Special library services for regional economic development (SRED) —Practice of the NSLC*

Xiwen LIU1,2†, Yuling SUN1, Ping JIA1, Fang CHEN1, Hao PENG1, Yafei YAN1, Lu DONG1, Xiaoli CHEN1, Shushu CHEN1, Wenjiao GUO1 & Zhuang LI1

1National Science Library, Chinese Academy of Sciences, Beijing 100190, China
2Center for Studies of Information Resources, Wuhan University, Wuhan 430072, China

Abstract

Purpose: By case studies of the service for regional economic development (SRED) carried out by the National Science Library of the Chinese Academy of Sciences (NSLC), this article tries to describe basic directions of special libraries in the SRED.

Design/methodology/approach: By comparing the aims and service forms of the SRED provided by domestic and foreign libraries and information service institutions, the authors examined the basic services provided by special libraries. Through a summary of the SRED exploration carried out by the NSLC, the authors introduce its main content, service methods, products, and service mechanisms. By analyzing the information needs of SRED users and summarizing users’ practical experiences of services, the authors propose a design for the SRED framework of the NSLC. In addition, the authors mention key points to be noticed during the process of service implementation, illustrating them with a number of selected SRED cases. The authors suggest that the SRED network and joint service mechanism are effective ways to implement SRED services.

Findings: Based on information resource and expert networks, special libraries like the NSLC can carry out SRED to meet user requirements. The NSLC has not only constructed its own SRED framework, but has also expanded the patron service to the industrial intelligence service area. By setting up a nationwide S&T (science and technology) novelty search network and a literature and information service alliance, the NSLC provides a variety of information training services. This enriches the content of the knowledge service of special libraries and enlarges the library service of the NSLC.

Research limitations: The SRED of Chinese libraries is still in the exploratory stage. Questions as how to scientifically design service content and service modes, and how to establish a sustainable regional service system based on user needs are still being researched.

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† Corresponding author: Xiwen Liu (E-mail: Liuxw@mail.las.ac.cn).
and discussed. Furthermore, we need to pay more attention to the construction of the service network and respond more quickly to feedback while creating the SRED.

**Practical implications**: The SRED experience of the NSLC has shown that special libraries can implement a knowledge service for economic development, and the SRED is an important direction of knowledge services for special libraries.

**Originality/value**: Through describing a practical SRED, this paper provides a valuable reference for libraries in the transformation process from library service to knowledge service. The experimental SRED of the NSLC has verified the rationality of our service framework in support of regional economic development.

**Keywords** Service for regional economic development (SRED); Service model of regional economic development; Library knowledge service; National Science Library of the Chinese Academy of Sciences (NSLC); Industrial intelligence service; Technology intelligence analysis; Business intelligence demand; Service Alliance of Document and Information; Joint information service mechanism

1 Introduction

As a national professional information service institution, the NSLC has the following functions. It not only provides document and information services for scientific research institutions and research groups, and S&T information literacy training for researchers and graduate students of the CAS itself, but also carries out literature information services for scientific research strategy and planning, research policies, and scientific management.

On the premise of ensuring literature and information needs of the research institutions of the CAS, the NSLC has carried out literature and information services in recent years according to the strategic intelligence needs for industries and regional development. These activities have not only supported research and regional development decision-making, but have also enhanced research and development of industrial technology, technology selection, and project applications of enterprises and research institutions. The term “services for regional economic development (SRED)” in this article refers only to strategic and tactical intelligence services and other information services for supplying the literature needs of research activities provided by special libraries for local governments, enterprises, technological research and development institutions, and social organizations.

2 SRED of public and special libraries

Literature and information service in the SRED can be traced back to the 19th century in the USA. The significant characteristics are the evolution of special
libraries and their services in USA. According to Christianson\cite{1}, after 1876, three factors contributed the most to the library service for regional economic development and enterprise services, including the development of American special librarianship, rapid expansion of business and industry, and the rapid development of libraries themselves. In 1904, Newark, New Jersey, Public Library curator John Cotton Dana introduced a business information service into the public library, and set up the first library branch of Newark, which later became the Business Branch of the Newark Public Library.

At the end of World War II, special libraries of the United States had entered a boom period\cite{1}, and a large number of scientific and technological libraries were established for research institutions, as scientific activities increased\cite{2}. It became popular to establish “information centers” in libraries in the 1960s, and libraries tried to charge fees for their services due to the growth of information service needs from American businesses, which consumed roughly three-quarters of the services of special libraries at that time\cite{1}.

