Governance and Improvement of Information Quality in Academic Social Networks: Postprint

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Abstract

[Purpose/Significance] Information quality constitutes a critical prerequisite for platforms to enhance competitive advantage and achieve sustainable development. The free and open spirit championed by academic social networks poses obstacles to information quality control; therefore, optimization and improvement of information quality necessitate analysis of key elements. [Method/Process] Based on prior research, this study constructs a governance decision-making model for information quality in academic social networks encompassing four dimensions: control rules, platform technology, information content, and information users. Employing the DEMETAL method, various influencing strategies are identified and analyzed to determine key strategies affecting information quality in academic social networks. [Results/Conclusion] Through data analysis, five significant conclusions are synthesized. Building upon these, two management insights and their implementation steps are distilled, thereby overcoming subjective speculation inherent in qualitative research. This provides actionable practical references for human-computer interaction, quality control, and service design in academic social network platforms.

Full Text

Governance and Improvement of Information Quality on Academic Social Networking Sites

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Abstract

[**Purpose/Significance**] Information quality is a critical prerequisite for platforms to enhance competitive advantage and achieve sustainable development. The free and open spirit championed by academic social networks creates obstacles for information quality control, necessitating optimization and improvement through analysis of key elements. [**Method/Process**] Building upon prior research, this study constructs an information quality governance decision-making model for academic social networks encompassing four dimensions: control rules, platform technology, information content, and information users. Using the DEMATEL method, we identify and analyze various impact strategies to determine key strategies affecting information quality. [**Result/Conclusion**] Through data analysis, we derive five important conclusions and distill two management insights with implementation steps that overcome subjective speculation in qualitative research, providing practical references for human-computer interaction, quality control, and service design on academic social networking platforms.

Keywords: information quality; platform service; multi-criteria decision-making; DEMATEL method
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In virtual spaces, information quality on application platforms serves as a crucial prerequisite for enhancing competitive advantage and ensuring sustainable development. In the context of academic social networks, information quality plays a decisive role in user satisfaction, representing the degree to which user expectations are fulfilled [1]. Consequently, platform operators continuously strengthen information quality control under the pressure of massive information environments, experimenting with various optimization and assurance strategies to enhance user trust in platform information quality, elevate brand image, and promote user loyalty.

Compared with traditional service systems, platform services in online environments are considerably more complex. First, due to the intangible nature of information services, information quality issues are more difficult to monitor and predict. Second, because of interactive characteristics online, users at different levels perceive distinct service experiences. Finally, given the user-generated nature of information content, content cannot undergo complete pre-delivery quality inspection and verification like physical products, creating numerous challenges for information quality control in academic social networks. The free and open spirit upheld by academic social networks erects barriers to content quality control, making it essential to achieve information quality optimization and improvement through analysis of key elements within the process and characteristics of user-perceived information quality. Moreover, scholars argue that user decision-making behavior in online contexts depends not only on the consumer surplus of information services themselves but also on users' overall

perception of the platform.

Current research on academic social networks primarily focuses on functional and structural studies [3], user characteristic differences [4], user behavior [5], and scholar evaluation [6]. However, the core value of research lies in guiding practice and serving practical needs, and studies targeting platform operators and service providers remain scarce. Therefore, based on previous research, this paper constructs an information quality governance decision-making model and employs the DEMATEL method combined with expert scoring to reveal the interrelationships and causal effects among various quality governance strategies, aiming to provide theoretical references and practical guidance for information quality governance and optimization on existing academic social networks.

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2. Related Research

2.1 Academic Social Networks

Compared with general social networks, academic social networks are more specific and specialized academic service platforms designed for academic institutions and scholars engaged in activities such as paper and dataset sharing, while providing functions like publication analysis, question-answering, and information exchange facilitation. Surveys show that scholars have increasingly adopted academic social networks due to their convenience in establishing collaborative relationships and facilitating online research work [7], with these platforms playing an increasingly significant role in advancing scientific development.

Many researchers have explored functional features of platforms like ResearchGate and Academia.edu. For instance, E. Pieterse and T.H. Meishar found through questionnaires of Israeli researchers that the primary usage function lies in information consumption rather than interaction [8]. M. Thelwall and K. Kousha investigated philosophy scholars' use of Academia.edu, discovering that faculty homepages received more visits than student pages—a pattern contrary to social media' s youth-oriented usage characteristics, indicating that academic social networks' main function remains academic exchange rather than socializing [9].

