Design and Application of Intellectual Property Information Services in University Libraries Based on Iterative Thinking: A Case Study of Chongqing University Library (Postprint)

Authors: Chang Tingting, Yang Xinyan, Fan Qi

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Abstract

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[Method/Process] Starting from the connotation of iterative thinking and its current research status in the library and information science field, this study explores the feasibility of integrating iterative thinking into university library intellectual property information services and designs service models. Taking the Chongqing University Library as a case study, it verifies the positive effects of university library intellectual property information services based on iterative thinking in regional patent navigation platform construction, intellectual property literacy education, and knowledge product development.

[Results/Conclusion] The study proposes recommendations for the development of university library intellectual property information services based on iterative thinking: potential service needs should be identified to increase iterative samples; flattened management should be implemented to meet the rapid response requirements of iteration; feedback and evaluation mechanism construction should be improved to strengthen process control of iteration; and inter-library case sharing should be formed to promote sustainable development, thereby driving the vigorous development of innovative intellectual property information services in China's university libraries.

Full Text

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Chang Tingting, Yang Xinya, Fan Qi
Chongqing University Library, Chongqing 400044

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Keywords: intellectual property; iterative thinking; Chongqing University Library; patent navigation; knowledge service
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In recent years, China's IP sector has faced new situations and tasks requiring high-quality development. The 2016 *Standards for Intellectual Property Management in Higher Education Institutions* explicitly defined university libraries as IP service support institutions [1]. The 2017 *National Education Development "13th Five-Year" Plan* proposed supporting university libraries in building IP information service centers to facilitate university innovation [2]. The 2020 *Opinions on Improving Patent Quality and Promoting Transformation and Utilization in Higher Education Institutions* demanded comprehensive enhancement of university patent information service capabilities [3]. Amid these opportunities and challenges, and to improve service professionalism and innovation while promoting healthy development of university library IP information services, this study introduces iterative thinking as a methodological framework for designing IP information services, integrating it into the practice of Chongqing University Library to provide an effective paradigm for Chinese university libraries.

2. Research Status

2.1 Connotation of Iterative Thinking

With the cross-integration of different fields in the information age, the algorithmic concept of "iteration" from computer science has gradually evolved into a 思维模式 [11]. Research on iterative thinking as a guiding ideology remains relatively novel. Zhao Dawei [12] introduced it as internet thinking, identifying two dimensions: "micro"—micro-innovation starting from small details; and "fast"—emphasizing timely or even real-time grasp of user needs. Li Guangdou [13] and Xu Hao [14] stressed that iterative thinking is about "speed and repetition," where speed is essential and repetition is the manifestation, with iteration's key lying in sublimation, accumulation, and summarization—a process from quantitative to qualitative change and back to quantitative change. Wu Rui [15] viewed iterative thinking as a broad-search thinking method that iterates through continuous divergence and convergence to propose solutions from different dimensions. Wei Binglin et al. [16] proposed that iterative thinking is a 思维模式 for solving problems using iterative methods, which contrasts with direct methods that solve problems in one go; it is a process of continuously deriving new values from initial variable values. Synthesizing these scholars' research reveals a common emphasis on the importance of feedback in iterative thinking. Feedback is not equivalent to iteration but represents a crucial link in the iterative process, as sufficient information feedback can accelerate iteration speed.

Based on existing research, this paper emphasizes the characteristic of "rapid response" in iterative thinking and the cumulative effect of "micro-innovation" achieved through each iteration. Furthermore, this paper defines the connotation of iterative thinking as being rooted in rapid response, starting from the simplest feasible original solution, and through continuous feedback and experience-based optimization, accumulating micro-innovations generated by rapid iteration to progressively achieve transformative service capability improvement from quantitative to qualitative change.

2.2 Research Status of Iterative Thinking in Library and Information Science

Iterative thinking has begun to be applied in library and information science research. Internationally, studies have applied iterative thinking to solve academic library portal website problems [17-18], and J.W. Gallant et al. [19] introduced a literature review of university library iterative user experience testing programs, describing research content on iterative user experience testing at Valdosta State University Library. In domestic research, Li Fayong [20] elaborated on its role from perspectives of innovation, dialectical thinking, and quality improvement, demonstrating that iterative thinking can serve as a methodology for knowledge service productization. Wu Rui [15] summarized that traditional reading service design can introduce iterative thinking to promote innovative design research

on reading service products. Additionally, there are similar iterative thinking-based studies: Song Ge [21] explored iterative innovation paths in co-citation analysis methods; Gu Chunmei [22] proposed an iterative service framework for mobile libraries based on iterative development; and Wang Fu et al. [23] proposed mobile library scenario construction based on continuously iterating user information reception expectations and established an evaluation matrix for iterative functions.

