Innovative Practice and Reflection on Library Information Services for Industry: Postprint

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Abstract

[Purpose/Significance] Addressing the overall demand for transformation, upgrading, and development facing domestic industries and the series of difficulties encountered by libraries in providing information services for industries, this study examines existing innovative practice cases to identify directions for libraries to develop industrial information services. [Method/Process] Through literature research, web-based investigation, and field visits, we preliminarily surveyed the current state of theoretical research and practical exploration of industrial information services both domestically and internationally, and detailed the achievements in industrial information services obtained by the National Science Library, Chinese Academy of Sciences in recent years. By comprehensively analyzing all research findings and considering the unique characteristics of industrial information services, we contemplated specific directions for libraries to carry out industrial information services. [Results/Conclusion] Based on existing innovative practical explorations, we summarize five advisable directions for libraries to develop industrial information services: taking meeting users' specific needs as the service core, adopting diversified cooperation methods as the service strategy, implementing management model innovation as the service guarantee, promoting service method innovation as the service driver, and establishing industrial platform construction as the service approach.

Full Text

Preamble

Innovative Practical Research and Reflections on Libraries Providing Information Services to Industries

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Abstract

[**Purpose/Significance**] In response to the pressing needs of domestic industries for transformation and upgrading, as well as the series of challenges libraries face in providing information services to industries, this study examines existing innovative practical cases to identify directions for libraries to develop industrial information services.

[**Method/Process**] Through literature review, web-based research, and field visits, this paper initially investigates the current state of theoretical research and practical exploration in industrial information services both domestically and internationally, with detailed introduction of the achievements made by the National Science Library, Chinese Academy of Sciences in recent years. Based on comprehensive analysis of all research findings and considering the unique characteristics of industrial information services, the paper reflects on specific directions for libraries to develop industrial information services.

[**Result/Conclusion**] Drawing from existing innovative practical explorations, this paper summarizes five viable directions for libraries to develop industrial information services: making user-specific needs the service core, employing diversified cooperation as the service strategy, using management model innovation as the service guarantee, taking service method innovation as the service driver, and building industry platforms as the service channel.

Keywords: library; industrial information service; information service platform; service model; practice
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As China's reform and opening-up deepens, domestic market competition is becoming increasingly internationalized, and the form of competition between nations is shifting from product competition to industrial chain competition [1]. Against the backdrop of China's transformation from an industrial giant to an industrial powerhouse, and in this special stage of entering the late industrialization period and transforming the economic development model, innovation and transformation have become the main themes of economic development under the new normal [2]. In today's era, industrial innovation and upgrading are inseparable from the mastery and analysis of information and intelligence, and the connection between industrial innovation and intelligence services is becoming increasingly close.

As the primary institution providing information and intelligence services, libraries have long been committed to serving the information needs of governments, the public, teaching and research institutions, and technology enterprises. In the current post-financial crisis period, when regional industrial clusters across China face transformation and upgrading, libraries urgently need to utilize modern information technology and innovative service models to estab-

lish a comprehensive information assurance system for various types of industries and provide information and intelligence services adapted to their development needs. However, the timeliness, systematic nature, and dispersed characteristics of industrial information needs, combined with the long-standing lack of market competition information and industry development dynamics in the library field, have determined that libraries must achieve innovation and transformation in resources, models, and products when serving entire industries, in order to truly adapt to industrial development needs. This is both a current challenge and a new opportunity for libraries to achieve self-development.

This study first conducts a preliminary review of the current status of major theoretical research and practical exploration in industrial information services both domestically and internationally, focusing primarily on analyzing existing domestic practices. The analysis is elaborated from three aspects: industrial information service platforms, industry information center service models, and library service practices. Based on comparative analysis of domestic and international industrial information service progress, the paper highlights the series of practices and achievements of the National Science Library, Chinese Academy of Sciences (hereinafter referred to as "the National Science Library") in serving Jilin Province's biomass industry in recent years, and proposes specific guiding suggestions for libraries currently exploring industrial information services.

1. Current Status of Theoretical Research on Industrial Information Services

1.1 Foreign Theoretical Research on Industrial Information Services

Theoretical research in developed countries on information services for industrial innovation development mainly manifests as holistic information service framework research. Through in-depth analysis of specific institutions and groups, the framework construction content is relatively detailed and easy to operate. Representative studies include: C. James et al. from the Information Engineering Department of the U.S. National Science Foundation studied information integration and service reorganization for technological innovation, proposing an information assurance framework for enterprise innovation services [3]; P. Sameer constructed an information service framework oriented toward innovation needs from both national and corporate levels [4]; L. Hsiu-Fen proposed enterprise innovation service concepts based on knowledge sharing through empirical research and built a new knowledge service system [5]; H. Mark surveyed users' innovation needs and constructed an innovation service framework [6].