As the SRED organized by special libraries linked research information to business information, and promoted the interaction of scientific research activities and commercial activities, libraries in England, Canada, Denmark, Australia, and other countries also began to establish information services for enterprises\cite{2}. Public libraries set up business branch libraries or business information service centers to serve enterprises, especially small and medium-sized enterprises (SMEs). The services were promoted based on selective dissemination of information (SDI) during this period\cite{3}.

According to the Urban Libraries Council of America\cite{4}, the services provided by public libraries for regional economic and social development concentrated on three areas: 1) offering information literacy education and training for the public, and job training; 2) supporting development of small business enterprises; and 3) setting up an embedded service network.

In order to support the development of the local economy, libraries expanded their space for business information resources, established convenient ways for small businesses to access databases, and added small-business information consultancy services.

With the development of economic globalization and information technology (IT), demand for information services and intelligence studies have increased. Libraries need to constantly adjust the types of services offered locally.

In addition to literature access services, high-level services, such as enterprise decision-making and government policy-making support, have become increasingly important. For example, the demand for custom consulting reports has required libraries to go far beyond their original lending and browsing services.
Business and industry have welcomed the ability to access a wide variety of data sources, in integrated form, through the library. Table 1 shows a comparison of SRED services offered by domestic and overseas libraries and information services.

Although domestic and overseas libraries and information institutions have different targets for enterprise services, they all focus on marketing their services and establishing cooperative relationships with enterprises and business intermediaries. For example, the British Library\(^5\) has embedded its services in the regional enterprise infrastructure support system, and the Canada Institute for Scientific and Technical Information (CISTI)\(^6\) provides an effective scientific communication environment for Canadian scientists and entrepreneurs, to promote innovation and industrialization.

As serving the regional economy and social development is an important mission of big domestic libraries and information institutions like the Institute of Scientific and Technical Information of China (ISTIC)\(^10\), National Library of China (NLC)\(^11\), and China National Chemical Information Center (CNCIC)\(^13\), they also carry out literature deliveries, science and technology novelty searching, strategic consulting for enterprise development, and trend analyses of industry and trade.

3 SRED practice of NSLC

3.1 Information demands of SRED users

High-tech enterprises are important users of the SRED in libraries. In the process of economic globalization, technology-based enterprises have become central in implementing the national strategy of building an innovation-oriented country, and upgrading the industrial structure for economic improvement.

More and more enterprise managers have realized the value of market and R&D information resources. To better serve regional economic development, the NSLC investigated the information needs of high-tech enterprises in Beijing and Tangshan City (an important industrial city in northern China). 100 questionnaires were distributed among users in 10 high-tech enterprises in Beijing. The survey investigated information needs, literature acquisition channels, models of literature information services, sci-tech novelty search demands, and intelligence and consulting services. In Tangshan, we held users forums and seminars to understand the demands of science and technology users (including R&D researchers, local administration of science and technology, and investors).