Within user behavior research on academic social networks, some scholars focus on knowledge contribution behavior [10], while others examine interactive communication behavior. For example, studies of academic blogs using statistical analysis have investigated relationships between post clicks, comments, and recommendations and user content usage behavior, finding that users prefer to recommend content in which they actively participate [11]. Additionally, numerous scholars have combined different theories with empirical research to analyze various behavioral influencing factors, such as factors affecting knowledge sharing in academic virtual communities [12], usage intention [13], and reciprocal behavior in online knowledge communities [14].

2.2 Information Quality on Academic Social Networks

Early information quality research originated from data quality perspectives, viewing information quality as a reflection of objective accuracy [15], focusing primarily on inherent information characteristics. Current research emphasizes the user perspective, defining information quality as the degree to which information meets receivers' needs or satisfies them, explaining that information quality represents users' subjective judgments about information content attributes, system performance, and utility through platform interaction—an outcome of interactions between external environmental features and internal user states. User-perspective information quality research has become mainstream in academic circles.

Although domestic and international information quality research has generated numerous findings in specific contexts, existing conclusions inadequately explain similar behaviors in academic social network scenarios, resulting in limited research targeting these platforms. Most studies concentrate on information quality evaluation, such as designing classifiers to select optimal answers based on question features in Q&A sections [16], or L. Li, D. He, and G. Zhang' s study on ResearchGate Q&A that distinguished subjective and objective factors in answer quality evaluation [17]. Other research integrated nine factors into a quality evaluation framework and tested evaluator consistency [18]. Regarding academic blog comment quality, Ding Jingda and Xu Xin developed the Blog Comment Index (BCI) based on reputation, audience, and influence to measure ScienceNet academic blog comment quality, finding that user comments and frequency reflect blog quality [18]. Studies on academic quality in virtual academic communities identified key attributes as academic and normative quality, innovation, scientific rigor, value, and efficiency [19].

Platform information quality governance research typically designs control mechanisms or evaluation systems from multiple dimensions based on influencing factors. For example, G.C. Kane' s case analysis of Wikipedia found that contributor activity types and experienced contributors positively impact article quality [20]. Zhang Faming and Fang Xupeng innovatively proposed content quality improvement methods for social Q&A platforms from user role economic relationships [21]. These studies reveal that information quality governance generally addresses media, information, and personnel dimensions.

In summary, information quality research in academic social network contexts has paid insufficient attention to antecedent factors driving information quality. Governance and improvement urgently require deeper exploration of relationships and effect magnitudes among influencing factors to provide references for user experience improvement and community sustainable development.

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3. Construction of Information Quality Governance Framework

Our previous research on information quality influencing factors concluded that academic social network information quality is affected by community, user, platform, and content factors, with different factors overlapping to influence user-perceived information quality. Community dimension factors rely on effective governance of control rules; platform dimension factors depend on technological support; content dimension factors include production and utility characteristics; user dimension factors encompass individual characteristics and participation enthusiasm. Users not only serve as information providers, but their motivations and interactive enthusiasm also significantly influence information quality. Therefore, this study proposes governance criteria from four aspects: control rules, platform technology, information content, and information users.

To obtain different impact strategy criteria across these four dimensions, we conducted a focus group interview with 16 participants from graduate student and faculty groups at a university in a provincial capital city in eastern China. The interview included 12 questions designed to elicit in-depth thoughts on information quality. Through transcription and coding analysis by two coders (Cohen' s Kappa = 0.92), we identified criteria for each dimension.

Control Rules (A1): Academic social network platforms implement control rules that regulate and safeguard researchers' online activities. Literature repeatedly indicates that users prefer visiting high-quality websites [23-24]. Focus group interviews identified four key criteria: featured post pinning mechanisms, reward and incentive systems, honesty guarantee mechanisms, and member norm control measures.

Platform Technology (A2): Platform technology manifests in various information service processes. Good interaction performance reduces users' burden in identifying and retrieving information, encompassing various interface experiences. Information technology enables more automatic and accurate information screening, filtering, and integration. Focus group analysis revealed that platforms primarily implement data anomaly monitoring, duplicate content detection, and spam identification and monitoring to enhance security and information filtering.