1.2 Domestic Theoretical Research on Industrial Information Services

From a holistic perspective, numerous domestic scholars have conducted theoretical research on information assurance system construction, information service model building, and factors influencing information service effectiveness. For example, the major National Social Science Fund project "Research on Informa-

tion Service System and Information Assurance System for Building an Innovative Country"; based on the characteristics of information services for strategic emerging industries, some scholars proposed three service models: the "user-attraction model" for the initial stage of industries, the "content-cooperation model" for the growth stage, and the "user-problem-solving model" for the mature stage [7]. Additionally, regarding the effectiveness of services for strategic emerging industries, scholars have conducted a series of explorations, including establishing impact models [8]; some scholars, guided by information ecology theory, analyzed the interactions among multiple ecological factors and their structural relationships in the information service ecosystem of strategic emerging industries, constructing a comprehensive ecological model framework and operational strategies for strategic emerging industry information services oriented toward improving information service effectiveness [9].

From a local perspective, some scholars conducted a census of information service platforms for industrial cluster innovation, statistically analyzing the construction entities, main functions, and existing problems of various platforms [10]; other scholars constructed an overall framework for an integrated service platform oriented toward cross-industry information needs in the industrial chain and proposed steps for establishing an information service system for strategic emerging industries in Hubei Province [11].

Different types of libraries in China are also actively exploring service directions and paths based on their own characteristics amid rising demand for industrial information services. Specifically: the Jingdezhen Ceramic Institute Library in Jiangxi Province explored methods for providing characteristic information services for the low-carbon ceramics industry to align with the Poyang Lake Ecological Economic Zone development strategy [12]; Jianghan University Library analyzed the characteristics of local industrial information needs and their demand for information services based on market research, and proposed corresponding measures for obstacles faced by university libraries in providing information services to regional industries [13]; Yibin University Library explored the basic framework of a liquor culture information service platform based on its self-built Chinese liquor culture database and liquor packaging culture exhibition room [14]; some industry-characteristic university libraries and similar alliance organizations discussed methods for providing information assurance and support services for industry think tanks [15].

1.3 Analysis of Theoretical Research Status

Compared with foreign theoretical research, current domestic theoretical research on industrial information services generally lacks studies on specific issues such as information needs of specific industries, development characteristics of specific industries, and difficulties in innovation and development of specific enterprises. It also lacks research on specific issues like information service integration organizations and cross-system information service utilization methods. Meanwhile, related research in various libraries is still in its infancy. The rea-

sons may be that, on one hand, the entire academic community lacks analyzable and referential practical achievements; on the other hand, there is neglect of research on practical achievements and targeted research on specific industrial information needs, as well as research on innovative paths for industrial information service models, methods, and strategies outside the library field. This constitutes the starting point of this study, attempting to conduct research and exploration from these neglected perspectives.

2. Current Status of Practical Exploration in Industrial Information Services

2.1 Foreign Industrial Information Service Practices

Most foreign countries emphasize the construction of national information infrastructure and the respective positioning of various information service institutions in serving industrial independent innovation. Building an information assurance system is an important measure for foreign countries to cultivate and develop emerging industries. For example, the United States established specialized government information service centers that conduct digital information assurance in cooperation with innovation subjects based on industrial information service alliance networks [16]; Japan constructed a comprehensive system for information management and consulting services for small and medium-sized enterprises, covering government policy support, information support from intelligence agencies, and an inter-enterprise information network system [17]; the EU established an Information Society based on multi-country integration and coordination, responsible for planning and coordinating information construction among EU member states, and proposed initiatives such as "e-Europe Action Plan" and "Inter-Administrative Data Exchange IDA (International Dyslexia Association)" [18]. The Europe Innova information service platform it established provides functions such as industry innovation monitoring, cluster mapping, financing, standards, industry innovation expert networks, innovation management, and communication [19].

Developed countries' support for emerging industries also relies on superior intermediary services. Most of these intermediary service organizations coexist as official and non-official, profit and non-profit entities, such as the U.S. Small Business Development Center, EU Innovation Relay Centers, Japan's Corporate Management Research Institute, and the San Jose Software Development Center [20]. Additionally, most public libraries in developed countries have business branches or business information service centers that provide business information services for enterprises (especially small and medium-sized enterprises), such as the Science, Industry and Business Branch of the New York Public Library, the Far Rockaway Branch of the Queens Public Library, the Brooklyn Business Library, and the "Business and Intellectual Property Center" of the British Library. There are also specialized libraries engaged in competitive intelligence services, such as the Japan External Trade Organization Business

Library and the Singapore Business Library.