3.1.1 Characteristics of high-tech enterprises in Beijing

As Fig. 1 shows, the users’ demands of the SRED were quite different from those of the CAS. As to acquisition channels, roughly 89% of business users have access
<table>
<thead>
<tr>
<th>Name of institutions</th>
<th>Tasks and missions</th>
<th>Goals of SRED</th>
<th>Content and form</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>British Library</strong>&lt;sup&gt;(5)&lt;/sup&gt;</td>
<td>• To stand out the role of libraries as community center and enterprise incubation center; • To stimulate regional economic development; and • To enhance social mobility.</td>
<td>1) Sharing and spreading service resources and professional knowledge in the library and community through the construction of specialized service network; 2) Making libraries become professional enterprise information service center with users’ trust; 3) Embedding library services in regional enterprise infrastructure supporting system; 4) Creating opportunities and resources to support regional economic development and corporate activities, promote the development of creative industry, and realize employment fairness.</td>
<td>• Business network services; • Business planning services; • Intellectual property protection services; • Market research services.</td>
</tr>
<tr>
<td><strong>CISTI</strong>&lt;sup&gt;(6)&lt;/sup&gt;</td>
<td>• To improve scientific research and innovation through scientific, technical and medical information and publication services with high values.</td>
<td>1) Providing equal, seamless and permanent services of access to information for Canadian research and innovation; 2) Providing quick and innovative scientific communication environment for Canadian scientists and entrepreneurs, and promoting knowledge innovation of Canadian scientists and entrepreneurs and industrialization; 3) Leading CISTI to promote the service innovation.</td>
<td>• To provide all kinds of patent information, trademark information, standards information, and information related to market and companies; and • To take on technology strategy information analysis, patent information analysis and standard competitive intelligence services.</td>
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<td><strong>SIBL</strong>&lt;sup&gt;(7)&lt;/sup&gt;</td>
<td>• To encourage lifelong learning; • To promote knowledge learning; and • To enhance team spirits.</td>
<td>1) Providing innovative information and education services; 2) Accelerating to raise the level of science and business information network, and providing training and encouraging the public to use digital technology; 3) Enhancing and expanding global science and business information collection.</td>
<td>• To establish information resource center of small businesses; • To offer business/enterprise guidance services; and • To provide Internet information resources and library digital resource database.</td>
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<td>Name of institutions</td>
<td>Tasks and missions</td>
<td>Goals of SRED</td>
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<tr>
<td>TEDA Library[8]</td>
<td>• To provide cultural security and intellectual support for regional economic construction and social development.</td>
<td>Establishing information center, knowledge center and cultural center adapting to regional economic and social development.</td>
<td>• To establish the science and technology information service platform;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• To take on sci-tech novelty retrieval, document delivery, decision-making reference and industry consulting.</td>
</tr>
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<td>Suzhou Dushu Lake Library[9]</td>
<td>• To serve regional economic and social development; and</td>
<td>Becoming important service base of literature information resources, education base of scientific communicating platform, academic culture, and industrial park of Suzhou.</td>
<td>• Book lending;</td>
</tr>
<tr>
<td></td>
<td>• To improve the capacity for independent innovation of science and technology.</td>
<td></td>
<td>• Information consulting;</td>
</tr>
<tr>
<td>ISTIC[10]</td>
<td>• To provide decision support for government departments, including MOST;</td>
<td>Offering information analysis for 1) Decision support and information service of science and technology;</td>
<td>• Training exhibition; and</td>
</tr>
<tr>
<td></td>
<td>• To provide comprehensive information services for science and technology innovation subjects; and</td>
<td>2) New technology research and promotion;</td>
<td>• Digital library and other kinds of services.</td>
</tr>
<tr>
<td></td>
<td>• To become the sharing management center and service center of national science and technology areas.</td>
<td>3) Advanced service platform management;</td>
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<tr>
<td>National Library of China[11]</td>
<td>• To provide literature information and reference services for the Central Committee of the Party, the Nation’s leading organizations, the communities and the public.</td>
<td>1) Carrying out all kinds of information consulting services for enterprises and national education, research, production units and for the public;</td>
<td>• Industry fields research;</td>
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<tr>
<td></td>
<td></td>
<td>2) Providing comprehensive information services for users of various industries and fields, including information monitoring, sorting, analysis, evaluation, professional consulting, decision-making reference, etc.</td>
<td>• Dynamic monitoring of science and technology;</td>
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<td></td>
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<td>• Regional innovation research;</td>
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<td></td>
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<td>• International science and technology strategy and policy.</td>
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</table>

*to be Continued*
### Name of institutions | Tasks and missions | Goals of SRED | Content and form
--- | --- | --- | ---
**Shanghai Library and S&T Information Institute**\(^{[12]}\) | - To provide decision support for government department, and comprehensive information services for science and technology innovation subjects. | 1) Providing literature information for SMEs, including policy, industry, market, technology, patent, standard, enterprise culture and so on; 2) Creating information service platform of industrial innovation; and 3) Undertaking partial functions of extension service of innovation information in the key industries of Shanghai. | - Sci-tech novelty retrieval; - Patent services; - Competitive intelligence services; - Strategy research and decision-making consulting services; - Internal reference services; and - Translation of science and technology literature. |
**CNCIC**\(^{[13]}\) | - To provide decision support and public services for government and society; and - To provide value-added services of professional information for industries and enterprises. | 1) Providing information and technical support for decision-making of the government; 2) Providing IT services for Chinese chemical corporations; and 3) Providing system integration, construction of information system and other information technology services for external corporations. | - To provide consulting services including industrial planning, professional park planning, analysis of investment opportunity, market research and patent novelty searching; - To provide industry information, media publicity, brand promotion platform; - To organize international professional conferences, exhibit; and - To participate in exhibitions. |

*(to be Continued)*
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The document and information needs of enterprise users were not only unique and customized, but also innovative and forward-looking. Only one-third of the investigated users reported that their organization had ordered document resources. The document and information needs of enterprise users were not only unique and customized, but also innovative and forward-looking.

![Graph showing different document access channels of enterprise users](image)

Fig. 1 Different document access channels of enterprise users

As for enterprise literature requests, Fig. 2 shows that standard documents (81.4%) are more frequently requested than scientific research literature (73.3%) or patents (68.6%), probably due to the difficulty of obtaining the full text of standard documents. Fig. 1 and Fig. 2 show that enterprises do not have a reliable channel for scientific literature and information.

