Value Flow Mechanism and Optimization Strategies of the Scientific Journal Industry Chain

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Abstract

Abstract

Purpose

To analyze the structure of the scientific journal industrial chain and the patterns of value flow within the chain, and to propose recommendations for optimizing value creation in the scientific journal industrial chain.

Methods

Fundamental theories of knowledge management were employed to systematically review the upstream, midstream, and downstream segments of the knowledge chain in scientific journal industry development. Based on value chain theory and integrated with the scientific journal industrial chain, the value activities of sub-chains including the supply chain, value-added chain, and output chain were identified, clarifying the direction of value flow in each segment of the scientific journal industry.

Results

A structural diagram of the scientific journal industrial chain was constructed with knowledge flow as its core, comprising upstream production and organization, midstream distribution and dissemination, and downstream services and applications. Inter-module value flow was analyzed from a value-added perspective, and a value flow model for the scientific journal industrial chain was established.

Conclusion

The scientific journal industrial chain suffers from issues such as blocked value flow, insufficient depth expansion, and imbalanced benefit distribution. Scientific journals should dismantle resource barriers to achieve collaborative sharing; accelerate capital injection and clarify revenue mechanisms; deeply mine content resources and explore cross-border value-added channels; improve technical capabilities and innovate the industrial ecosystem.

Full Text

Research on Value Flow Mechanism and Optimisation Strategy of Science and Technology Journal Industry Chain

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Abstract

Purpose This study analyses the structure of the science and technology journal industry chain and the laws governing value flow within it, proposing recommendations for optimising value creation in the industry chain. [**Method**] Using fundamental theories of knowledge management, we systematically examine the upstream, midstream, and downstream segments of the knowledge chain in science and technology journal development. Based on value chain theory and in conjunction with the characteristics of the science and technology journal industry chain, we identify value activities across sub-chains including the supply chain, value-added chain, and output chain, clarifying the direction of value flow in each segment of the industry. [**Findings**] We construct a structural diagram of the science and technology journal industry chain centred on knowledge flow, comprising upstream knowledge production and organisation, midstream distribution and dissemination, and downstream service and application. Analysing value flow between modules from a value-added perspective, we develop a value flow model for the science and technology journal industry chain. [**Conclusions**] The science and technology journal industry chain suffers from blocked value flows, insufficient depth in vertical expansion, and imbalanced benefit distribution. Science and technology journals should break down resource barriers to achieve collaborative sharing, accelerate capital injection with clear revenue mechanisms, deeply explore content resources to develop cross-border value-added channels, and improve technical capabilities to innovate the industrial ecosystem.

Keywords: Science and technology journals; industry chain; value chain; value flow

Introduction

During the 20th collective study session of the Political Bureau of the CPC Central Committee, General Secretary Xi Jinping emphasised the need to accelerate the cultivation of world-class science and technology journals, build internationally influential scientific literature and data platforms, initiate high-level international academic conferences, and encourage major basic research findings to be published and exploited first in Chinese journals and platforms [1]. Science and technology journals constitute a vital component of the national scientific and technological innovation system, serving as key carriers for disseminating research achievements and facilitating scientific exchange. They represent a critical battlefield for international competition in cultural soft power and scientific innovation capacity, playing pivotal roles in uniting academic communities, guiding research directions, and promoting scientific progress. As digitalisation, specialisation, conglomeration, and internationalisation transform the industry, the science and technology journal industry chain is being reconstructed through deep integration, creating numerous opportunities for development. However, China' s science and technology journal industry chain still exhibits significant shortcomings. From a horizontal perspective, barriers between various segments impede resource coordination and capital integration, resulting in a fragmented and blocked chain. From a vertical perspective, the industry chain has yet to achieve integrated deep fusion, lacking a comprehensive value flow mechanism that connects the entire chain.

The *Opinions on Deepening Reform to Cultivate World-Class Science and Technology Journals* states: "Support several science and technology journal publishing enterprises in reorganising and integrating journal resources across departments and regions, unblock the industry chain, reconstruct the value chain, and form an innovation chain" [2]. Against this backdrop, systematically mapping the structure of the science and technology journal industry chain, examining the patterns of value flow between various chains and modules, and identifying bottlenecks and blockages will help propose actionable strategies for the high-quality operation of China' s science and technology journal industry chain.