2.2 Domestic Industrial Information Service Practices

2.2.1 Current Status of Industrial Information Service Platform Construction In recent years, the Chinese government has begun to attach importance to the significance of information services for industrial innovation, actively encouraging and promoting the construction of regional and industry public information service platforms and service institutions [21]. After several years of concentrated construction, China's public information service platforms have made important progress in quantity. However, scholars have found through statistics that most of these platforms are functional single e-commerce platforms [10]. This study's investigation reveals that the main advocates and builders of China's current industrial information service platforms are generally concentrated in central or local governments and their directly affiliated public institutions, or some well-developed industry information centers and industry associations, or emerging technology enterprises funded by scientific research organizations. Overall, these construction entities have more advantages than libraries in terms of appeal, execution, coordination, industry information resources, network technology, comprehensive support services, or financial resources for developing industrial information services.

Existing platforms can be roughly divided into two categories based on functional types: The first category is integrated one-stop comprehensive service platforms that integrate many service institutions. Their characteristics include providing business services such as upstream and downstream supply and demand information sharing, equipment and instrument sharing, e-commerce transactions, R&D design, technology transfer, network technology support, technology credit, technical product inspection and testing, and intellectual property agency for enterprises in the industry. These platforms have a wide service audience, diverse service functions, and service content mainly focused on universal enterprise needs, primarily providing business information support services for industrial development. The second category has relatively single service content, mainly built by professional information service institutions with advantages in industrial information resources and/or industrial information analysis technology. Their characteristics include fewer platform cooperation institutions, service objects concentrated on a specific industry or target, service content focused on refined, in-depth, and accurate multi-type industrial development reports or special intelligence analysis service products, and unique and exclusive platform resource construction or service functions, focusing on personalized needs of specific service objects and mainly providing high-level intelligence support services for industrial development.

2.2.2 Current Status of Chemical Industry Information Center Services This study selects the service model of the China Chemical Information Center (CNCIC, hereinafter referred to as "the Chemical Center") to elaborate

in detail on the current status of industrial information services in industry information centers. The Chemical Center is a professional information consulting research and information service institution dedicated to serving the national chemical industry for a long time. Its main organizational structure is shown in [Figure 1: see original paper]. Among them, the Industry Information Department mainly provides services such as strategic planning, expert consultation, and solutions. For different fields in the chemical industry, the department has established specific teams to conduct special field development dynamic tracking and provide corresponding services. The pesticide team has long maintained close cooperative relations with relevant industry associations. In addition to regularly attending large association meetings each year, it also obtains the latest industry dynamics in a timely manner and maintains information synchronization with industry development by sponsoring association-related meetings or inviting association members to attend competitive intelligence-related meetings. By promoting its own services and products at meetings, it can also acquire a large number of hidden potential users, conduct direct and detailed investigations of users' industrial information needs on-site, and further contact and carry out in-depth services for users with relevant information and intelligence needs after the meeting. It can be said that under the guidance of this service model, more and more new users and new information needs in the pesticide industry continue to converge, urgently needing an open and comprehensive environment to meet demands and provide services. The Chemical Center has continuously accumulated many industry-related databases over the past decades of development, such as chemical product databases, product price databases, customs resource databases, manufacturer information databases, news databases, as well as purchased series of commercial resources and long-maintained chemical patent databases and industry professional journals, all of which have laid a good resource foundation for this environment. Against this background, the pesticide demonstration platform of the Chemical Center was born. The platform also provides online browsing and downloading of full-text journals, online viewing of relevant patents, and special services such as visual dynamic analysis of specific products for all network users.

2.2.3 Current Status of Library Industrial Information Services Libraries originated to meet society's need for large-scale literature collection, organization, preservation, transmission, and provision for use. Their self-worth exists in the degree to which we meet social needs [22]. Currently, whether strategic emerging industries or traditional important industries are facing the development needs of innovation and upgrading. As an important component of the national information assurance system, libraries need to utilize their accumulated advantages in information resources, information technology, information service capabilities, and talent teams to serve the further development of local industries. Through literature research, this study finds that overall, public libraries pay more attention to the public welfare nature of services and their role in regional industrial development when providing industrial informa-

tion services; university libraries rely on the university's research environment and external cooperative relationships to serve university projects and regional industry-university-research development; and specialized libraries, due to the specificity of their service scope, mainly serve specific institutions or industries.

Currently, library industrial information resource construction mainly concentrates on three forms: The first is based on self-built characteristic databases; the second is extracting collection resources and network resources; and the third is conducting industrial information tracking and building self-built industrial information resource databases. Among them, the second form is the most common and fundamental resource construction method. Libraries that have long built characteristic databases can leverage their advantages to find industries related to the resource database to carry out services. The third construction method is the most targeted and also the most difficult, requiring not only close relevance to the needs of the served industry but also continuous innovation in ways and approaches to obtain industrial information.