With regard to types of services (Fig. 3), the demands are more diverse in project applications, mentoring, and technical consulting services. Business users need individualized services, as their information requirements are all different.

From the investigation of high-tech users in Beijing, we found that they need to have authoritative, reliable, and timely channels for information. Enterprise staff and developers seek the latest S&T information in the processes of scientific research, project applications, and technology development. Their R&D activities depend on timely and accurate information to enable them to prepare patent applications.

Regional high-value industries and consulting services were found to be short of authoritative information sources, and the service quality was spotty. It was
**Fig. 2** Enterprise user demand for different document types

<table>
<thead>
<tr>
<th>Document types</th>
<th>Proportion (%)</th>
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<tbody>
<tr>
<td>a: Standard document</td>
<td>81.4</td>
</tr>
<tr>
<td>b: Research papers</td>
<td>73.3</td>
</tr>
<tr>
<td>c: Patents</td>
<td>68.6</td>
</tr>
<tr>
<td>d: Statistic data</td>
<td>55.8</td>
</tr>
<tr>
<td>e: Industry research report</td>
<td>53.5</td>
</tr>
</tbody>
</table>

**Fig. 3** Enterprise user demand for different services

<table>
<thead>
<tr>
<th>Service demand</th>
<th>Proportion (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a: Project application and mentoring</td>
<td>62.5</td>
</tr>
<tr>
<td>b: Technical consulting and assessment services</td>
<td>42.5</td>
</tr>
<tr>
<td>c: Offering and analysis of market information</td>
<td>37.5</td>
</tr>
<tr>
<td>d: Policy and legal consulting and other services</td>
<td>37.5</td>
</tr>
<tr>
<td>e: Patent strategies and analysis on competitors</td>
<td>36.3</td>
</tr>
<tr>
<td>f: Sci-tech novelty search service</td>
<td>36.3</td>
</tr>
<tr>
<td>g: Technical analysis</td>
<td>32.5</td>
</tr>
<tr>
<td>h: Training services</td>
<td>30.0</td>
</tr>
<tr>
<td>i: Compiling and sorting of industrial policies</td>
<td>26.3</td>
</tr>
<tr>
<td>j: Investing and financing information services</td>
<td>25.0</td>
</tr>
<tr>
<td>k: Others</td>
<td>3.8</td>
</tr>
</tbody>
</table>
difficult to meet business users needs, especially for small and medium-sized enterprises (SMEs).

3.1.2 Characteristics of S&T users in Tangshan City

Tangshan City is included in the Beijing-Tianjin-Tangshan Metropolitan Region, located in the heart of the Bohai Economic Development Zone. Tangshan is a heavy chemical industry city with a hundred-year history, and it has developed such pillar industries as steel, energy, construction materials, chemicals, machinery, and ceramics.

Many traditional industry users in Tangshan are faced with re-structuring, while bio-medicine, intelligent equipment and manufacturing, energy conservation and environment protection, and other strategic industries are booming. Enterprise R&D researchers and management need document, sci-tech novelty search, and other services, to which considerable attention has been paid by the government and investors. Enterprise users need to be well-informed, and are in need of up-to-date literature and information.

With a sound environment for investment and transfer of science and technology achievements, Tangshan’s enterprises have relentless information demands. Government at all levels and industrial decision-making departments have strong demands of decision-support information, such as technology and industry trends.

Through the investigation and survey, we found that there is only one university (North China University of Science and Technology) in Tangshan City. The information demands we found are not being met, due to the lack of professional and large-scale document and information service centers. To meet the urgent demand for high-quality scientific information services, it seems to be time for them to develop cooperation with authoritative information service institutions to support regional economic and social development.

3.2 SRED framework of the NSLC

As a national document and information service agency, the NSLC not only provides subject-based information services embedded in the research process for researchers of the CAS, and discipline research information for the decision makers of the CAS, but also shoulders the responsibility to provide document and information services for regional and local economic entities.

NSLC has great assets of information resources and expertise networks to provide the SRDE. It also has strong expert teams from every institute of the CAS. In addition, it has huge information resources in the fields of natural and physical sciences. An outstanding vision of the NSLC has been set up in the industries for decades, owing to its service foundation of sci-tech novelty search.
Nevertheless, the SRED of the NSLC cannot fully cover all document and information demands for all users. We should select the service areas in which we have obvious advantages and strong user demand, and build an SRED model with the capacity of sustainable development, according to characteristics of the resources, institutional missions and visions, personnel teams, and technology infrastructures of information services of the NSLC. The design of the SRED should take full account of users’ needs and characteristics.