Literature Review

Scholars hold differing views on the connotation of "value activities in the science and technology journal industry chain" and "value chain of the science and technology journal industry." Xu Jie et al., from the perspective of researchers, define value creation and appreciation activities in science and technology journals as a series of products or services with continuous value-added relationships provided to meet researchers' needs in studying, writing, publishing, and disseminating research achievements [3]. Yan Lingyan et al., from the academic publisher' s perspective, define the academic publishing value chain as the chain of all value activities that affect the final value of academic publishers throughout the entire publishing process [4]. Zheng Xuejie defines the industry value chain of academic journals in the digital publishing era as the chain of value

creation among relevant enterprises in producing final products or providing related services [5]. Zhu Ze et al. studied the knowledge value chain of digital literature information resources covering content circulation subsystems, publisher value subsystems, and data provider value subsystems, constructing a stock-flow model for the knowledge value chain of digital literature information resources [6]. Zeng Yuanxiang et al. attempted to elaborate on the value flow links in the science and technology journal industry chain, exploring the value input and output processes among subjects including researchers (authors), science and technology journal publishers, technical service providers, distributors, and academic evaluation service providers [7]. Current research methods concentrate on qualitative approaches, with limited quantitative research. For instance, Ye Guanghui et al. established an evaluation index system to measure the knowledge value in the "production-publication-consumption" value chain of scientific literature, thereby obtaining the knowledge value contribution rate at different nodes [8].

Our literature review reveals that existing research on value activities in the science and technology journal industry chain primarily focuses on concepts and connotations, segments and components, and extension and reconstruction. However, studies seldom address the connection logic and value flow patterns between various chains and segments, largely neglecting potential value including hidden value, silent value, and service value. Therefore, this paper uses knowledge flow as the core thread to connect the value chain of the science and technology journal industry, examining structural changes in China' s science and technology journal industry chain under digital integration and convergence. Combining explicit and implicit value, we investigate value flow across different chains and segments, proposing development strategies for value creation, appreciation, and realisation.

Theoretical Framework

Knowledge Management Theory

Knowledge Chain Synergy Theory. The formation mechanism of knowledge chain synergy can be described through three dimensions: subject synergy, mechanism synergy, and knowledge synergy. Subject synergy forms the foundation, mechanism synergy provides the driving force for knowledge chain operation, and knowledge synergy represents the key element. Knowledge constitutes the core resource of the knowledge chain, achieving synergy through flow, sharing, and creation [9].

Knowledge Spiral Theory. This theory describes the transformation process between explicit knowledge and tacit knowledge through four modes: combination, internalisation, socialisation, and externalisation. Specifically, it refers to the expansion of tacit knowledge through these four conversion modes to become a higher-level knowledge entity.

Knowledge Value Theory. Knowledge value theory represents a knowledge

management approach that understands knowledge as static organisational resources, treating it as intellectual capital or knowledge assets. This perspective integrates multiple concepts (intellectual capital, learning, information). Knowledge can enhance organisational performance, possessing strategic, tactical, and operational value, and contributes to better decision-making [10].

Science and technology journals serve as carriers for academic papers, which are manifestations of academic knowledge. The science and technology journal industry is a knowledge-dominated industrial cluster, with a knowledge management chain running through the industry chain connecting upstream (knowledge production and organisation), midstream (knowledge distribution and dissemination), and downstream (knowledge service and application). This chain reveals how knowledge flows across upstream, midstream, and downstream segments under the participation of different subjects, clarifying value generation and direction.