In terms of service content, in addition to the most basic literature services and information training services, many libraries have also carried out industrial information push, industrial exchange activities, and technical support services according to their own conditions. Some libraries have even provided high-precision special services and industrial intelligence services for industries and built professional platforms for industrial information services. In addition, there are many innovations in service methods and techniques. For example, the Ningbo Digital Library established a special fund to conduct large-scale visits and publicity to enterprises, institutions, and residential communities, and fully utilized the bridging role of industry unions and associations to enter thousands of institutions to carry out promotion and training work [23]; Huazhong Agricultural University Library used a series of push tools and social network platforms to respond to sudden diseases in the citrus production process at the first time and quickly provide solutions [24]; China University of Mining and Technology Library developed a coal industry technology information system composed of coal industry scientific and technological achievements, coal industry experts, coal industry units, and coal mining technology levels for industry associations, and based on its own association advantages, carried out resource co-construction and sharing work for the coal industry with the VIP database [25]; Wenzhou Clothing Library regularly invited enterprises and relevant departments to the library to participate in exchange activities to understand frontline industrial information needs in real-time [26].

2.3 Analysis of Exploration Practice

Compared with foreign practice status, China's industrial information services are still in the preliminary exploration stage. From the national level, a complete information assurance system and information infrastructure have not yet been established, and mature intermediary service systems have not been established for different industries. In addition, based on the lack of overall coordination

and systematic construction, China's current information service mechanism is relatively chaotic, mainly manifested as various types of service institutions not having clear service positioning and direction in the information service market, resulting in phenomena such as redundant information service construction, chaotic service objects, unsound service systems, and unspecific service content. At a time when the national industrial information service system is not yet sound, if libraries actively seize opportunities and continuously innovate and explore, they are expected to occupy an important position in the future information service market.

3. Practice of Biomass Industry Information Services at the National Science Library, Chinese Academy of Sciences

3.1 Background of Biomass Industry Information Services

Biomass energy is a green, low-carbon, and environmentally friendly renewable energy source. Its large-scale application can achieve the recycling of organic waste and reduce pollution emissions from fossil energy, attracting increasing attention worldwide. The State Council's "Twelfth Five-Year Plan for National Strategic Emerging Industries Development" released in July 2012 elevated biomanufacturing from a "key scientific and technological field" to a "strategic emerging industry" [27], and released the "Biomass Industry Development Plan" in December of the same year. Due to policies, large population, limited grain output, and low forest coverage, China's biomass resources currently mainly focus on the development and utilization of agricultural waste. China's three northeastern provinces, with their vast Greater and Lesser Khingan forest areas, large amounts of crop straw, and abundant biogas resources, have become key regions for national deployment of biomass resources and technology transformation and utilization.

In 2013, the National Development and Reform Commission, Ministry of Finance, Ministry of Industry and Information Technology, Ministry of Science and Technology, Chinese Academy of Sciences, and other departments jointly promoted the "Implementation Plan for Major Innovation Development Projects of Bio-based Materials." In 2014, the "State Council's Opinions on Several Major Policy Measures to Support Northeast Revitalization in the Near Future" indicated the need to "encourage Jilin to carry out high-end utilization of non-grain biomass resources" [28], and the Jilin Provincial Government also proposed the "Jilin Province Biomass Economy Development Implementation Plan" in January of the same year.

In this environment, the Changchun Branch of the Chinese Academy of Sciences (hereinafter referred to as "Changchun Branch") actively laid out biomass research projects, organized and coordinated research institutes from different regions of the Chinese Academy of Sciences to cooperate with the Jilin Provincial Government and key enterprises, and strived to innovate the transformation model of biomass technology to 打通 the industrial chain from technological in-

novation to end products. Based on this, Changchun Branch urgently needed to comprehensively grasp existing biomass technologies and their development status both domestically and internationally, and further gather more technology R&D institutions and technology application enterprises to build a complete industrial innovation chain. In response, the National Science Library and Changchun Branch carried out long-term and close cooperation, leveraging their respective advantages in the innovation and development of the biomass industry, forming a good mutually beneficial and win-win cooperation mechanism, and effectively assisting government and regional industrial policy planning and economic transformation development.