Current research has not yet seen studies on integrating iterative thinking into library IP information services. Since IP information services inherently require timely rapid response and strive for innovative breakthroughs in effectiveness, this provides new insights for proposing iterative thinking as a methodology for university library IP information service design.

3. Design of University Library IP Information Services Integrating Iterative Thinking

3.1 Feasibility of IP Information Services Under Iterative Thinking

The compatibility between IP information services and iterative thinking methodology determines the feasibility of introducing iterative thinking into university library IP information service design, specifically manifested in the following aspects:

(1) IP information service is a process of intellectual activity and creative thinking expression, while iterative thinking is the product of intellectual development and thinking innovation—both premised on scientific thinking concepts. The IP information service process involves collecting, processing, and analyzing IP-related information, requiring induction, summarization, reasoning, and innovation. This continuous output of intellectual labor and thinking expression necessitates scientific thinking concepts as guidance.

(2) Both require rapid response. The value of IP is time-sensitive, demanding timely service response, as delayed information services lose practical value. Only by capturing needs and trend changes in real-time, advancing with the times according to industry development, and outputting the latest and most efficient service information can IP information services ensure their advancement and applicability. Rapid response is the foundation of iterative thinking, making their timeliness requirements consistent.

(3) University library IP information services lack referable experience and urgently need innovation, while iterative thinking's role is to achieve continuous innovative accumulation through quality improvement in iteration. China's university library IP information services are still in initial development stages, with service content and forms in an open innovation phase requiring continuous experimentation with possible paths. Through iterative innovation with continuous divergence and convergence, suitable

IP information service designs for China's university development can be explored.

(4) Users of IP information services often have unclear service demands, matching the characteristic of object uncertainty in iterative thinking. Compared to active and sporadic IP information service content in university libraries, such as patent retrieval and novelty searches triggered by specific project application needs, most current university library IP information service users have potential demands. Users' implicit appeals regarding long-term IP literacy development goals and needs for IP-related problem assistance in scientific research remain unclear, making IP information services particularly passive. The object uncertainty in iterative thinking precisely emphasizes the uncertainty of user needs and content, requiring continuous feedback during the iterative process to achieve demand judgment, identification, and tangibilization, thereby gradually clarifying demand objectives.

3.2 Iterative Thinking-Based IP Information Service Model

The iterative thinking-based IP information service model begins at the initial stage when users' ultimate demand goals are not yet concrete. It uses user demand assumptions as input to launch the simplest feasible original service design. This approach enables IP information service content to cover the latest intelligence information and be presented to users swiftly, while quickly obtaining user feedback to facilitate adjustment of service plans and strategies, enabling timely construction of service scheme upgrades. During service scheme optimization, the model continuously approaches demand objectives through divergent and convergent iterations, achieving cumulative effects of multiple micro-innovations. Through continuous optimization cycles, it ultimately outputs ideal IP information service effects. The service framework of this model is shown in Figure 1 [Figure 1: see original paper].

In the iterative process, the model emphasizes user information feedback, as each new iteration builds upon the information feedback and experience-based innovation summary from the previous iteration. The continuous divergence and convergence in IP information service iteration can be viewed as repeated testing and correction of upgraded service schemes to eliminate service defects and strategic deviations as much as possible. In essence, the IP information service model guided by iterative thinking is a process of achieving cyclical improvement of service experience and cumulative innovative effects.

4. Service Design Practice

The Chongqing University Intellectual Property Information Service Center, affiliated with Chongqing University Library, is among the first batch of National Intellectual Property Information Service Centers for higher education institutions and an approved institution of the Technology and Innovation Support

Center (TISC). Taking the Chongqing University Intellectual Property Information Service Center as the main service body, Chongqing University Library has collaborated with multiple departments including the Ministry of Education's Sci-Tech Novelty Search Station and the Subject Service Evaluation Center, guided by iterative thinking methodology, conducting extensive research and practice in innovative IP information service work and achieving favorable service results.

4.1 Promoting Regional Industry Development: Rapid Construction of Patent Navigation Platform

To deeply implement the national patent navigation pilot project and base itself on regional industrial development characteristics, at the end of 2019, the Chongqing University Intellectual Property Information Center was approved to construct the "Chongqing New Energy Industry Patent Navigation Center" project. Guided by iterative thinking during the construction period, it adopted a step-by-step construction approach, with specific work as follows:

(1) **Building demand profiles.** At the project's inception, the library did not fully grasp the demands of various new energy enterprises in Chongqing regarding the patent navigation center's construction. The evolutionary strategy of iterative thinking [20] precisely refers to continuously exploring user intentions and making improvements when user needs are not fully understood, achieving an enlightening effect on users. Therefore, the project's first task was to investigate the demands of Chongqing's new energy industry and initially form a demand profile.

