Process and Methods for Subject Competitiveness Analysis in University Libraries: A Case Study of the Peking University Subject Competitiveness Analysis Report (Postprint)

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Abstract

[Purpose/Significance] Disciplinary competitiveness constitutes the core manifestation of university competitiveness. The development trajectory, competitive advantages, and reputation of a university fundamentally derive from the developmental level of its disciplines. Understanding the current state of disciplines, clarifying strategic directions, identifying gaps, and formulating countermeasures represent critical considerations for university management. As a center for literature and information services, libraries can provide decision-makers with decision support services for disciplinary competitiveness based on abundant information resources and information analysis expertise.

[Method/Process] A scientific and rational indicator system and research methodology for disciplinary competitiveness analysis can establish a solid foundation for scientific decision-making. The disciplinary competitiveness analysis system encompasses constructing an overall framework, screening indicator systems, identifying benchmark institutions, and emphasizing both the accessibility of data sources and the richness of analytical methods. A comprehensive illustration is provided using the disciplinary competitiveness analysis report completed by Peking University Library as an example.

[Results/Conclusion] Based on user needs research, adopting a comprehensive and objective indicator system, conducting in-depth processing and standardization of multi-modal source data, and performing multi-dimensional analysis through various analytical databases, data analysis software, and visualization tools, a scientific and effective set of processes and methods for university disciplinary competitiveness analysis with strong operability is formulated. This can provide in-depth disciplinary intelligence consulting and decision-making services for university leadership, research teams, faculty, students, and related

university institutions, and can also serve as a reference for more university libraries to develop such services.

Full Text

Preamble

Process and Methods for University Libraries to Conduct Discipline Competitiveness Analysis: A Case Study of the "Analysis Report on Discipline Competitiveness of Peking University"

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Abstract: [Purpose/Significance] Discipline competitiveness represents the core manifestation of a university's overall competitiveness. A university's development trajectory, competitive advantages, and reputation are fundamentally reflected in the development level of its disciplines. Identifying current disciplinary status, clarifying directions, recognizing gaps, and formulating countermeasures constitute critical concerns for university management. As a literature and information service center, the library can provide decision-makers with decision-support services for discipline competitiveness based on abundant information resources and information analysis expertise. [Method/Process] A scientific and rational discipline competitiveness analysis indicator system and research methodology can lay a solid foundation for evidence-based decision-making. The discipline competitiveness analysis system includes constructing an overall framework, screening indicator systems, identifying benchmarking institutions, and emphasizing both data source availability and methodological diversity. This paper provides a comprehensive explanation using the discipline competitiveness analysis report completed by Peking University Library as an example. [Result/Conclusion] Based on user demand research, the report adopts a comprehensive and objective indicator system, conducts in-depth processing and standardization of multimodal source data, and performs multi-dimensional data analysis through various analytical databases, data analysis software, and visualization tools, forming a scientific and effective process and method for university discipline competitiveness analysis. This approach is highly operational and can provide in-depth disciplinary intelligence consultation and decision-making services for university leaders, research teams, faculty, students, and relevant university institutions, while also offering reference for more university libraries to develop such services.

Keywords: discipline competitiveness; process and method; information service innovation; decision-making support; Peking University

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The construction of world-class universities and first-class disciplines (hereinafter referred to as the "Double First-Class" initiative) represents an inevitable choice and important measure for building a strong higher education system and implementing a human resources powerhouse strategy. The foundation of the "Double First-Class" initiative lies in first-class discipline construction, as a university's development momentum, competitive advantages, and reputation fundamentally manifest through the development level of its disciplines. Against this backdrop, universities increasingly focus on discipline construction and development. Key priorities include identifying advantageous disciplines, clarifying disciplinary positioning, optimizing disciplinary structure and layout, and rationally allocating disciplinary resources and funding. Universities require more precise, comprehensive, and rapid access to information and data analysis that can support strategic decision-making in discipline construction and development. This necessitates accurate analysis of discipline competitiveness. Based on diverse literature resources, outstanding information analysis talent, professional information analysis methods, and rich disciplinary service experience, many university libraries have expanded their service scope, integrating into school development planning and conducting discipline competitiveness evaluation to provide decision support for school discipline construction.