3.2 Current Status of Biomass Industry Information Services

To support the Chinese Academy of Sciences' Science and Technology Service Network STS (Science and Technology Service Network Initiative) energy structure optimization plan, embed intelligence services into the industrialization process of high-tech achievements, respond to the entrustment of Changchun Branch, promote local governments to achieve regional biomass industry innovation development and transformation upgrading, and also to enhance its own information and intelligence service capabilities for frontline industries, the National Science Library has been exploring a series of information service products to promote biomass technology transfer and utilization since 2015, mainly including the "Biomass Conversion and Utilization Industry Consulting Report" and the "Biomass Industry Technology Information and Intelligence Service Platform."

The "Biomass Conversion and Utilization Industry Consulting Report" was mainly developed to help government departments and Changchun Branch understand the development status, domestic layout, and market demand of key biomass-related technologies, and to build non-grain biomass industrial chains and business models. The report covers 20 sub-fields in four main directions of non-grain biomass conversion and utilization (pretreatment, biofuels, bio-based chemicals, and bio-based polymer materials), and conducts detailed analysis of each sub-field from four aspects: industrial environment, industrial technology chain, competitors, and industrial chain. The analysis content is not limited to key industrial technology analysis but also covers product information, market supply-demand relationships, technical economics, and policy orientation. The industrial information analysis methods mainly concentrate on expert consultation, bibliometric analysis, text mining, interviews with key laboratories, multi-dimensional patent analysis, and SCI paper analysis, among which expert consultation plays a crucial role in helping intelligence analysts quickly understand industrial layout and key technology development status. In addition, to obtain more market information, flexible methods such as web-based research, visits to key laboratories, and participation in industry development-related conferences were adopted during the report development process.

The construction of the "Biomass Industry Technology Information and Intel-

ligence Service Platform" was mainly to efficiently promote the building and development of high-quality biomass industrial chains, achieve sharing and interconnection of biomass industry information to form a vibrant industrial information service community, and meet the continuous industrial information needs of governments, research institutes, enterprises, etc. The platform is operated and maintained by the literature service team, monitoring service team, and professional achievement docking team composed of the National Science Library and various research institutes of the Chinese Academy of Sciences. It mainly includes four major modules: technology, demand, experts, and resources, providing literature services and in-depth intelligence consulting services including special topic retrieval, sci-tech novelty search, industrial technology analysis, product technology analysis, and industrial strategic analysis. It also sets up an achievement transfer and transformation column, providing not only relevant scientific and technological achievement information but also investment information, achievement docking, and sci-tech financing services, building an information sharing bridge for docking between achievement providers and investors. The platform also simultaneously developed a WeChat service account, allowing enterprise users to quickly log in to the platform by scanning QR codes and subscribe to keywords to obtain daily required push notifications within the WeChat service account. In addition, with further in-depth cooperation between the National Science Library, Changchun Branch, and the Jilin City Science and Technology Bureau (see [Figure 2: see original paper]), the platform has planned to carry out services for the national biomass industry alliance, which was initiated by the Jilin City Science and Technology Bureau and united numerous research institutes and technology enterprises related to the biomass industry. As the vice-chairman unit of the alliance, the National Science Library will also be committed to comprehensive services for China's biomass industry in the future.

3.3 Biomass Industry Information Service Model

Information users, information service providers, information service content, and information service strategies are the four elements of information services. Based on the different relationships and emphases among these four elements, the basic models of information services can be divided into three types: the "transmission model," the "use model," and the "problem-solving model." The generation models of information services can be divided into the "interaction-value-added" model, the "platform-self-service" model, the "user-attraction" model, and the "content-contracting" model [7]. The series of service explorations conducted by the National Science Library to serve the regional biomass industry development not only covers all these service models but also has breakthrough innovations in talent teams, cooperation mechanisms, and service methods. Its service model of embedding into industrial development alliances and serving as an important institution can also provide reference for the industry. Specifically:

3.3.1 Basic Model: Both the "transmission model" centered on information service products and the "use model" centered on user information use will have problems such as neglecting user needs and service benefits to varying degrees. The series of consulting reports and publications developed by the National Science Library to solve the problems of biomass industry decision-makers and industrial service providers adhere to the user-oriented, problem-centered "problem-solving model." In addition, the construction of the industry platform and the service content accommodated in the platform also incorporate the other two service models to varying degrees, forming an industrial information service model with multiple service models coexisting, on-demand services, and emphasis on benefits.