Information Content (A3): Information content constitutes the main object of quality governance and the primary manifestation of quality. It directly affects user-perceived information quality and represents what researchers value most in cognitive processing. Information content quality is a multidimensional concept [25]. From the user perspective, it involves usability and relevance; from the information itself, it includes accuracy, reliability, and completeness. Focus group results identified criteria including spelling and writing norms, information volume, reference source completeness and timeliness, and logical expression clarity.

Information Users (A4): Like many social networks, academic social networks are user-generated content communities—a value co-creation process among members. Information quality research has gradually shifted from content itself to users. Focus group results showed that personal information completeness and authenticity helps establish authoritative source attributes, while users' proactive affirmation of others' contributions and interactive enthusiasm significantly impact quality.

Thus, these four dimensions—control rules (A1), platform technology (A2), information content (A3), and information users (A4)—intertwine to collectively influence user-perceived information quality in academic social networks. Effective governance of their respective criteria can significantly enhance perceived information quality. To reveal interrelationships among criteria, this study establishes the academic social network information quality governance decision model shown in Figure 1 [Figure 1: see original paper]. In this model, information quality governance represents the ultimate goal, with community branding and operation (A11), featured post pinning (A12), knowledge contribution quality reward-punishment mechanisms (A13), and member behavior norm control (A14) as control rule criteria; data anomaly monitoring (A21), duplicate content detection (A22), and spam identification and monitoring (A23) as platform technology criteria; writing norms (A31), information volume (A32), reference source completeness and timeliness (A33), and logical expression (A34) as information content criteria; and personal information completeness and authenticity (A41), proactive affirmation of others' contributions (A42), and interactive enthusiasm (A43) as information user criteria.

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4. Analysis of Information Quality Governance Impact Strategies

4.1 Research Method

The Decision-Making Trial and Evaluation Laboratory (DEMATEL) method primarily addresses complex real-world multi-criteria decision problems. DEMATEL examines mutual influence degrees among criteria and establishes system structure models through matrix, graph theory, and related mathematical analyses to investigate internal relationships and influence degrees [26]. This study' s investigation of academic social network information quality governance represents a typical multi-criteria decision problem suitable for DEMATEL analysis.

First, to scientifically construct relationships among impact criteria, we invited 26 researchers and academic social network experts from eight disciplines (agricultural science, economics, management, literature, education, social science, chemistry, and computer science). Experts anonymously and independently compared 14 elements pairwise based on influence degree (0=no influ-

ence; 1=low; 2=medium; 3=high; 4=very high), constructing an initial direct influence matrix. After standardization, we obtained standardized and total influence matrices. Using MATLAB, we calculated each criterion' s influence weight (P), influenced weight (Q), centrality (X=P+Q), cause degree (Y=P-Q), and relative weight, ranking overall weights to obtain information quality governance strategy impact degrees shown in Table 1 (highest weights in each dimension/criterion bolded). The centrality and cause degree distribution appears in Figure 2 [Figure 2: see original paper].

4.2 Results Discussion

4.2.1 Academic Social Network Information Quality Improvement Relies on Benign User Group Interaction. Combining Table 1 and Figure 2, after considering interactions among four dimensions and 14 criteria, "interactive enthusiasm (A43)" and "proactive affirmation of others' contributions (A42)" in the information user dimension rank highest in the governance system (overall weights 0.098 and 0.089). "Personal information completeness and authenticity (A41)" and "proactive affirmation of others' contributions" constitute important prerequisites for "interactive enthusiasm." This indicates that only in an atmosphere of positive interaction can users actively affirm others' contributions through likes, comments, and shares, forming benign user group interactions.

Traditional information quality research, such as information systems success models [27] and data quality frameworks [28], emphasizes only information content. In the Web 2.0 era, the information environment has transformed dramatically—virtual community users are not merely consumers but also producers and disseminators of content. Academic social networks represent a platform model based on community logic, where users constitute the primary behavioral agents. Given the user-generated content community characteristics, users substantially influence academic social network information quality. Scholars have found that users judge information content quality based on answerer identity [29]. For individual users as information sources, authentic and complete personal information can demonstrate professional competence and academic influence, affecting others' quality perception judgments.

Moreover, user scale and activity level critically impact healthy academic social network development. Only active, proactive community interaction generates more information quality judgment cues, such as positive likes, favorites, and comments. Thus, social interaction mechanisms provide psychological cues for users' information quality judgments. Improving information quality from the user perspective requires enhancing user interaction levels.