2 Concept and Characteristics of Discipline Competitiveness Analysis

2.1 The Concept of Discipline Competitiveness

Disciplines constitute the basic elements of universities and the fundamental units for discipline competitiveness evaluation and analysis, generally referring to academic disciplines and the organizations established around them. Each country has its own discipline classification system, such as the Classification of Instructional Programs (CIP) in the United States, the Joint Academic Coding System (JACS) in the United Kingdom, the National Standard of the People's Republic of China: Discipline Classification and Codes, and the Discipline Catalogue for Degree Conferral and Talent Training formulated by the Academic Degrees Committee of the State Council and the Ministry of Education.

The concept of competitiveness originated in the economic fields of Western developed countries like the United States and was subsequently applied across multiple domains. Due to scholars' different academic backgrounds and application contexts, no consensus has been reached on the definition of competitiveness. Researchers at home and abroad have defined competitiveness from different levels including national, regional, industrial, and enterprise perspectives. For instance, it has been defined from a national perspective as the ability to increase residents' income and living standards, from an international trade perspective as a comparative advantage or export share and its growth, and from an enterprise perspective as a capability, innovation capacity, or produc-

tivity. Generally, competitiveness can be viewed as the power demonstrated by competing entities during competition. Competitiveness is a concept that can only exist through comparison and competition among entities. The competitive power demonstrated during competition represents the manifestation of their capabilities or qualities, their attractiveness to or ability to acquire competitive objects, and their capacity to ultimately obtain certain benefits. Discipline competitiveness refers to the ability and potential of disciplines within universities, as competing entities, to secure advantageous positions in their development. It represents the comparative advantages or performance gaps among the same disciplines at different universities in certain aspects. This capability and potential are constituted by numerous factors such as talent cultivation and research achievements, discipline leaders, disciplinary teams, funding and equipment investment, disciplinary development direction, supporting conditions from related disciplines, and the disciplinary construction and development environment, as well as the interrelationships among these factors.

2.2 The Concept and Basic Elements of Discipline Competitiveness Analysis

Discipline competitiveness analysis involves systematic and scientific objective evaluation to grasp the distribution of resources, strengths, achievements, and effects of various disciplines at universities, thereby identifying comparative advantages and gaps among universities, clarifying priorities and directions for disciplinary development, providing important basis for formulating disciplinary development strategies, enhancing research competitiveness and international influence, and offering guidance for university disciplinary development strategies.

Discipline competitiveness analysis comprises several basic elements: (1) Closely aligned with disciplinary development needs. As an information product supporting decision-making, discipline competitiveness analysis should first be formed based on user needs, actively understanding and incorporating the university's disciplinary construction goals and grasping the development directions of various faculties. This is the prerequisite for accurate and effective report conclusions. (2) Integration of information sources. Discipline competitiveness analysis must provide comprehensive information from a holistic perspective, based on rich, accurate, and reliable information sources that integrate diverse, multimodal data for comprehensive evaluation of university discipline competitiveness from different dimensions to form complete and unified effective conclusions that provide valuable information for decision-making. (3) Dynamic tracking and evaluation. Only through continuous dynamic tracking of discipline competitiveness analysis that reflects the historical development trajectory of disciplines can future disciplinary development be predicted.

3 Research and Development Status of Discipline Competitiveness Analysis

3.1 Domestic Research

Currently, domestic scholars have conducted literature research on discipline competitiveness analysis from perspectives including analysis objects, data sources, analysis indicators, and analysis methods. For example:

From the perspective of analysis objects, some studies focus on single disciplines such as library science, plant and animal science, arts, materials science, pharmacy, and electrical engineering. Others target multiple disciplines, such as those based on Donghua University's disciplines in the top 1% of ESI globally, Peking University's 44 national doctoral-level first-tier disciplines, or the five Ministry of Education first-tier disciplines in Tsinghua University's School of Information Science and Technology. There are also holistic analyses based on certain types of specialized institutions, such as 26 finance and economics universities or 33 industry-characteristic universities.