In addition, we need to carefully select the proper partners to cooperate with, and distribute service content and service teams in accordance with regional industrial advantages, resource advantages, and personnel advantages. On the basis of fully understanding the characteristics and advantages of regional development, we should develop service goals and strategies and identify the key points we want for the SRED to decide which things to do first.

Based on a wide range of information demands of the SRED and demands of industrial development, NSLC should further deepen the sci-tech novelty search and expand the influence of the service; in the meantime, it should focus on the topics of industrial monitoring and industrial technology to directly meet the demands of decision-making subjects, such as enterprises and local governments.

Furthermore, NSLC should establish different forms of intelligence service network according to the intelligence demands of regional economic development, and directly dock services of document and information and demands of business
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intelligence. Eventually, NSLC should establish the SRED system of document and information, including document supporting services, information literacy training, S&T monitoring services, technology intelligence analysis, industrial technology intelligence study, industrial competitive intelligence study, and regional strategic intelligence research and consulting.

The basic structure of the SRED of the NSLC consists of the following five parts: 1) innovation and activation of patron services, 2) industry intelligence research and service network, 3) sci-tech novelty search service network, 4) document and information service alliance, and 5) document delivery service network.

Through close cooperation with regional scientific research and development institutions, technological service institutions (such as the Tangshan Technology Transfer Center of the CAS), and library and information service institutions, it is necessary for the NSLC to establish an SRED network that can be integrated into the environment of technological development teams or in the process of S&T decision-making.

NSLC has provided document and information services focusing on innovation and entrepreneurship by transforming service models of the Library, such as releasing industrial technology intelligence and analysis reports, offering entrepreneurship training services, technology and finance partnerships, and advisory services for industry competition mapping.

As for the content of the SRED, NSLC has focused on the demand for regional strategic intelligence, and other intelligence demands of enterprise technology R&D. This has not only organized research and advisory services of industrial technology intelligence, but also expanded industrial intelligence studies, including market intelligence, technical intelligence, and business intelligence.

The NSLC has also focused on profiling the evolution pathways of industrial technology, integrated technology assessment, technology and process innovation, technological value analysis, technical maturity analysis, technology industrial analysis and other industrial technology intelligence services, and organized consulting services for the whole industrial technologies delivery chain. The technical intelligence analysis and trend monitoring, on one hand, provide intelligence services for end-users through various forms of joint service networks; on the other hand, they build trust with end-users through good intelligence products, which further stimulate the users’ need of intelligence services.

After nearly three years’ efforts, the NSLC has established two successful service methods. First, it has developed a close cooperation relationship with users, by making active use of a variety of channels. For instance, taking sci-tech novelty retrieval as a starting point, NSLC has developed mutual trust with enterprises, governments at different levels, and other customers, based on our document and
information services. Second, together with local information service institutions, the NSLC has gradually expanded its services, and has improved the Library’s connections with its end-users.

4 Typical cases of SRED in NSLC

4.1 Establishment of Tangshan Industrial Intelligence Center

One of the most important ways for the NSLC to provide SRED is to co-construct industrial competitive intelligence centers with local S&T organizations or information service institutions. In 2014, NSLC and Tangshan Research and the Commercialization Center for High-Tech (TRCCHT) of the Chinese Academy of Sciences constructed an “Industrial Intelligence Research Center”, which also operates an information commons (IC) for scientific researchers. In addition, a joint team has been set up to provide document retrieval services, sci-tech novelty retrievals, and industrial technology consulting services, making full use of the NSLC’s strength in satisfying the document and information needs of local S&T users.

As collaboration achievements of 2014, NSLC and TRCCHT have jointly conducted more than 30 sci-tech novelty retrieval topics for large enterprises (such as Kailuan Coal Group and Baichuan Group) in Tangshan City. The cooperation services not only have met the enterprises’ needs, but also have offered important intelligence support in applying for projects or producing technological achievement assessments for these enterprises.

To deal with the lack of literature and intelligent services in Tangshan, the NSLC and TRCCHT have jointly launched training on literature retrieval and access and intelligence analysis for local technological developers. In 2014, almost 200 people from enterprises, university libraries, and science and technology management institutions in Tangshan participated in these events.