Industry Value Chain and Value Network

The industrial value chain derives from value chain theory. In 1985, renowned management scholar Michael Porter proposed the "value chain" theory based on research into corporate value creation, intending to describe internal production activities from a value flow perspective. Subsequently, the theory has been continuously supplemented and improved, with research subjects shifting from specific enterprises to overall industrial value creation, moving from micro to macro levels. Numerous scholars have defined the industrial value chain, with understanding of its connotation mainly falling into two perspectives: first, from the industry subject perspective, viewing the industrial value chain as an interdependent and coordinated value system formed by connecting the value chains of various enterprises [11]; second, from the industry segment perspective, viewing the industrial value chain as the value creation and appreciation process experienced by enterprises in various industry segments to produce final products or services [12]. The former perspective treats corporate value activities as the foundation of industrial value chain formation and development, analysing value activities as industry subjects move from separation to organisation. The industry segment perspective defines the industrial value chain from the organisation and creation process of the industry chain structure, covering all segments and stages in the value creation process of products or services, focusing on value exchange, transfer, and appreciation across upstream, midstream, and downstream industries.

As digital transformation and upgrading advance, value chains in industries have become networked and interconnected, extending and expanding value chain theory. This has led to the concept of the "value network" —a user-centred value creation system. The value network replaces traditional chain structures, proving more suitable for dynamically and complexly intertwined network value systems. From the value network perspective, stakeholders shift from original point-to-point linear relationships to multi-subject interactive relationships [13].

Taking science and technology journals as an example, while knowledge achievements in the downstream industry chain are disseminated, they simultaneously exchange value with upstream academic creation in the form of research assistance, causing the value flow chains of the science and technology journal industry chain to become intertwined.

The publishing value chain refers to the chain structure formed by various investment and operation activities involved in the entire process from content resource production to development and dissemination. Consistent with the publishing industry value chain, the science and technology journal value chain refers to an organised series of steps comprising all value creation and appreciation activities in the process from knowledge generation to academic paper writing, publication, dissemination, application, and interaction. It mainly consists of several principal chains: "creation-production-dissemination-reading," with content representing the hidden core competitiveness in each link of this value chain. The value chain of science and technology journal publishing begins with researchers' new ideas, appreciates through peer review, publication, and distribution links, and ultimately delivers ideas to readers, inspiring new ideas [14]. This paper combines industry value chain theory to analyse value flow patterns across various segments and modules of the science and technology journal industry chain.

Value Acceptance and Value Co-creation

The Value-Based Adoption Model (VAM), developed by Singaporean scholar Kim, identifies "perceived usefulness," "perceived enjoyment," "perceived cost," and "technical characteristics" as the main drivers of user value acceptance.

Value co-creation theory posits that value is not created solely by enterprises but through the joint participation of producers, consumers, and other stakeholders. Value co-creation theory exhibits three characteristics: first, all subjects are interconnected in value creation; second, information and resource sharing and synergy among subjects promote overall value realisation; third, the goal of value co-creation is to meet environmental development needs and maximise value creation [15].

Industry Chain Structure and Value Flow

Knowledge-Flow-Oriented Structure of the Science and Technology Journal Industry Chain

The science and technology journal industry is a knowledge-dominated industrial cluster, with a knowledge management chain running through the industry chain connecting upstream (knowledge production and organisation), midstream (knowledge distribution and dissemination), and downstream (knowledge service and application). In the upstream segment, while explicit knowledge (academic papers, research data, etc.) is edited, published, and carried in journals and

databases, it is also necessary to transmit and radiate the tacit knowledge formed by knowledge producers in their daily research work to achieve deep mining and maximised utilisation of knowledge resources. In the midstream segment, due to the highly specialised nature of science and technology journals, their long knowledge timeliness, and passive dissemination attributes, a one-to-many, full-chain knowledge dissemination model centred on science and technology journals radiates to audiences. In the downstream segment, knowledge synergy connects multiple knowledge economy entities, complementing knowledge and conducting knowledge innovation to facilitate achievement transformation. The basic segments of the science and technology journal industry chain are shown in Figure 1 [Figure 1: see original paper].

Value Chain Analysis

Supply Chain The science and technology journal supply chain primarily comprises author groups, publishing houses, distribution companies, and reader groups. Authors are suppliers of raw materials (works), publishing houses are manufacturers of raw materials (works), distribution companies are distributors, and readers are end users. Each segment is interdependent, completing the flow of logistics, information flow, and capital flow.