3.3.2 Generation Model: In the process of providing services for the development of the biomass industry in Northeast China, Changchun Branch and the National Science Library have always maintained close multi-channel and all-round communication and exchange. Whether it is the layout of the industrial report field in the early stage or the cooperation intention for platform construction reached later, all have fully benefited from the smooth communication between the two parties. The service products and visions achieved are derived from the generation of needs and the derivation of service satisfaction, which constitutes the "interaction-value-added" model with unobvious service strategies. In addition to releasing policy regulations, industrial dynamics, and market information on the platform, the National Science Library also attracts new potential users by sharing simplified versions of industrial reports and data products, and achieves the expansion of industrial chains and service communities by setting up technical demand forms and technical provision forms that can be filled out by enterprises and institutions, thus constituting the "platform-self-service" model and the "user-attraction" model. With the promotion and use of the platform, the National Science Library can further contact new platform users through active direct contact via telephone, WeChat, email, and other online and offline methods, and provide customized services and in-depth intelligence services beyond platform service content according to their individual needs, thus forming the "content-contracting" model.

3.3.3 Embedded Model: Embedding into local industrial development frontlines, reaching a united front with governments and industrial institutions, and providing intelligence support services based on frontline industrial development issues are the biggest characteristics of the National Science Library's industrial information services. To carry out services for the biomass industry frontline, the National Science Library established three teams for literature services, monitoring services, and achievement docking services in its exploration and practice, and invited the Chengdu Documentation and Information Center from other provinces to participate in the platform's special topic services. The research experience and service insights accumulated by the 16-person team involved in report development, as well as the close cooperative relationships established with field experts and industrial institutions, have all enabled the National Science Library to harvest a high-quality core industrial service team,

laying a talent foundation for future development. In addition, the cooperation mechanism established among the National Science Library, Changchun Branch, and the Jilin City Science and Technology Bureau (see [Figure 3: see original paper]) has also achieved mutual benefit, win-win, and mutual promotion among the three parties: focusing on the doubts and needs of the government's biomass industry layout, Changchun Branch not only provides government demand analysis but also helps the National Science Library establish a biomass expert resource database and provides channels and opportunities for the National Science Library to communicate and cooperate with key industrial institutions and users. In the process of serving Changchun Branch and the government, the National Science Library not only accumulated industrial service experience and constructed an industrial technology intelligence analysis framework and indicators but also helped Changchun Branch improve its scientific research service capabilities and industrial analysis capabilities. As the third-party beneficiary, the government also actively provided project funds and financial support based on satisfaction. Innovation in service methods is mainly reflected in the fact that information and intelligence collection is no longer limited to in-house databases and network resources but collects the most frontline and specific industrial technology dynamics through personal visits to national key laboratories, enterprises, and expert interviews, combined with intelligence analysis methods, ultimately achieving report development. By embedding into the Jilin City Straw Biomass Industry Alliance as the vice-chairman unit and quickly and accurately obtaining industrial needs from numerous research institutions, enterprises, and laboratories within the alliance on the frontline, the National Science Library plans to continue cooperating with alliance units to develop a biomass refining R&D sci-tech resource sharing platform and its talent introduction and training platform under the guidance and support of the Jilin City Science and Technology Bureau.

3.4 Status Analysis

The National Science Library's exploratory practice oriented toward the biomass industry frontline is another major breakthrough beyond long-term service to scientific research and sci-tech decision-making. Serving industrial development and innovation is another challenge to the center's overall mechanism and a good opportunity to integrate into the market environment, enhance its social visibility, win recognition from governments and enterprises, and integrate its own resource capabilities. From meeting the needs of Changchun Branch and the Jilin Municipal Government for decision-making, the center integrated its team to develop consulting reports that run through the entire biomass industrial chain, providing solid materials for governments, scientists, and enterprises in the industrial field to understand the overall picture of the biomass industry nationwide, with the potential to be published in the market to benefit more users in need. With a good cooperation mechanism and strong recognition from the government and industrial users, the relevant industrial information service platform has been successfully built and put into trial operation. The tripartite

cooperation and mutual benefit service model and the achievement of serving as an important council member in the industrial alliance are all references for information and intelligence institutions in industrial information services.

However, while achieving success, it is still necessary to be clear about many existing problems: lack of characteristic self-built resource databases related to the biomass industry, making it difficult to quickly respond to users' specific needs in subsequent services; lack of acquisition and understanding of industrial market information, product information, and business information; insufficiently close connections with relevant institutions in the industry, and no friendly cooperative relationships have been established; its own resources are not fully utilized, resulting in idleness and waste; limited human resources, and refined intelligence products and platform maintenance require deep manual extraction and processing; the management mechanism lacks vitality, not paying enough attention to benefits and efficiency; current service content is relatively limited.

4. Reflections and Recommendations

Based on the above theoretical and practical research status and the National Science Library's industrial service practical experience, combined with the unique characteristics of industrial information services, this study proposes the following reflections on how the library industry can develop industrial information services.