Regarding data and information sources, most papers rely on traditional journal evaluation databases like ESI or ESI combined with InCites, while some consider non-traditional evaluation indicators such as the Nature Index, Innography patent data, Altmetrics-based social network data, and award data, textbook data, funding data, and expert data.

In terms of analysis indicators, most are based on research achievements, research teams, software and hardware facilities, research platforms, and academic exchanges, though different studies vary. Examples include five first-level indicators (disciplinary team, scientific research, academic exchange, talent cultivation, and supporting conditions) with 11 second-level and 24 third-level indicators; six first-level indicators (talent cultivation, scientific research, social service, team structure, software and hardware facilities, and qualitative indicators) with 29 second-level indicators; three first-level indicators (academic team, scientific research, and teaching achievements) with eight second-level indicators; and four dimensions (research output, research impact, research themes, and research connections) with six first-level indicators (publication quantity, high-level publication quantity, citation impact, knowledge mapping, contribution to research frontiers, and collaboration) and 12 second-level indicators. Some research summarizes analysis indicators into two major aspects: research strength and research potential, with research strength including research achievements, research income, research platforms, research environment, and research teams, while research potential includes potential in these same areas.

In terms of research methods, scholars employ different approaches based on disciplinary characteristics and indicator conditions, such as using AHP and entropy weight method to determine indicator weights, using integrated entropy weight and TOPSIS to establish evaluation models, employing AHP to calculate weights and fuzzy comprehensive evaluation for comprehensive assessment, uti-

lizing DEA from a relative efficiency perspective for variable weight-based evaluation, and adopting literature analysis, stepwise target decomposition, and Delphi method to construct evaluation indicator systems and comprehensive scoring methods to build evaluation models.

Overall, domestic discipline competitiveness analysis shows a trend toward increasing quantitative indicators to reduce human influence. China's Ministry of Education has completed four rounds of discipline evaluations, gradually emphasizing indicators such as number of cited academic papers, citation counts, and highly-cited papers. In international discipline evaluation projects, besides international peer review, quantitative data analysis based on bibliometrics is increasingly added as evidence for discipline competitiveness.

3.2 International Progress

Few international studies report on libraries conducting discipline competitiveness evaluation. Most research concentrates on bibliometric indicator analysis, including application scopes of traditional indicators and addition of new indicators, which are widely applied in evaluating researchers, research groups, and institutions. The Assessment of University-Based Research (AUBR) expert group established by the European Commission proposed a multi-dimensional research assessment matrix in a 2010 report, pointing out that different indicator systems should be designed for different evaluation units (individuals, research groups, faculties, institutions, and research fields) based on different objectives. The matrix contains four evaluation methods: peer review, end-user comment, quantitative indicators, and self-assessment, with quantitative indicators at the core, including paper counts, citation counts, impact factors, normalized impact, and impact share, as well as patents, intellectual property transfer, conference invitations, project funding, doctoral graduation rates, and proportion of active researchers.

The UK's Department for Business, Innovation and Skills commissioned Elsevier to complete "International Comparison of UK Research Performance," which measured the UK's research foundation performance against seven other research-intensive countries and three rapidly growing countries from six aspects: research input, human resources, research output, research collaboration, research productivity, and knowledge exchange. Indicators included publication quantity, article citation counts, highly-cited article quantity, article downloads, collaborative paper quantity, patent counts, patent citation counts, intellectual property income, researcher quantity, R&D expenditure, and researcher mobility, using both absolute indicators and relative indicators such as per capita, per annum, relative share, and normalized impact.