Under the digital publishing model, the science and technology journal publishing supply chain has undergone digital upgrading and dissemination, with the supply chain involving only information flow and capital flow. In the digital publishing supply chain, content producers (authors) provide original works to content integrators (publishers), who supply edited and reviewed works to technology providers for digital operation while simultaneously providing digital content to channel operators for dissemination through multiple online and offline channels. Finally, users access needed content and services from network platforms through various terminal devices. Terminal device providers, telecom operators, and financial service providers supply the technical means for delivering digital content to readers. The flow of digital information constitutes the current science and technology journal digital publishing supply chain, as shown in Figure 3 [Figure 3: see original paper].

Value-Added Chain The principal value of the science and technology journal value chain lies in the original ideas within papers—that is, knowledge—with all other segments serving as auxiliary value addition. Actors participating in the value appreciation process include: authors, reviewers, editors, planners, technical service providers, distributors, sales channel providers, and readers (users). Authors create initial value by writing papers based on their research, serving as content producers who provide principal value to the value chain. Reviewers, generally including editorial board members and peer reviewers, ensure academic paper quality, acting as "gatekeepers" who add value to the chain. Editors standardise and process papers, improving their academic, scientific, and creative qualities to meet publication requirements. Planners design spe-

cial columns based on research frontiers and hotspots, intensively concentrating journal content to enhance readability and influence. Technical service providers offer technical support for deep mining and processing of paper content, such as visualising paper content and building knowledge element databases, undertaking the work of making valuable content concrete and visible. Distributors and sales channel providers distribute and disseminate journals through various channels, acting as connectors that link the entire value chain. Readers (users) receive journal information at the end of the value chain, enjoy knowledge services, and generate new ideas through feedback and interaction. For science and technology journals, readers (users) are highly homogeneous with authors; after receiving journal information, readers (users) are likely to become initiators of new value-added chains, making them both consumers and content producers.

Science and technology journals are collections of papers, which can be regarded as collections of knowledge. Knowledge achieves value appreciation through the value-added chain. Publishing departments integrate and mine knowledge, connecting individual pieces of knowledge to form knowledge networks and knowledge bases, thereby providing knowledge services such as think tanks. The management objective of the value-added chain is to organise disordered knowledge, efficiently present the inherent value of knowledge, ensure effective knowledge dissemination, and maximise information appreciation.

Output Chain The output chain of the science and technology journal value chain lies at the end of the value chain, where the appreciation objectives of the midstream value-added chain are realised. The main subjects of the output chain are consumers such as readers, governments, and research institutions, with the standard for value realisation being consumer satisfaction with the knowledge value and service value provided by science and technology journals. The management objective of the output chain is to understand and integrate consumer needs, provide timely feedback to the value-added chain, and prompt the value-added chain to conduct value appreciation activities in multiple ways, thereby gaining consumer recognition of journal value.

For science and technology journals, most currently provided knowledge services cannot adequately meet user needs, leaving considerable room for improvement in user participation and interaction. Science and technology journal knowledge services need to shift towards creating and expanding user target needs by providing high value-added services. The particularity of science and technology journal users lies in that most users are also content producers. Under appropriate stimulation, users can transform from knowledge service recipients to knowledge service participants. Motivations for user participation in knowledge service co-creation can include information needs, problem solution design, and user recognition and sharing of creations. Unlike one-way knowledge service provision, user participation not only enhances user achievement and satisfaction but also stimulates knowledge creation and improves knowledge service quality. Through value co-creation among various target groups, ecosystems based on

academic and research communities or even industry are formed, as shown in Figure 4 [Figure 4: see original paper].

Value Flow Patterns in the Science and Technology Journal Industry Chain

From a value appreciation perspective, the science and technology journal industry chain can be regarded as a value-added chain centred on "knowledge resources." Through overall collaboration among various industry chain segments, overall production efficiency improves and production costs decrease. During this process, value segments such as research assistance and knowledge services gradually evolve from sub-chains of the science and technology journal value chain into components that extend upstream and downstream in the industry chain. From this perspective, value flow in science and technology journals can be divided into three modules: knowledge production and organisation, knowledge distribution and dissemination, and knowledge service and application. Continuous value exchange, transfer, and appreciation occur between modules, while value flow also exists within sub-segments inside each module.