4.1 Making User-Specific Needs the Service Core

Making user needs the core has always been the purpose of the library industry in providing information and intelligence services, but this core is particularly important for serving industries. This is mainly determined by the characteristics of industrial information resources, which are highly professional, dispersed in existence, dispersed in management, and used interactively [19]. Moreover, from the perspective of achieving good benefits, it is unrealistic for a single institution to provide information services for the entire industrial chain. Therefore, adopting an industry-needs-oriented, problem-solving model to carry out industrial services is a strategy that can ensure service quality and achieve a win-win situation for both service supply and demand parties.

The National Science Library precisely launched a series of industrial report studies to solve users' problems of vacancy in industrial technology layout and development status. The good results directly promoted the construction of the industrial platform. During the platform construction process, multiple demand discussions were held with users. In response to the unique resource distribution characteristics of the biomass industry, the center breakthroughly integrated numerous resources and strived to generate a visual biomass resource distribution map on the platform. Similarly, the Chemical Center also provides classified statistics and special customized services for relevant patents on the platform according to pesticide users' sensitivity to patents, and conducts multi-angle

visual displays of patent distribution and expired patents. It can be said that whether industrial information services can achieve expected results entirely depends on the service provider's satisfaction of users' specific, particular, and personalized needs.

4.2 Employing Diversified Cooperation as the Service Strategy

Cooperation awareness has long been lacking in libraries' service models. When providing information services to industries, it is difficult to break through numerous difficulties and meet user needs without seeking diversified cooperation and only using one's own resources and technologies. With the country attaching importance to industrial development and industrial information service systems, libraries should actively utilize national policy advantages to cooperate extensively with different types of institutions or existing industrial service platforms to achieve mutual complementarity of advantages and disadvantages, making up for their own shortcomings in industrial information services such as limited coordination, small audience, lack of funds, and lack of understanding of industries. In addition, carrying out in-depth cooperation with intermediary institutions related to a certain industry is a good strategy for developing industrial information services. Through close cooperation with industry associations or some large and medium-sized institutions with many industrial user resources, not only can trivial work such as attracting users, promoting services, and collecting needs be saved, but if the cooperative relationship is solid enough, the cooperation partner can also help libraries jointly carry out industrial information services and achieve good interactive cooperation mechanisms on the basis of maximizing mutual benefits.

For example, the Library of China University of Mining and Technology, together with 38 enterprises and institutions in the coal industry, established the Science and Technology Literature and Information Consulting Professional Committee of the China Coal Industry Association, with the secretariat of the committee located in the library [25]. Another example is the cooperation between Wenzhou Clothing Library and Wenzhou Clothing Chamber of Commerce, where the library is mainly responsible for collecting and analyzing key information for Wenzhou's clothing industry and training professional talents for enterprise information construction, while the chamber of commerce is responsible for determining the information topics or special projects needed by the industry, assisting the library in collecting information worldwide, undertaking communication and exchange between enterprises and the library, and being responsible for information promotion [26]. Another example is the Chemical Center, which embedded the pesticide platform into a project of the Chinese Academy of Engineering (Chemical Professional Knowledge Service System), expanding the platform's audience from a few thousand people to the entire chemical industry, with many users related to the pesticide industry and even non-pesticide industry users benefiting from it, and when they have in-depth needs, they will actively consult the Intelligence and Information Department of

the Chemical Center. The successful case of the National Science Library serving the biomass industry is also inseparable from close cooperation with Changchun Branch. Through sharing industrial information and expert resources, the National Science Library was able to quickly and accurately enter an industry it had never contacted before. It can be said that extensive and open cooperation can add wings to libraries' industrial information services and provide them with strong impetus.

4.3 Using Management Model Innovation as the Service Guarantee

Overall, most libraries' management models are still traditional vertical management models or division-based management according to information processing processes, which can easily lead to problems such as departments operating independently, developing separately, rarely communicating, or even competing with each other. Providing frontline services to industries, due to their huge, complex, targeted, and emerging characteristics, requires libraries to cooperate fully, achieve mutual support and coordination among departments such as resources, technology, user services, and intelligence analysis, and jointly mobilize or re-optimize the allocation of required resources to possibly achieve a qualitative leap in industrial service efficiency from an overall perspective, effectively reduce or eliminate the waste of idle resources, and efficiently solve problems in industrial development. Only when the entire library works together as one can any department have sufficient confidence and foundation to respond to all difficult, specialized, and in-depth needs of industrial users when providing services to industries, thereby achieving its own sustainable development.

