\}=(A+I)\{3\}\$$.

3.3 Level Partitioning

After obtaining the reachability matrix, we decomposed it hierarchically. The reachable set R(Si) contains all columns with value 1 in row i, representing factors reachable from Si. The antecedent set Q(Si) contains all rows with value 1 in column i, representing factors that can reach Si. Their intersection is T=R(Si) Q(Si). Table 3 shows these sets for all factors.

Using the condition R(Si)=R(Si) Q(Si), we extracted top-level factors. After removing them, we repeated the process to identify subsequent levels. The resulting five-level hierarchy is: Level 1 (S2, S7, S8, S9, S10), Level 2 (S3, S11, S12, S13, S14, S16), Level 3 (S5, S6, S4, S15), Level 4 (S1), Level 5 (S17, S18, S19).

3.4 Model Establishment and Analysis

Based on the hierarchical partition, we constructed the multi-level interpretive structural model shown in Figure 1 [FIGURE:1]. The model demonstrates high inter-factor correlation, with multiple factors influencing others, particularly bottom-level factors that affect many others.

The five-level structure divides into root, intermediate, and surface layers. Surface-layer factors directly influence quality: compiler innovation, material completeness, reliability, richness, distinctiveness, social demand insight, process standardization, rigor, interactivity, collaboration, and refinement. In the digital age, these are immediate quality determinants. Digital compilation offers richer content and carrier forms, more standardized processes, and enhanced collaboration—including public engagement—all directly impacting quality. Social demand insight determines whether products meet digital-age needs.

Intermediate-layer factors play a bridging role, both influencing and being influenced. These include personnel structure rationality, professional ethics, advanced compilation philosophy, technological diversification, and professional competence. Compilers' knowledge, skills, and innovative philosophy—shaped by digital culture and technology—generate new perspectives and methods. These factors also affect surface-layer elements; for example, personnel structure and ethics influence process standardization and material richness, which in turn directly affect quality.

Root-layer factors represent the deepest influences: economic environment, policy environment, and technological environment. External economic conditions and financial support enable compilation work and platform construction. Technological progress facilitates access to richer materials and improves process efficiency. Policy support encourages innovation and professional development. These foundational factors ultimately determine product quality.

Quality Improvement Strategies

4.1 Ensure Material Reliability and Develop Distinctive Compilation

Quality improvement begins with source materials. In the digital age, authenticity and reliability remain crucial for reference and evidential value. Compilers should leverage ancient book databases and knowledge repositories to obtain complete, rich materials, verifying online and offline sources through multi-party comparison. Digital-age products must maintain archival characteristics while showcasing local customs, regional features, and contemporary relevance, enhancing interest and readability through diverse digital formats that increase appeal and social impact.

4.2 Standardize Compilation Processes and Enhance Public Interaction

High-quality products must meet social needs as practical, valuable, distinctive, and readable cultural products. Modern management concepts and digital tools should ensure meticulous, standardized, and rigorous processes. Archival institutions should establish comprehensive regulations and digital management systems, strengthening assessment, supervision, and accountability. Digital platforms should support all stages—from topic selection and material examination to editing, proofreading, and publication—ensuring compliance with standards. Simultaneously, compilers should engage in networked, bidirectional interaction with the public to understand digital-age user needs and drive innovative development.

4.3 Enhance Professional Competence and Leverage Cross-Disciplinary Collaboration

Compilers are key to product quality. The research-oriented, creative, and scientific nature of compilation work depends entirely on their professional competence. "Three-dimensional" training should encompass theory, technology, standards, and innovation, developing solid theoretical knowledge, digital technology application skills, and awareness of evolving user needs. Cross-disciplinary collaboration has become essential in the digital era. Combining personnel with diverse knowledge, skills, and experiences through complementary cooperation enables multi-perspective understanding of compilation and users, optimizing products in scale, structure, content, and audience reach.

4.4 Leverage Economic and Policy Environments and Adopt New Technologies

As an important method for archival information resource development and cultural construction, compilation suffers from long cycles, slow value realization, and limited dissemination due to technological constraints. Development and quality improvement require strong economic and policy support alongside effective technology adoption. Funding ensures adequate human resources and

equipment; policy support raises institutional priority; new technologies transform workflows and enrich product formats through diversified media and publishing methods, expanding dissemination and demonstrating information and cultural value to gain social recognition. This creates a virtuous cycle supporting resource development and cultural construction.

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Author Contributions

Song Xueyan: Conceptualization, research framework design, manuscript revision.
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Analysis on the Interpretive Structural Modeling of Factors Influencing the Quality of Archival Document Compilation Products in the Digital Age

Abstract: [Purpose/significance] To improve the quality of archival document compilation products in the digital age, this paper studies the influencing factors and proposes quality improvement strategies. [Method/process] Using interpretive structural modeling, we construct and analyze a model of these influencing factors. [Result/conclusion] Through comprehensive analysis of hierarchical relationships among 19 factors, we establish an interpretive structural model and propose reasonable strategies from perspectives of compilation materials, personnel, and processes.

Keywords: archival document compilation; compilation product quality; influencing factors; interpretive structural modeling

Figures

Figure 1: Figure 2