4.2.2 Platform Technology Monitoring Provides Important Guarantee for Information Quality Improvement. Among the four governance dimensions, platform technology significantly influences both information content and information users. Figure 2 shows that "data anomaly monitoring

(A21)," "spam identification and monitoring (A23)," and "duplicate content detection (A22)" have the highest centrality, representing important reference indicators for information quality improvement.

The platform serves as the carrier for academic social network information flow, with technology as operational support. Information quality research detached from carriers remains incomplete [30]. While control rules can constrain user-generated low-quality information, they cannot completely prevent generation and dissemination of various low-quality information, such as false information with embedded advertising, malicious voting, and redundant information. Pre-emptive information quality audit technologies are required to maximize information utility maximally. Empirical research in social media contexts has demonstrated that platform technology control of information quality positively correlates with information quality [31]. Information technology enables more automatic and accurate information screening, filtering, and integration, effectively guaranteeing high-quality information dissemination.

4.2.3 Academic Social Network Information Quality Governance Requires Appropriate Reward-Punishment Mechanism Design. Table 1 shows that after considering interactions among dimensions and criteria, "knowledge contribution quality reward-punishment mechanism (A13)" has high influence weight (4.949) and relatively high overall weight (0.067) within control rules. Figure 2 indicates this mechanism is the most important influencing factor, demonstrating that reward-punishment mechanisms enhance user participation enthusiasm.

Academic social network control rules reflect platform service providers' management capabilities. Users' perceptions of company capabilities form evaluations that subsequently affect product quality assessments [32]. Research has proven that platform rewards for high-quality information users encourage quality information provision strategies, while penalties for low-quality information improve social platform information quality—greater penalties facilitate system evolution [33]. Effective community reward measures include "point rewards" and "account accelerated upgrades,"which elevate high-quality information contributors' status and incentivize continuous valuable academic creation.

4.2.4 Guiding Optimized Information Presentation Constitutes an Effective Information Quality Improvement Approach. Table 1 shows that "logical expression (A34)" in the information content dimension has relatively high overall weight (0.073) and influence weight (3.365). Figure 2 indicates "writing norms (A31)" has high cause degree, representing an important factor affecting perceived information quality.

Information content represents the core manifestation of information quality and the most valued indicator in quality evaluation [34-35]. Sufficient academic information resources, diverse resource types, and normative presentation formats are key to attracting long-term researcher usage. Unlike general social communities, academic information presentation primarily involves text, charts, hy-

perlinks, and a small portion of video formats. Academic social network users are mostly researchers with relevant knowledge backgrounds who pay greater attention to information content itself. As platforms for academic information dissemination, academic social networks should demand higher standards for clear and accurate information expression. Starting from accuracy and completeness requirements while considering dissemination, platforms should guide users to share academic information according to prescribed format norms.

4.2.5 Effective Information Quality Governance Affects Academic Social Network Platform Brand Reputation. Considering interactions among dimensions and criteria, "community branding and operation (A11)" has high influenced weight (4.661) among the 14 criteria, indicating this outcome criterion is most affected by others. This suggests that implementation of various control mechanisms and measures directly impacts platform brand reputation.

Brand reputation represents the ability of academic social networks to convey superiority to users, enabling rational cognition and emotional orientation regarding identification [36]. This occurs because reputation ensures source credibility to some extent, with scholars confirming that source reliability positively affects information quality [31]. In e-commerce research, reputation is considered an important factor affecting online customer trust and perceived risk [37]. Similarly, academic social network platform reputation is more easily recognized by users, providing higher confidence value. Before using academic social networks —prior to quality experience, as some scholars note—users tend to judge site information quality based on platform reputation [38]; higher site reputation or word-of-mouth leads to better user expectations and experiences.

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5. Management Implications

By employing DEMATEL to establish and analyze relationships among information quality governance criteria, we propose two important management insights based on the data analysis.

5.1 Position Application Scenarios and Researcher Characteristics to Improve Community Interaction Experience

Under new technical environments, platforms must fully position application scenarios and researcher characteristics to improve interaction experiences in researcher network communities. Early academic exchange websites primarily positioned themselves as "academic," whereas Web 2.0-era academic social networks emphasize "openness" and "academic social" functions, forming stable research network communities with content, interaction, and values. From user aggregation and active interaction to community brand formation and commercialization, these platforms demonstrate diverse community ecological development models.