Additionally, international university rankings such as QS, THE, and US News also evaluate and analyze disciplines. Taking QS as an example, its discipline rankings have four sources: academic reputation and employer reputation from global surveys, with each paper's research citations and h-index for related topics

derived from Scopus database, and different weights for the four indicators across different disciplines.

3.3 Innovations in the "Analysis Report on Discipline Competitiveness of Peking University"

Existing research shows that current theoretical studies on discipline competitiveness analysis mostly use single databases or analyze single disciplines, or remain at the theoretical level without practical results. Among university libraries that have undertaken such work, most conduct exploratory practice trying to integrate into school discipline construction upon request from relevant functional departments, though successful cases exist, systematic completion of large-scale, comprehensive discipline evaluation reports remains rare.

Compared with discipline competitiveness analysis services in domestic university libraries, the innovations of the "Analysis Report on Discipline Competitiveness of Peking University" (hereinafter referred to as the "Analysis Report") are mainly reflected in:

(1) Comprehensive investigation of disciplinary development needs with solid and in-depth preparation. Since the establishment of Peking University Library's Research Support Center in 2015, comprehensive investigations began. On one hand, the library actively aligned with the university's disciplinary development strategy, extensively contacting the university's discipline office, research department, social sciences department, and various faculties to understand needs, conducting small-scale pilot projects for single disciplines to find convergence points between discipline construction and library services. On the other hand, the library innovated information services, fully leveraged advantages, strengthened top-level design, investigated how domestic and international university libraries conducted such services, understood relevant database platform functions and data source characteristics, and conducted data cleaning and standardization work. Over a year of demand investigation and data cleaning laid a solid foundation for completing the "Analysis Report."

(2) Innovative construction of a discipline competitiveness analysis system that balances completeness with disciplinary development characteristics. The "Analysis Report" constructed a multi-dimensional competitiveness analysis system, vertically adopting five first-level evaluation indicators (in the 2018 version): research achievement performance, research foundation strength, innovation capability, international influence, and faculty contribution/key faculty competitiveness. Horizontally, it covered 43 doctoral-level first-tier disciplines/30 "Double First-Class" construction disciplines at Peking University (2018 version), aligning with Peking University's first-class discipline construction fields. For benchmarking institution selection, besides 15-18 general benchmarking schools including Harvard, Cambridge, Tsinghua, and Fudan, nearly 50 discipline-specific

benchmarking schools were included to ensure comprehensive and objective analysis that meets personalized needs of different disciplines.

(3) Integration of multiple information sources to construct a comprehensive indicator system. The report not only adopted and integrated commercial data sources such as Web of Science (WoS), Scopus, CNKI, InCites, SciVal, and Innography through mapping methods, but also utilized open data including funding projects, research awards, research platforms, expert teams, and international university rankings. Using big data technology and considering disciplinary characteristics and evaluation content differences, the report formulated discipline competitiveness evaluation indicators from a heterogeneous perspective and made differentiated selections for each discipline, constructing a reasonable and comprehensive indicator system and diversified subject discipline construction evaluation models.

(4) Diversified analysis methods with continuous tracking and updating. Based on multiple data analysis platforms and diversified analysis methods, Peking University Library completed and released 38 discipline competitiveness analysis reports in 2017, initially establishing an indicator system for university discipline competitiveness analysis. Subsequently, after fully absorbing opinions from multiple parties, the library adjusted the indicator system, expanded data sources, and completed the 2018 version of the "Analysis Report." Future editions will be published regularly to form a dynamic tracking monitoring and evaluation system. Through current status assessment and dynamic tracking of disciplinary frontiers, benchmarking against relevant domestic and international institutions reveals disciplinary strengths and weaknesses, providing in-depth academic intelligence consultation and decision-making services for university leaders, research teams, and relevant university institutions.

Figure 2 illustrates the workflow of proactive discipline competitiveness analysis services.

Figure 1 shows the table of contents for the economics discipline competitiveness analysis report from the "Analysis Report," offering a glimpse into its structure.