(2) **Iteration-centered construction process.** First, winning with speed is an important manifestation of integrating iterative thinking with IP information services. Chongqing University Library promptly pushed comparative information on new energy industry patent layouts between Chongqing and other major domestic key regions to service users. Second, while satisfying users' need to obtain the most current and effective content, it quickly collected user feedback, constructed diversified service content and upgrade schemes, and gradually contacted enterprises with 意向需求 to conduct service iteration cycles. Through continuously providing multi-dimensional IP intelligence information, the iterative service continuously stimulated users' pain points, such as providing services for judging patent technology risks, diagnosing patent technology bottlenecks, and assessing competitiveness. Unlike inertial thinking, iterative thinking considers problem solutions from different angles. Therefore, based on different service content demand inputs, different solutions were designed, as shown in Figure 2 [Figure 2: see original paper]. This ensured that each micro-innovation in service iteration provided users with advanced effects, and since all were based on information services within the new energy field, each experiential innovation also accumulated for the next iteration upgrade.

(3) **Rapid online deployment of network service platform.** First, relying on Chongqing's existing patent navigation platform for technological innovation, the library quickly built the original framework of the new energy navigation center. Then, in the process control of new energy database development, through a series of small-cycle improvements in "service platform function design—module construction—data resource import—system update and maintenance," the website design continuously iterated and upgraded, completing the cyclic optimization of the large construction cycle. Thus, it ultimately achieved the ideal online service platform construction goal, rapidly implementing the network service platform's launch and operation within less than a one-year construction period [24].

Through iterative thinking-based information service design, the "Chongqing New Energy Industry Patent Navigation Center" constructed by Chongqing University Library completed the transformation from initially unclear user demands to guiding quality improvement in patent application and layout for Chongqing's new energy enterprises, and inspiring them to seek optimal solutions for realizing the value of scientific and technological achievements.

4.2 Assisting IP Literacy Education: Achieving Multi-Level Education Model Innovation

4.2.1 Problem Discovery in Initial General Education To promptly launch IP education work, Chongqing University Library initially integrated IP education into the university's public elective courses on information literacy. The general education attempt achieved certain results, but through multiple iterative attempts and cyclic summarization, the main problems were found to be: education primarily targeted campus audiences with limited social openness; educational activities progressed gradually but randomly without order, with complicated content emphasizing theory over practice; and mismatched content for various educational audiences with insufficient targeting.

4.2.2 Iteration Opens Channels for Multi-Level IP Literacy Education Through questionnaires, post-class tracking, and other methods, Chongqing University Library quickly obtained problem feedback, promptly identified the drawbacks of single general education, and under iterative thinking guidance, achieved multiple accumulative changes through repeated skeptical negation, rapidly innovating a multi-level IP education system, as shown in Figure 3 [Figure 3: see original paper]. This completed the transition of educational content from initial general education focusing on "quality improvement + publicity orientation" to emphasizing "compound + application-oriented" approaches that enter scientific research application scenarios, iteratively developing education forms such as "order-based training," "joint training," and customized-topic training. Through integrated experience accumulation, it further adapted to internal faculty and regional IP industry development needs, achieving the high-

level talent development goal of "professional training + practical strengthening," thereby enabling various educational groups to gain better educational experiences and forming an IP talent cultivation channel where everyone can become talented.

Under iterative thinking guidance, the upgrade from general education to multi-level IP literacy education, through continuous divergence and convergence in problem discovery and resolution, completed the spiral ascent of Chongqing University Library's IP education philosophy iteration.

4.3 Innovation-Driven Development of Rapidly Iterated Knowledge Products

Chongqing University Library continuously takes "information, demand, research, and service" as its core, innovation as its driver, and iterative thinking as its guidance to comprehensively develop IP knowledge products, as shown in Figure 4 [Figure 4: see original paper].

Chongqing University Library's IP knowledge products began with the compilation of the *Chongqing University Literature and Intelligence Dynamics* journal, initially focusing on timely delivery of public readers such as quarterly and annual reports on Chongqing University's patent information. During the feedback process of reading product distribution, demands were gradually clarified, themes with more reader feedback in reading products were continuously revised, and reading-skipped areas with templated content and unchanged data were gradually abandoned, progressively improving the distributed knowledge products. Throughout the entire knowledge product development service process, iterative thinking has been consistently applied to guide the sustainable innovation and applicability of developed knowledge products.

Chongqing University Library has also embedded IP knowledge products into specialized analysis services. The design of iterative thinking-based IP information services aims not merely to satisfy user demands but to exceed user expectations in experience, making them full of anticipation for IP information services and thereby increasing user stickiness. For example, during a competitor intelligence analysis service project for a Chongqing company, the library not only delivered the requested on-demand results but also continuously guided the company's deeper service demands during the service period, providing multi-dimensional competitor IP analysis reports and customized competitor tracking intelligence databases. After each knowledge product distribution, it focused on users' new problems and expected breakthrough points as input for the next iteration goal, continuously bringing surprises to users.