As digital transformation and upgrading advance, value chains in the science and technology journal industry intersect and connect, with industry value chain segments deconstructing and reorganising. The chain-based value flow model will gradually fade, while complex network-like value networks will become clearer. At this point, the value network replaces the traditional chain structure, proving more suitable for dynamically and complexly intertwined network value systems. From the value network perspective, stakeholders shift from original point-to-point linear relationships to multi-subject interactive relationships. For example, while knowledge achievements in the downstream industry chain are disseminated, they simultaneously exchange value with upstream academic creation in the form of research assistance, causing the value flow chains of the science and technology journal industry chain to become intertwined. The value flow model of the science and technology journal industry chain is shown in Figure 5 [Figure 5: see original paper].

Initial Value Creation: Knowledge Production and Organisation Supported by various research services, researchers condense research achievements into innovative knowledge, completing initial value creation. After authors submit manuscripts to science and technology journal publishers or publishers solicit contributions from authors, publishers provide corresponding knowledge services. Through content editing, peer review, and academic integrity checks, they process and refine literature, thereby endowing it with complete knowledge value and completing value transfer and appreciation within the module. At this point, researchers obtain corresponding remuneration, academic reputation, and sense of self-worth, while page charges and advertising fees collected by publishers become manifestations of knowledge service value. During this value flow process, science and technology journal technical service providers

exchange value with publishers. Although not directly participating in core segments of the science and technology journal industry chain, they participate in initial value creation in an auxiliary form and connect with various nodes of the value chain through technical advantages.

Value Transfer and Diffusion: Knowledge Distribution and Dissemination Knowledge value transfers from science and technology journal publishers to distributors and database platform providers. As a segment that directly generates economic benefits, distribution has gradually become one of the important value appreciation nodes in the science and technology journal industry chain. As technology and knowledge integration deepen, science and technology journal distribution platforms shift from publishing models primarily providing academic content to providing products and services, with some value consequently transferring from knowledge products to service products. During this process, besides journal distribution income, science and technology journal distributors also obtain operational service income, subscription income, advertising income, data income, etc. Content disseminator data platform providers occupy important positions in the science and technology journal industry value chain, even obtaining the majority of market output income. In the knowledge distribution and dissemination segment, value-added services are mainly user-oriented and can be roughly divided into three types: first, personalised services oriented by user needs, such as providing customised literature recommendations and subscription services; second, knowledge services characterised by deepened content re-aggregation, i.e., deeply mining literature value and information value, such as literature aggregation analysis; third, diversified and multi-channel reproduction of knowledge content, such as open access, enhanced publishing, and on-demand publishing. Furthermore, dissemination has become an important segment for realising endogenous motivation and cross-border extension in the science and technology journal value chain, with knowledge information diffusing in research communication communities, spawning new knowledge and new value creation.

Value Appreciation and Circulation: Knowledge Service and Application Knowledge value transfers upstream to research assistance services, achieving appreciation and value circulation. By providing corresponding research support to researchers and institutions, the science and technology journal industry chain completes value reflux, driving new knowledge value and content creation, thereby promoting sustainable development of the industry chain [16]. Research assistance includes both knowledge service products such as industry frontier dynamic tracking reports, policy analysis reports, and industry reports, and research value-added services including literature resource management, scientific and technological dynamic information analysis, research data collection and analysis, data management and storage, and research project information integration [17]. Academic evaluation service providers also participate, providing academic evaluation services for journals, organisations, and

scholars.