4 Process and Framework for University Library Discipline Competitiveness Analysis Services

4.1 Workflow for University Library Discipline Competitiveness Analysis Services

The focus of demand-driven discipline competitiveness analysis services lies in efficient communication with demand parties to clarify their key points and requirements, ensuring report conclusions directly address specific needs. The workflow is shown in Figure 3.

4.2 Overall Framework for University Library Discipline Competitiveness Analysis Services

From a work content perspective, each discipline competitiveness analysis service should adopt a relatively standardized workflow and a scientific, accurate, targeted, and normative work system. The overall framework of this system is shown in Figure 4.

Peking University Library's university discipline competitiveness analysis is based on the work framework in Figure 4, manifested in the form of the "Analysis Report." Specific methods are applied during the preliminary preparation stage, report writing stage, and report revision and completion stage to ensure the effectiveness and accuracy of analysis conclusions.

In terms of service forms, library discipline competitiveness services can be divided into proactive services and demand-driven services. Proactive services are oriented toward the university's discipline construction goals and planning directions, independently designing analysis frameworks, indicator systems, and research methods to complete corresponding reports. Demand-driven services involve relevant departments or decision-makers proposing specific requirements, based on which the library provides customized and personalized materials or analysis reports. Whether proactive or demand-driven, competitiveness analysis reports are completed from an independent third-party perspective, demonstrating objectivity and professionalism.

For demand-driven services, demand parties generally have relatively clear purposes and objectives, and can even provide analysis ideas and indicator systems. During the preliminary preparation stage, the focus is on multiple effective communications with demand parties to obtain their recognition of data sources and analysis methods. For proactive services, the primary consideration is how to align discipline competitiveness analysis conclusions with the university's discipline development goals and provide accurate and valuable decision-making references for school decision-makers. In this regard, it is first necessary to broaden horizons, expand thinking, read numerous reports on school development planning, proactively contact and communicate with university functional departments and faculties, summarize and organize multi-party information, and form target needs from the demand party's perspective.

In preliminary preparation, small-scale pilot analyses are needed to determine whether benchmarking institutions are representative, whether data sources are easily obtainable, whether indicator systems are overly complex, and whether analysis methods are feasible. Only after validation can large-scale implementation proceed. The core of discipline competitiveness analysis research methods lies in having clearly targeted benchmarking institutions, objective and comprehensive indicator systems, multi-channel and multimodal data sources, standardized and deeply processed analytical data, and multi-dimensional and multi-level analysis methods.

5 Research Methods for University Discipline Competitiveness Analysis

5.1 Clearly Targeted Benchmarking Institutions

From the concept of discipline competitiveness, discipline competitiveness represents the comparative advantages or performance gaps among the same disciplines at different universities in certain aspects. "Comparison" is the core of discipline competitiveness analysis, making the selection of benchmarking institutions a crucial factor determining analysis conclusions. Three key points must be considered in confirming benchmarking institutions: the level of benchmarking institutions, the number of benchmarking institutions, and differentiation across disciplines. In terms of level selection, the university's development goals and current position serve as the basis. "Double First-Class" universities typically compare with world-class institutions, while non-"Double First-Class" universities may take "Double First-Class" universities as catch-up targets. Regarding quantity selection, the breadth and precision of benchmarking institutions must be considered, such as different levels and regional/national distributions. Based on existing practical research and actual conditions, the number of analysis institutions should be 8-18. Since the main subject of discipline competitiveness analysis is "discipline," benchmarking institutions for different disciplines should have disciplinary characteristics, making development directions and catch-up targets more explicit.