What’s more, NSLC and TRCCHT have regularly published reports of Tangshan Industrial Technology Intelligence to meet current industrial and technological demands in Tangshan. These reports have not only provided analyses of the current situation of technology development in “hot” industries, but also introduced mature technologies that could be transformed into products. To date, the NSLC has published four issues of such reports, with topics as steel (weathering steel), coal chemical industry (coal-ethylene glycol), high-end manufacturing equipment, and environmental protection industries, which have been well-received in Tangshan by business customers and leaders of the Tangshan Science and Technology Bureau.

The joint service mechanism has shortened the distance between the NSLC and end-users. In this mechanism, local information service institutions act as a bridge
Special Feature

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Connecting NSLC and end users, so it is not necessary for them to go to Beijing to access the NSLC services. Furthermore, local technical service institutions have benefited by improving the information literacy of their staff in regional technical development. The joint service mechanism is a win-win cooperation pattern.

After constructing the “Tangshan Industrial Intelligence Research Center”, the NSLC constructed “Industry Intelligence Research Centers” with the Yinchuan Science and Technology Innovation & Industry Incubation Center, CAS; the Guizhou National Key Laboratory of Natural Chemicals, CAS; and the Baotou Rare Earth Research and Development Center of the CAS. Through joint construction, the NSLC has developed an SRED network, an intelligence service network that is based in Beijing and extends its services to Tianjin, Hebei Province, and to the entire country.

4.2 Consulting services for governmental decision-making

Jilin Province is a leader in agriculture, animal husbandry and forestry. It is rich in straw, manure, and forestry waste resources. Every year, there are more than 94 million tons of straw, rice husks, forestry residue, and manure to be gathered in the Province. Since biomass represents an important renewable energy source, the Provincial government has studied approaches to its utilization, determining which transformation technology is mature enough to be industrialized when making investment decisions. Responding to such consulting needs, the NSLC initiated a cooperative project with the Changchun Branch of the Chinese Academy of Sciences (CB-CAS). The project engaged in systematic intelligence studies of major science and technology issues for scientific decision-making, and was conducted jointly by the NSLC and CB-CAS to compile a strategic consulting report. After communicating with experts in biology, the NSLC developed an intelligence study program, and selected 16 sub-realms of non-grain biomass transformation and utilization in writing the report (Table 2).

This is a typical case of an intelligence study service that supports regional economic development. In this case, there are two key points, and also two main difficulties. First, the needs of the customers are wide-ranging. We have to understand the current situation of the non-grain biomass industry and the industrialization of each sub-field, and identify key technologies, leading institutions, and key persons in its industrialization.

The content of the report includes holistic analysis of technologies involved in the non-grain biomass field, and the key technologies that will be needed in the industrialization of different sub-realms. In the process of writing the report, we interviewed experts in biomass in the early stages, and held meetings with intelligence analysts, customers, and scientific experts. The report analyzed the
industrial environment of each field and described the technologies used in up-, mid- and downstream industry chains. Our report focused on key technologies that support decision-makers in understanding the owners, the potential, and the shortcomings of the technologies.

In the report, we analyzed the leading institutions and experts and summarized related industries by using patent mapping and bibliometrics to predict the technological and economic development trends of the industry. The report exemplifies NSLC capabilities in supporting industrial decision-making.

4.3 Service practice for high-tech enterprises

4.3.1 Intelligence services for enterprise R&D decision-making

To meet the high-level intelligence demands of enterprises, the NSLC has developed an SRED model, which begins with providing sci-tech novelty retrieval services and ends with offering intelligence services for R&D decision-making. Of course, establishing mutual trust with these enterprises is essential.

For example, two companies (a tobacco company and an agricultural company) asked the NSLC to provide sci-tech novelty retrieval services and document retrieval services. After in-depth discussions, we realized that what they actually needed was a technical competitive analysis. Based on a comprehensive analysis of a large number of documents, our consulting reports pointed out the technological breakthroughs and possible cooperation partners for research and development.

<table>
<thead>
<tr>
<th>Non-grain biomass transformation subjects</th>
<th>16 sub-fields</th>
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<tbody>
<tr>
<td>Bio-based polymer materials</td>
<td>Polylsine</td>
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<tr>
<td></td>
<td>Polymalic acid</td>
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<tr>
<td></td>
<td>Polylactic acid (PLA)</td>
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<td></td>
<td>Polypropylene carbonate (PPC)</td>
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<tr>
<td></td>
<td>Poly 1,3-trimethylene terephthalate (PTT)</td>
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<tr>
<td></td>
<td>Polybutylene succinate (PBS)</td>
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<td></td>
<td>Polyhydroxyalkanoates (PHA)</td>
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<tr>
<td>Bio-based chemicals</td>
<td>Bio-succinic acid</td>
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<td></td>
<td>1,3-propanediol</td>
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<td></td>
<td>Pyruvic acid</td>
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<td>Isosorbide</td>
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<td>Bio-acrylic acid</td>
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<td>Biomass fuel</td>
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<td></td>
<td>Biomass briquette</td>
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<td></td>
<td>Biogas produced from anaerobic methane fermentation, and natural gas produced from biogas</td>
</tr>
</tbody>
</table>
Both reports were finished by their deadlines, and provided more than simple document retrieval services (Table 3).