Simultaneously, the science and technology journal industry value chain extends and expands downstream, with three main appreciation paths. First, the science popularisation appreciation chain. Although the value of disseminating popular science knowledge through media cannot be transformed into economic benefits in the short term, its hidden value remains significant. Second, the research achievement transformation appreciation chain. Taking medical science and technology journals as an example, some research findings contain enormous practical significance, and their value can be effectively transformed. Third, the appreciation chain oriented toward serving enterprises, organisations, and institutions [18]. As the digital platformisation trend of science and technology journals further strengthens, the chain-based value flow model will gradually fade, while complex network-like value networks will become clearer.

Problems in the Industry Chain

Fragmentation Causing Value Flow Blockage

China currently implements a "territorial principle" for supervising and managing science and technology journal publishing activities, i.e., a "territorial management system." While this system plays a positive role in implementing principal responsibilities and supervising regional journals' compliant operation, it also restricts resource integration across industry chain segments and imposes numerous limitations on social capital entering the science and technology journal industry. Cooperation between science and technology journal publishing institutions across regions, supervisory authorities, and units is hindered, making content resource and capital integration difficult. Isolated use of resources among publishers not only impedes resource integration, correlation, and deep development but also intensifies economic burdens and resource waste through duplicate investment. Value cannot flow and appreciate smoothly across various chains, modules, and subjects in the science and technology journal industry, with capital chains and resource chains becoming disconnected. The industry lacks sustained momentum for kinetic transformation, which is unfavourable for the cross-regional clustering and market-oriented development of science and technology journals.

Insufficient Vertical Expansion of the Value Chain

The science and technology journal industry chain encompasses multiple value creation and growth nodes. Although the industry value chain has attempted to extend upstream and downstream, derivative segments remain underdeveloped, with value activities still centred on research papers and lacking deep mining and utilisation of content resources. Value-added forms are relatively singular, and value growth effects need strengthening. The process of science and technology journal industry activities centred on "knowledge resources" still contains substantial untapped potential value and service value, including secondarily

processed content resources, data resources, user resources, expert resources, and research information resources. If publishers can leverage their resource advantages to screen, integrate, and reorganise owned resources, they will gain more discourse power when cooperating with enterprises, organisations, and institutions, substantially increasing the possibility of cross-border integration and expanding greater value creation space for the entire industry. Regarding achievement transformation, after paper publication, science and technology journals seldom conduct long-term tracking of research achievements, with only a tiny fraction of achievements realising actual implementation value transformation, causing much potential value to be lost in this process.

Imbalanced Profit Distribution in the Industry Chain

China' s current science and technology journal industry value chain exhibits mismatches between value creation, value appreciation, value realisation, and benefit distribution. Database platform providers in the dissemination segment occupy the majority of income in the industry chain, while knowledge content providers and processors—researchers and science and technology journal publishers—gain minimal benefits. As digital sales channels are controlled by platform providers, science and technology journal publishers lack bargaining power in benefit distribution negotiations. Copyright transfer agreements between publishers and platforms are mostly long-term fixed amounts unaffected by inflation and other factors. After deducting literature checking fees paid to platforms, ordinary journals can only charge extremely low literature download fees from platform providers [19]. The value input and income of science and technology journal publishers are clearly imbalanced, forcing some publishers to obtain income by charging authors more page fees. Researchers and research institutions face similar difficulties. The rigid demand for database platforms forces researchers and institutions to pay substantial fees, with researchers bearing heavy review and page charges and research institutions and university libraries bearing high database fees and platform service charges. This imbalance and unreasonable benefit distribution restricts normal academic exchange and is unfavourable for the sustainable development of the science and technology journal industry value chain.

Lack of Integrated Value Flow Mechanism Across the Entire Industry Chain

Multiple reasons prevent the science and technology journal industry from achieving integrated value flow across the entire industry chain. Cross-regional, cross-supervisory, and cross-unit content and resource collaboration face numerous restrictions, making it difficult to form linkage and connectivity of value chains among industry subjects. Simultaneously, lacking corresponding financial and technical support, industry integration development often requires substantial capital. The entry and exit mechanisms for non-public capital in China' s science and technology journal industry chain remain unclear,

leaving social capital in a wait-and-see posture. Lacking support from actual benefits, technical service providers offering technology platforms also lack investment motivation. Intense competition among industry subjects, with database platform providers such as CNKI holding absolute control over digital sales channels, has marginalised content providers. This dominant player phenomenon is unfavourable for healthy industry development and creates conflicts between database platform providers and publishers. Against this backdrop, forming an integrated value flow mechanism across the entire industry chain is no easy task. Fierce market competition and high transformation thresholds lead to unsmooth connections between segments and uncoordinated operation of the industry value chain.