The 2018 version of the "Analysis Report" followed these rules in selecting benchmarking schools. General benchmarking schools used for almost all disciplines included: Harvard University, MIT, Stanford University, Cambridge University, Oxford University, University of Toronto, University of Tokyo, National University of Singapore, University of Hong Kong, Hong Kong University of Science and Technology, Tsinghua University, Zhejiang University, Sun Yat-sen University, Shanghai Jiao Tong University, Fudan University, Nanjing University, Wuhan University, and Renmin University of China. Additionally, nearly 50 schools served as discipline-specific benchmarking institutions. For example, foreign benchmarking schools for library and information science included the University of Illinois at Urbana-Champaign, University of North Carolina at Chapel Hill, and University of Washington—institutions with strong library and information science programs.

5.2 Objective and Comprehensive Indicator System

From an operational perspective, discipline competitiveness analysis mainly involves several elements: research achievements, faculty teams, platform construction, research funding, and international cooperation. The indicator system finalized in the 2018 version of the "Analysis Report" includes five dimensions: research achievement performance, research foundation strength, innovation capability, international influence, and faculty contribution/key faculty competitiveness.

Research achievements are important evaluation indicators for researchers' level and value and key indicators for university discipline competitiveness assessment. Research achievements are primarily manifested through academic papers, with publication quantity and quality being the most basic indicators reflecting discipline competitiveness. For science and engineering disciplines and some social sciences, WoS paper counts and citation impact, as well as Scopus paper counts and citation impact, serve as primary indicators. For individual disciplines such as mathematics and computer science, supplementary indicators include papers from discipline-specific databases, conference papers, and patents. For most humanities and social sciences and some mixed disciplines, CNKI paper level and citation impact can serve as basic indicators. However, monographs are extremely important but more difficult-to-obtain achievement forms in humanities and social sciences. The "Analysis Report" exploratorily used the China Book Citation Statistics Analysis Database combined with manual screening results to reflect monograph achievement indicators.

Research foundation strength indicators include research projects, research platforms, expert teams, research awards, and discipline evaluation status. Research projects reflect researchers' innovative and frontier research ideas, with project funding serving as the financial prerequisite and necessary material guarantee for discipline competition. Research platforms such as experimental equipment, laboratories, and research bases are gathering places for high-end talent and important platforms for promoting interdisciplinary integration, with their construction level determining the effectiveness of university discipline construction. The fourth round of discipline evaluation also included platform construction as an evaluation indicator. Faculty teams constitute the core competitiveness of disciplines. National programs such as the National Science Fund for Distinguished Young Scholars, Changjiang Scholars Program, and Young Overseas High-level Talent Recruitment Plan are important measures for creating outstanding discipline leaders and promoting young scholars to become academic leaders. Only with high-level discipline leaders, reasonable research team structures, and layered research age echelons can disciplines achieve sustainable development. Research foundation strength indicators represent the basic conditions and guarantees that disciplines possess for creating research achievements.

Innovation capability indicators include high-impact papers, high-impact journal papers, and funded papers. High-impact research achievements represent pioneering research in disciplinary fields, while academic papers completed based on funded projects reflect frontier research. These indicators reflect innovation output and effectiveness, highlighting the status of high-level, high-value, high-impact achievements and encouraging the transformation from quantity to quality in research output.

International influence indicators include international discipline rankings and international cooperation status. International cooperation has increasingly gained attention and recognition as an important factor affecting discipline competitiveness. The fourth round of discipline evaluation, ARWU World University

Academic Ranking, QS World University Rankings, and THE World University Rankings all include international cooperation as a measurement indicator.

Faculty contribution and key faculty competitiveness indicators are based on address analysis of literature authors, conducting comparative analysis of competitiveness of high-contribution faculties. The purpose is to identify the contribution of various faculties within the university to disciplines, mapping disciplinary distribution and status within faculties, and analyzing the competitiveness of various disciplines within faculties to provide discipline development decision-making references for faculty management. At this level, interdisciplinary and integration characteristics were further discovered.