### Table 3 Intelligent consulting reports for two company customers

<table>
<thead>
<tr>
<th>No.</th>
<th>Customer</th>
<th>Project title</th>
<th>Content and methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tobacco company</td>
<td>Analysis of Cigarette Tobacco Additives</td>
<td>• Industry analysis&lt;br&gt;• State-and-trend analysis of specific field&lt;br&gt;• Key technology screening</td>
</tr>
<tr>
<td>2</td>
<td>Tobacco company</td>
<td>Analysis of Cigarette Filter Tip</td>
<td>As above</td>
</tr>
<tr>
<td>3</td>
<td>Agricultural company</td>
<td>Transmissible Gastroenteritis Detection and Vaccination of Pigs</td>
<td>• State-and-trend analysis of specific field&lt;br&gt;• Key technology screening&lt;br&gt;• Setting up a micro thematic literature database</td>
</tr>
<tr>
<td>4</td>
<td>Agricultural company</td>
<td>Pseudorabies Detection and Vaccination of Pigs</td>
<td>As above</td>
</tr>
<tr>
<td>5</td>
<td>Agricultural company</td>
<td>Hog Cholera Virus Detection and Vaccination</td>
<td>As above</td>
</tr>
<tr>
<td>6</td>
<td>Agricultural company</td>
<td>Japanese Encephalitis Virus Detection and Vaccination of Pigs</td>
<td>As above</td>
</tr>
</tbody>
</table>

We have found that the need for SRED is poorly understood. Enterprise decision-makers do not fully grasp the benefits of intelligence reports. Library staff and service teams should therefore go beyond actual customer information demands, and seek out latent but unexpressed needs while providing intelligence services.

Furthermore, we need to allocate our service staff in a more efficient way. Those who are skilled in communication and have practical experience should contact customers. The key to motivating customers to use our services lies in having a staff that understands and keeps pace with customer requirements. Quick and thorough customer service is essential.

### 4.3.2 Proposal proofing and novelty retrieval services for enterprises

NSLC offers sci-tech novelty retrieval services for projects. This service addresses customer demands for analysis of technological advancements, trends, and competitors for specific development projects. During novelty retrieval projects, we use intelligence analysis methods to provide researchers evidence for technological issues and competitors in R&D project applications, which improves upon traditional forms of sci-tech novelty retrieval and broadens its meaning.

For instance, a large-scale company of professional environmental protection and new energy recently undertook a special National Key Science & Technology project. This project involves water supply, solid waste treatment, sanitation, renewable resources, new energy, and eco-agriculture, and thus requires various
kinds of document and information services. They asked the NSLC for paper citation retrieval, sci-tech novelty retrieval and thematic information retrieval services. As this is an important company and a key customer of the SRED, the NSLC visited the companies for on-site investigation, which helped us understand the actual needs of the researchers. In addition, we provided literature retrieval training to strengthen cooperation with the company.

Sci-tech novelty retrieval information requests for technology-based enterprise projects are normally concrete and detailed, for companies are usually interested in technology implementation conditions, equipment parameters, production processes, and competitors. In the process of providing services, the NSLC established a service team for each individual project, and completed several consulting reports according to the project needs (Table 4).

For example, the report *Research on MBBR technology equipment of sewage treatment in towns and villages*, based on scientific papers and patent literature, gives an analysis of the development progress of MBBR technology from the perspective of both basic research and technology research and development. The *Market survey of water supply equipment in towns and villages* report details the market for domestic integrated water supply equipment. This report is a survey of product information. Furthermore, the content of our report also combines macro industry technology analysis with case studies. For instance, a report entitled *The use of mobile internet in the water sector* provides information support for the company through analyzing domestic mobile device patent applications in the water sector. In this report, we list the main Chinese companies engaged in the mobile water sector.