Optimisation Strategies

Resource Coordination to Unblock the Industry Value Chain

The *Opinions on Deepening Reform to Cultivate World-Class Science and Technology Journals* proposes: "In accordance with national entry policies and publishing management systems, encourage the introduction of enterprise forces for collaborative journal operation and promote deep industry-university-research cooperation" [20]. To this end, journal management departments should implement classified management of Chinese journals, supporting diversified development of science and technology journals. Government and academic societies should take the lead, encouraging collaboration among universities, enterprises, and journals to achieve cross-regional, cross-supervisory, and cross-disciplinary resource cooperation. For example, Central South University Press, through capital increase and shareholding, coordinated related business resources and took the lead in reaching cross-regional journal operation strategic cooperation with Youke Publishing. This new model of joint publication by academic societies, universities, and research institutions effectively solves the current problem of disconnection in the science and technology journal industry value chain, becoming a breakthrough for cross-regional capital cooperation. Various collaborative journal operation models such as "academic society + enterprise," "university + enterprise," and "research institution + enterprise" also deserve attention [21]. By integrating government, industry, university, research, finance, technology intermediaries, and market application resources, the industry value chain can be unblocked.

China-characteristic science and technology journal clusters dominated by researcher communities will become the future development direction. Science and technology journals under the same supervisory unit, in the same discipline, or in the same region can form alliances to share infrastructure, resources, and technology. These can be horizontal collaborations—for example, journals in the same field jointly publishing a series of themed articles in their columns to form clusters—or vertical alliances across fields and disciplines. Various clusters can be nested to form large-scale, influential science and technology journal clusters. Additionally, relevant technical standards for various digital resources should

be accelerated, including content resources, data resources, author resources, and user resources. Attempts should be made to establish resource integration and sharing platforms connecting upstream, midstream, and downstream of the industry chain, forming a resource service system that runs through the entire industry chain. Meanwhile, the importance of technical resources should not be overlooked. As some Chinese journals have limited scale and cannot form their own technical advantages, industry associations, organisations, and technology providers could take the lead in attempting to establish public technical service support systems.

Capital Injection to Activate the Industry Value Chain

To accelerate value flow in the science and technology journal industry, diversified capital support and injection are needed. Currently, Chinese science and technology journals' income mainly comes from superior department appropriations, operating income, special funding, and institutional sponsorship. Although non-public capital has participated in platform services, technical services, marketing, and international copyright cooperation, it remains involved only in small scopes and scales due to unclear entry, exit, and income mechanisms. In response, the industry should vigorously promote "capital integration + resource synergy + university-enterprise-journal" cooperation, coordinating capital forces across upstream, midstream, and downstream of the science and technology journal industry chain. China should advance the lawful and orderly absorption of extra-industry capital and broaden financing channels for its science and technology journal industry. Simultaneously, to regulate the orderly development of non-public capital in the science and technology journal industry, restrictions on non-public capital participation in various segments of science and technology journal publishing operation must be further clarified, along with penalty standards and supervisory responsibilities for illegal journal operation. Multiple regulations should be adopted to strengthen cultural and ideological security responsibilities of science and technology journals, improve confidentiality management systems, and perfect confidentiality protection measures. The author suggests establishing a journal industry investment fund with joint participation of public and social capital, clarifying property rights after non-public capital entry, and establishing a mechanism for mutual supervision and checks and balances among multiple investment subjects to ensure sustained non-public capital investment. Additionally, to promote the international development of science and technology journals, public and non-public capital can jointly conduct overseas mergers and acquisitions, international copyright cooperation, and dissemination.