Compared with existing discipline competitiveness research, the "Analysis Report" balances comprehensiveness and advantage principles. Multi-source indicators can fully reflect actual disciplinary development, but more indicators are not necessarily better. Instead, key indicators affecting the overall situation should be selected based on disciplinary characteristics. Additionally, multi-level use of indicators should be emphasized, comprehensively considering absolute, relative, and normalized indicators, as well as trend analysis. For example, absolute totals reflect comprehensive strength, annual trends reflect disciplinary trajectories, relative indicators reflect quality, and especially per capita academic output calculated based on researcher scale at each benchmarking university can eliminate bias from faculty size. Normalized indicators, such as the Category Normalized Citation Impact (CNCI) based on WoS papers, Impact Relative to World (IRW), and Field-Weighted Citation Impact (FWCI) based on Scopus, are unbiased impact indicators that exclude the effects of publication year, discipline field, and document type, enabling comparison across different scales and disciplines and intuitively showing differences from global average levels.

Table 1 shows the main differences between the "Analysis Report" and existing discipline competitiveness research. Compared with existing discipline rankings, the "Analysis Report" focuses on easily obtainable data and does not include QS survey data, but is more extensive and in-depth in quantitative data acquisition and analysis than discipline rankings.

5.3 Multi-Channel, Multi-Modal Data Sources

Multi-channel data sources can comprehensively excavate materials, consider disciplinary development trends, and enable comparison of multiple data sources for the same type of literature to eliminate analysis bias from single data sources. The "Analysis Report" data sources include commercial database data and publicly available online data. Commercial database data primarily includes journal paper inclusion and citation data from WoS, Scopus, and CNKI, monograph citation data from the China Book Citation Database, and discipline-specific database inclusion data, used to analyze research achievement performance, innovation capability, and contribution. Publicly available online data cov-

ers a broader scope, including: (1) national-level research funds and awards, discipline-specific awards, academicians, Changjiang Scholars, National Science Fund for Distinguished Young Scholars, Excellent Young Scientists Fund, national key laboratories, humanities and social sciences research bases, and discipline evaluation data from official websites, used to analyze research foundation strength; (2) four major world university rankings and Nature Index rankings, used to analyze international influence; (3) researcher information from university official websites, serving as the basis for per capita output analysis.

5.4 Deep Data Processing and Standardization

Accurate data form the foundation of good analysis, and data retrieval is a critical link determining dataset accuracy. During data retrieval, specific institutional retrieval methods in databases are utilized, but institutional name evolution, writing forms, postal codes, and other auxiliary information must also be considered when constructing retrieval formulas, with full use of truncation symbols and logical operators to ensure precision and recall. During data download, compatibility between data formats and analysis tools and the possibility of merging and calculating different data must be considered. For example, record download content and file formats from WoS, Scopus, and CNKI are unified or selected in formats that can be imported into the same analysis software. During data organization, fields are supplemented and sequences adjusted for data that cannot be directly used, with similar, duplicate, and invalid information records deleted to ensure standardized and tidy data.

At the discipline competitiveness analysis level, determining disciplinary scope is key. Each database has its own independent discipline classification system, and numerous differences exist in discipline settings between domestic and foreign universities. Addressing this situation, the "Analysis Report" took Ministry of Education doctoral-level first-tier disciplines as analysis objects, and based on experience, consensus, and discussion, while adhering to objectivity, accuracy, operability, and consideration of the university's disciplinary particularities, established mapping relationships between different discipline classification systems from sources including WoS, Scopus, CNKI, funding projects, expert teams, and award achievements and Peking University's doctoral-level first-tier disciplines.

5.5 Multi-Dimensional, Multi-Level Analysis Methods

In data analysis, the report fully utilized various analytical databases, data analysis software, and visualization tools including InCites, SciVal, ESI, TDA, SPSS, Tableau, CiteSpace, and ChartShow to comprehensively process and analyze data, with comprehensive interpretation of various analysis results. Specific methods include:

(1) Data analysis methods based on Excel and WPS. Excel's pivot table and function capabilities have advantages in data summation and averaging,

enabling quick completion of paper publication counts, citation counts, and annual trend statistics. However, Excel has weak CSV format compatibility and may experience cell data misalignment with large datasets, in which case WPS is used cooperatively to solve problems.