5. Development Suggestions and Outlook

University libraries should correctly grasp the development trend of IP innovation powerhouse strategy, promote the integration of IP information services

with university libraries, and seek important transformation in library innovative business. This study applies iterative thinking-based university library IP information service research to the practice of Chongqing University Library, verifying significant improvements in service capability and effectiveness, gaining substantial user acclaim, and providing an effective paradigm for innovative IP information service approaches in university libraries. Concurrently, this paper proposes the following development recommendations for iterative thinking-based university library IP information services:

5.1 Explore Potential Service Demands to Increase Iterative Samples

Currently, although China's university library IP information services enjoy strong national policy support, target user groups still appear uncertain about the direction and content of university library IP information services. For instance, IP navigation services remain primarily "government-driven," with insufficient transmission from "government heat" to "market heat," failing to effectively stimulate market endogenous demands. As the main body of IP innovation services, university libraries should integrate unique university resources, environment, and social public service advantages, enter schools, enterprises, research institutions, and other internal and external organizations to conduct branded promotion activities, and fully utilize self-media and other channels to expand publicity participation and coverage, thereby excavating potential user demands. Increasing the user base for university library IP information services will stimulate service demands, gradually enlarging iterative service samples, improving service quality, enhancing user quantity and recognition, and ensuring user stickiness.

5.2 Flatten Management to Meet Rapid Response Requirements of Iteration

Rapid execution capability is an important factor reflecting core competitiveness in IP information services and the foundation of iterative thinking. In a sense, iteration speed is more important than service quality—only rapid cyclic iteration can gradually satisfy the innovative accumulation of service effects. To achieve rapid response to external influencing factors and rapid service iteration, flattened management models are worth adopting. Flattened management guarantees high-efficiency execution, enabling timely top-down communication, centralized information resources, and smooth upstream-downstream service connections. For flattened management of university library IP information services, specific considerations include coordinating similar service project management, streamlining service processes, and reducing redundant service review links. This not only accelerates information service transmission speed, enabling service content to appear before users earlier, but also allows timely or even real-time adaptation to possible IP intelligence changes along with market and policy factors during service processes, achieving rapid response in iterative services and improving service efficiency.

5.3 Improve Feedback Evaluation Mechanism Construction to Strengthen Iterative Process Control

One-time IP information service development often fails to satisfy most user demands—repeated iteration is needed to perfect information services. This emphasizes the importance of feedback collection and effect evaluation in multi-round iterative service processes. Improving feedback evaluation mechanism construction helps strengthen iterative process control within a certain standard framework. An effective university library IP information service feedback evaluation mechanism should prominently highlight feedback evaluation on service effect timeliness and innovation, which is the foundational guarantee for iterative thinking-guided information services. Additionally, it should include feedback evaluation and indicator design on dimensions such as service librarians' business capabilities, professional degree of service design content, and benefit situations from service gains.

5.4 Form Inter-Library Case Sharing to Promote Comprehensive Sustainable Development

Currently, China's university library IP information services lack experience. Chongqing University Library's iterative thinking-based IP information services have achieved phased results, demonstrating a model for innovative IP information services in Chinese university libraries. However, IP information services guided by iterative thinking require accumulation of micro-innovations from large case samples to achieve transformative ideal innovation breakthroughs. Only by promoting practice in numerous university libraries and forming case sharing of iterative IP information services can comprehensive sustainable development be promoted.

In recent years, alliances such as the "University Intellectual Property Information Service Center Alliance" established by multiple key Chinese university libraries, and regional organizational alliances like the "Chengdu-Chongqing Economic Circle University Intellectual Property Information Service Alliance" led by Chongqing University Library and University of Electronic Science and Technology Library [25], all serve as channels for facilitating inter-library IP service case sharing. Through inter-library IP information service alliance cooperation, mutual learning of iterative thinking-based service cases can be promoted, expanding typical case experience input and comprehensively advancing sustainable iterative innovation in university library IP information services.

Iterative thinking provides an efficient and applicable methodology for university library IP information service design, which has been applied and verified through the IP information service practice of Chongqing University Library. The current period is an important time for university library innovative service transformation and upgrading. Chinese university libraries should seize the opportunities brought by IP services and comprehensively apply iterative thinking-integrated IP information service innovative design to jointly promote

the vigorous development of IP information services in Chinese university libraries.

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Author Contributions:

Chang Tingting: Proposed research questions, designed the paper's research framework, and wrote the paper;
Yang Xinya: Determined research positioning and provided guidance on ideas;
Fan Qi: Wrote practical cases and proofread the paper.

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