Cross-Border Value-Added to Extend the Industry Value Chain

Although the science and technology journal industry value chain has extended upstream and downstream, true cross-border value-added has not yet been realised. Whether publishers, distributors, or data providers, all science and tech-

nology journal industry subjects should leverage their advantages, use knowledge resources as the central hub, conduct secondary development around knowledge resources, and deeply expand service objects and scope. While perfecting the value chain centred on "knowledge resources," they should expand into fields such as science popularisation, education, and finance to maximise value chain appreciation and generate greater economic, cultural, and social benefits.

Personalised knowledge services targeting enterprises, governments, and social organisations will become the focus of value-added. By providing customised information retrieval and collection services, industry report services, decision-making consulting services, think tank services, public opinion monitoring services, etc., the content value of science and technology journals can be deeply utilised. Journals in various fields can enrich their service types according to their disciplinary characteristics and choose to cross into different fields and directions based on their advantageous resources. Among these, crossing into education represents a common value-added path for all science and technology journals. Through long-term content accumulation, science and technology journals possess extremely rich knowledge and data resources. Therefore, they can cooperate with education platforms to provide digital education resources and corresponding literature materials. Additionally, they can process popular science knowledge and collaborate with popular science videos, interactive games, and audio products to achieve industry chain extension. Furthermore, the potential energy of science and technology journal knowledge resources can be transformed into economic development kinetic energy through achievement transformation. To this end, cooperation between science and technology journals and enterprises should be strengthened, deepening the collaborative development of "technology and finance," activating the vitality of technology transformation applications and potential demands, and promoting the popularisation and application of independent innovation achievements.

Technology Leadership to Enhance the Industry Value Chain

Value flow through technology exchange and sharing among various subjects in the industry chain constitutes an important component of the science and technology journal industry value chain. Any improvement or development of core technologies in the technology cluster will affect the science and technology journal industry, becoming a driving force for industry value chain evolution. Among these, science and technology journal industry technological progress belongs to exogenous drivers, while technological innovation can be categorised as endogenous drivers. Precisely because technology plays such an important role in enhancing the industry value chain, all participants in the science and technology journal industry must attach great importance to technological innovation and application.

For new publishing forms such as integrated publishing, enhanced publishing, virtual reality, and multimodal content, science and technology journal technical service providers, publishers, distributors, and other industry subjects should

perfect relevant technical means. While transforming and upgrading product forms, they should provide knowledge services suitable for new products, effectively associating and integrating science and technology journals with other forms of content resources to jointly increase the added value of knowledge products [22]. Innovations in publishing formats brought by open access and preprint platforms also require the science and technology journal industry chain to break through existing operation models, taking expanding domestic capital demand as the strategic foundation to help the science and technology journal industry chain grow stronger and unblock capital circulation.

Conclusion

Knowledge flow connects the science and technology journal industry chain, forming an industry chain comprising upstream (knowledge production and organisation), midstream (knowledge distribution and dissemination), and downstream (knowledge service and application). Knowledge resources flow among various segments, undergoing value exchange, transfer, and appreciation, thereby achieving initial value creation, value transfer and diffusion, and value appreciation and circulation. The study finds that value flow in the science and technology journal industry chain is not smooth enough, requiring breakdown of resource barriers to promote collaborative sharing; attraction of capital injection to energise the chain under standardised management; exploration of cross-border value-added channels to effectively expand industry influence; and active embrace of new technologies to innovate the industrial ecosystem.

This study has systematically examined the structure of the science and technology journal industry chain from a knowledge management perspective and analysed value flow patterns, achieving certain results. However, limitations remain: industry practice investigation has not been sufficiently deep, lacking adequate practical experience. Future research should better integrate practical experience from the science and technology journal industry to construct a dynamic mechanism for sustainable development and innovation improvement, proposing more constructive strategies for science and technology journals to better create, appreciate, and realise value.

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Author Contributions Statement

YANG Haiping: Conceived the research idea, wrote and revised the manuscript, supervised the study;
ZHANG Bingyue: Designed the research framework, wrote and revised the manuscript;
WU Ruilin, QIN Zhouya: Conducted literature and data review, provided revision suggestions.

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