### Table 4 Five sci-tech novelty retrieval projects for the enterprise

<table>
<thead>
<tr>
<th>No.</th>
<th>Customer</th>
<th>Project title</th>
<th>Content and methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental protection enterprise</td>
<td>Research on MBBR technology equipment of sewage treatment in towns and villages</td>
<td>Literature analysis, Patent analysis</td>
</tr>
<tr>
<td>2</td>
<td>Environmental protection enterprise</td>
<td>Research on energy-efficient MBR technology and equipment of sewage treatment in towns and villages</td>
<td>Literature analysis, Patent analysis</td>
</tr>
<tr>
<td>3</td>
<td>Environmental protection enterprise</td>
<td>International competitors of integrated biological turntable</td>
<td>Patent analysis, Market survey</td>
</tr>
<tr>
<td>4</td>
<td>Environmental protection enterprise</td>
<td>Market survey of water supply equipment in towns and villages</td>
<td>Market survey</td>
</tr>
<tr>
<td>5</td>
<td>Environmental protection enterprise</td>
<td>The use of mobile internet in the water sector</td>
<td>Patent analysis, Market survey</td>
</tr>
</tbody>
</table>

5 Conclusions and future work

It is not new that special libraries provide document and information services for regional economic development (SRED). The prosperity of professional sci-tech
Strategic Transformation of Special Libraries

libraries resulted from the rapid development of science and technology, the refinement of the specialization of labor, and the diversity of research activities. These have yielded various kinds of information sources, allowing special libraries to provide reference and consultancy services. Modern digital technologies, including the Internet and informatics, have become the basic tools for special libraries to produce intelligence studies.

The target of the NSLC’s SRED is to establish an intelligence study service network, to construct joint service mechanisms, and then to organize competitive intelligence and competitive technical intelligence based on needs. These include such needs as regional strategic intelligence, industrial intelligence, and document and information services, to support enterprise research and development. However, business intelligence, information about policies and laws, technological evaluation, and financial information have not yet been addressed by the NSLC to date, due to the lack of special databases and appropriate document and information service systems. Through integrated survey and investigation and intelligence studies, the NSLC has started to provide strategic intelligence study services for regional strategic planning, industry planning, and enterprise strategy formulation, indicating the future direction of document and intelligence service institutions and promoting their development in providing regional economic services with complete intelligence solutions.

The subjects and users of the SRED have a wide and complex range. Therefore, special libraries should answer these questions to guide their development directions: How to keep up with the leading edge of technology and business intelligence? How to establish SRED on a firm basis? And how to ascertain that we are meeting the needs of all of our customers, at all levels?

Many SRED customers consider document and information consulting and services as a kind of commercial resource. If they had a better and more cost-effective choice, they would choose it over SRED without hesitation. We must make an effort to maintain the best and most cost-effective services for our customers, in order to keep them. We must also constantly think about how to enrich our services and their delivery, as the NSLC enlarges its services for regional economic development.

Author contributions

X. W. Liu (liuxw@mail.las.ac.cn, corresponding author) put forward the basic SRED framework of the NSLC, and supervised the research and practice of each SRED case. He wrote the paper and revised the final version of the manuscript, and participated in the discussion. Y. L. Sun (sunny1@mail.las.ac.cn) drafted the manuscript and organized service case of industrial technology intelligence for non-food substances, and summarized the parts of service experiences of the
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SRED of this article. P. Jia (jiap@mail.las.ac.cn) participated in the discussion on the framework of the paper and coordinated parts of the SRED practice. She also organized the investigation on users information needs. F. Chen (chenf@mail.las.ac.cn), H. Peng (pengh@mail.las.ac.cn) and Y. F. Yan (yanhf@mail.las.ac.cn) summarized the case study of hi-tech companies. L. Dong (dongl@mail.las.ac.cn), X. L. Chen (chenxl@mail.las.ac.cn), S. S. Chen (chenss@mail.las.ac.cn) and W. J. Guo (guowj@mail.las.ac.cn) organized and participated in the service demands survey and wrote the summary report of business users. Z. Li (liz@mail.las.ac.cn) finished the statistical analysis of the questionnaires for business users.

References

Submission Guidelines

♦ Aims
Chinese Journal of Library and Information Science (CJLIS) is a scholarly journal in the field of library and information science (LIS). Its aim is to provide an international communication link between researchers, educators, administrators, and information professionals.

With the publication of the research results both from China and from other foreign countries, the Journal CJLIS tries to strike a balance between theory and practice. With its goal to provide an open forum for Chinese and international scholars in this field to exchange their research results, CJLIS also offers new possibilities in the advancement of Chinese library operations. The CJLIS tries to establish a platform for LIS students, researchers and library staff all over the world to engage in intellectual dialog and also to improve library services so as to promote even more quickened and substantial development of LIS in China.

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Editor-in-Chief of CJLIS
The CJLIS Editorial Office
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