First, implement incentive measures to enhance user interaction enthusiasm. In academic social networks, social interaction mechanisms such as evaluation replies and forums significantly reduce users' perceived uncertainty about information quality, indicating that perceived information quality outcomes closely relate to interaction experiences. Quality connections, trust, collaboration, and interaction are important factors for enhancing perceived quality; successful academic social networks must establish benign interaction and participation incentive mechanisms.

Second, academic social networks can provide rich "digital interfaces" for research-related applications, offering complete digital tools to help construct healthy academic ecosystems and improve community interaction experiences. This goal requires identifying approaches from product and service characteristics themselves, as they represent the most direct entry points determining users' information needs in early decision-making. Simultaneously, platforms must combine usage scenarios to consider the real value of community interaction. Sustainable development of academic social networks depends on excavating user needs and experiences to form new scenario classifications. Many academic social networks are gradually opening digital interfaces with literature discovery systems and institutional repositories, creating new application fields. For example, Direct2Experts, developed for biomedical researchers, allows cross-platform interoperability with multiple research tools [39], greatly enhancing usage frequency.

Finally, platforms should eliminate blind spots in frontier area development by conducting deep member mining and introducing successful social network operation models. Future development requires continued user accumulation and stratification, deep member mining, and revitalizing abundant researcher data. Platforms could also consider introducing successful social network operation models to enhance community interaction vitality and freshness. For instance, scholars have noted that economic returns help improve social Q&A content quality [40], and moderate charging for premium content can promote platform healthy operation, complete business model iteration, and stimulate continuous learning commitment and participation willingness.

5.2 Strengthen Algorithmic Technology and Manual Intervention to Improve Community Signal-to-Noise Ratio

Signal-to-noise ratio (SNR) represents the ratio of valuable to worthless information in virtual communities. For worthless platform information, manual intervention is needed to guide valuable user-generated content (UGC) and introduce effective information filtering mechanisms, while algorithmic technology should enhance data monitoring and investigation.

First, strengthen algorithmic innovation in data monitoring technology. With rapid AI and algorithmic technology development, technical implementation of data monitoring can effectively improve academic social network SNR. For ex-

ample, algorithmic innovation in information audit and filtering technology can reduce information load and improve SNR. Facebook determines information stream demotion and display based on user interaction, widely praised by users. Similarly, in 2014 Sina Weibo launched an "information flow optimization plan" using big data technology to identify and restrict low-quality information dissemination, reducing low-quality information display by approximately 35% [41]. Algorithmic technology can also conduct user evaluations of information quality. Current methods using external information features for automated quality evaluation should be expanded to explore deeper semantic relationships and construct classification prediction models aligned with real contexts, achieving true information quality evaluation through machine learning.

Second, complement algorithmic technology with manual intervention in information quality control. Platforms should improve reporting and supervision mechanisms for low-quality, illegal, and spam information, allowing user manual tagging and feedback for better processing. Platform service providers should leverage resource advantages to help users reduce information quality discrimination costs and lower barriers to accessing high-quality academic resources. Most current academic social network services are static; platforms could consider designing online expert interaction functions to meet users' online academic exchange needs.

Finally, design information filtering mechanisms. Generally, academic social networks adopt BBS-like community approaches to ensure information quality. For example, domestic platforms like Jingguanzhijia and Xiaomuchong classify users with common or similar goals. As user numbers increase and differences grow, communities subdivide into more refined sections with distinct themes, creating closed sections that filter information by shielding users from irrelevant information. Another filtering mechanism involves strong manual intervention and operation, such as Xiaomuchong' s moderator system designating active users as section leaders who serve as community leaders and information auditors. A more scientific filtering mechanism can achieve both deep content acquisition and processing. Taking Zhihu as an example, it treats users as information flow organization nodes, pushing not content but followed users, gradually breaking down boundaries between subdivided thematic areas. This approach assumes user evaluation derives from their UGC content, while UGC quality comes from others' recognition, highlighting the importance of user recommendations worthy of academic social network adoption.

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Zhang Ning: Designed the paper framework, wrote and revised the manuscript.
Yuan Qinjian: Proposed the research direction and provided revision suggestions.

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