Taking the Chemical Center as an example, its service philosophy of "benefit prioritization, market-oriented operation, and user needs guiding our work" directly guides its on-demand service management model. Through large-scale demand surveys of users every year and information needs of undertaken projects, it achieves targeted allocation and selective purchase of required resources (including expensive commercial resources). In addition, columns such as industry consulting and technology transfer established on the pesticide platform are not all completed independently by the Intelligence and Information Department but are correspondingly connected to the Industry Consulting Department and Technology Transfer Department. The National Science Library's biomass industry platform is also like this. By handing over technology transfer to Changchun Branch, special topic services to Chengdu Branch, and connecting the lacking collection resources to the center's Resource Development Department, it can effectively avoid the problem of "having more willingness than ability" faced by a single department in industrial services. It can be said that only when the entire library works together as one can any department have sufficient confidence and foundation to respond to all difficult, specialized, and in-depth needs of industrial users, thereby achieving its own sustainable development.

4.4 Taking Service Method Innovation as the Service Driver

Robert Darnton, former librarian of Harvard University, pointed out in his article "Libraries in the New Age": "The information around us is growing dramatically, and the speed of information technology change is also dazzling. How to adjust ourselves in this new situation is an important problem we currently face" [18]. The transformation and development of libraries in the new era has always been a theme explored and researched by the industry, and libraries also need opportunities for transformation and development to regain their position in information and intelligence circulation. Providing services to specific industries not only introduces a new force to libraries but more importantly is reflected in its impact on traditional service methods. The timeliness, precision, and effectiveness of industrial services have all brought new requirements to libraries' promotion methods, demand collection methods, business intelligence acquisition methods, user contact and communication methods, and even service concepts and logic.

From the perspective of the Chemical Center's industry service experience, it attaches great importance to building its own reputation. It not only regularly conducts direct demand surveys for long-term cooperative users but also adopts an all-acceptance approach to all harsh needs raised by users. In its user information needs collection work, it mainly adopts methods such as cooperating with industry associations, sponsoring industry conferences, and participating in annual association meetings to directly contact user needs and promote its own services. In addition, through annual public welfare training classes, it elicits its users' potential information needs. For some particularly difficult services or services that do not belong to its business scope, it also solves problems through outsourcing or external cooperation. The humanized and flexible service model has won a good reputation for the Chemical Center and brought a continuous stream of new users. Changchun Branch's excavation of industrial information needs mainly adopts the method of establishing friendly cooperative relationships with large industrial enterprises, obtaining exclusive commercial confidential intelligence through long-term offline communication and trust mechanisms. These service methods that focus on business strategies can bring new inspiration and stimulation to libraries' current development of industrial intelligence services. Grasping the opportunities of the times and achieving their own transformation and development are the continuous directions for libraries to advance in the long river of history.

4.5 Building Industry Information Service Platforms as the Service Channel

Industrial information service platforms have become a common industrial service method. From the analysis of the current platform research status above, current platforms are generally one-stop comprehensive service platforms. If libraries want to make achievements in industrial platforms, they can adopt different service paths after analyzing their own advantages and disadvantages.

Specifically, for large comprehensive platforms, libraries can cooperate with them to provide intelligence support and information analysis services, which can not only enrich platform service content and deepen platform service levels but also expand their own influence and contact a wide range of user groups. For some existing professional service platforms oriented toward specific industries, libraries can learn from their construction experience and customize their own industrial platform's specialized design according to the specific characteristics of the served industry, fully demonstrating the library's advantages in information resources and intelligence service capabilities in the platform.

By building platforms, not only can all users in the industrial chain be gathered, services can be promoted to the outside world, and industrial information service communities can be formed, but also diversified service content can be added to meet industrial users' information and intelligence needs. Platform construction can not only benefit the development of many small and medium-sized enterprises but also save libraries a lot of unnecessary time and energy, because most information needs can be obtained through self-service queries by users. It can be said that industrial information service platform construction is an effective service method that integrates advantages such as improving service efficiency, saving service costs, and expanding service groups.

However, platform construction also requires attention to some details. First is the screening of information sources; libraries should control the source and strictly control information quality to provide high-quality and streamlined industrial information. For industrial resource construction, they should achieve "what others don't have, I have," striving to form characteristic industrial databases from information collection and construction. For operation strategies, they should not only ensure the attractiveness of public welfare information but also pay attention to intellectual property and copyright issues, ensure platform interface friendliness, and attach importance to online and offline user contact and communication methods. For the joining of other institutions, they should ensure the perfection and controllability of the joining mechanism. For the differences and diversification of information needs between large enterprises and small and medium-sized enterprises, different sections and services should also be designed in the platform. Overall, the construction and operation effects of industrial information service platforms can directly become a calling card for libraries' industrial services and have high plasticity.

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Author Contributions

Xia Haoling: Responsible for paper framework, content design, service investigation, and paper writing.
Jia Ping: Provided paper direction and topic guidance, put forward constructive opinions and suggestions on paper framework, investigation objects, and research content, and proposed paper revision suggestions.

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