(2) In-depth data analysis using SPSS. SPSS is software for statistical analysis, data mining, predictive analysis, and decision support tasks with powerful functions. Besides Excel and WPS, the "Analysis Report" also used SPSS software for in-depth data analysis and statistical processing.

(3) Data linking and visualization analysis using Tableau. Tableau is an easy-to-use, flexible data analysis and visualization tool that can handle massive data. Using Tableau's data mapping and cross-data connection functions, data from different sources can be integrated into a single Tableau worksheet.

(4) Direct analysis using InCites and SciVal databases. The InCites database is a research evaluation tool built upon WoS's three major citation databases, capable of analyzing dimensions including countries/regions, institutions, research directions, and journals, and can directly import WoS-retrieved data into InCites for analysis. SciVal is a research management analysis tool based on the Scopus database that can analyze more than 10 indicators including research output and quality for research institutions and disciplines. Using InCites and SciVal platforms enables direct analysis of paper inclusion, citations, highly-cited papers, collaborative papers, and high-impact journals based on WoS or Scopus data.

At the report content level, various methods were employed including literature research, field investigation, expert interviews, and multi-data comprehensive interpretation. During initial report design, literature research was used purposefully and systematically to review domestic and foreign literature and conduct field investigations at other libraries to obtain ideas. The library also contacted relevant decision-making departments on campus to understand discipline development planning goals and needs. Expert interviews were conducted for face-to-face communication with discipline experts, and opinions from relevant experts were solicited again upon report completion. The "Analysis Report" conclusion section used multi-data comprehensive interpretation methods, analyzing the same research object using different channel data, comparing and comprehensively interpreting analysis conclusions from various data sources to obtain unified target countermeasures and development recommendations.

6 Conclusion and Future Outlook

The "Analysis Report" is an important measure by Peking University Library to implement national education development strategies, support education modernization, and promote scientific, technological, and cultural innovation. It is an effective solution to support university discipline construction and develop-

ment and integrate into core university affairs, as well as a powerful means for libraries to innovate information services and enhance academic influence. Since its release, the "Analysis Report" has received enthusiastic responses both on and off campus, becoming an important basis for multiple faculties to demonstrate their development advantages and scholars' influence, compile "Double First-Class" discipline construction plans, and formulate discipline development strategies. It has also become a focus of attention in the library industry both domestically and internationally.

Based on the good effect and influence of the "Analysis Report," university functional departments and various faculties have conducted more cooperation with the library, including research frontiers, discipline international evaluation, and second-level discipline competitiveness analysis reports, boosting the university's "Double First-Class" construction from multiple levels.

Discipline competitiveness analysis service is an ongoing endeavor. For university decision-makers, mastering current disciplinary development status, global positioning, and future trends is crucial. Although discipline competitiveness analysis based on bibliometrics cannot fully reflect actual disciplinary development, it is currently an objective and key angle for measuring disciplinary development. How to fully excavate big data value, effectively utilize data analysis methods, and increase analysis comprehensiveness and recognition are key considerations for the next steps in discipline competitiveness analysis. Future reports will also be combined with other information products (such as discipline research frontiers and discipline international evaluation) to identify precise potential focus points for leading discipline construction and development. Libraries can use discipline competitiveness analysis as a benchmark to continuously enhance information service capabilities, provide better innovative information service products for university leaders, research teams, faculty, students, and relevant university institutions, and offer precise decision-making support for the university's "Double First-Class" discipline construction.

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Process and Method of Universities' Discipline Competitiveness Analysis Conducted by University Libraries: Taking the "Analysis Report on Discipline Competitiveness of Peking University" as an Example

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Abstract: [Purpose/significance] Discipline competitiveness is the core embodiment of university competitiveness. The development trend, competitive advantage, and reputation image of universities are fundamentally reflected in the development level of disciplines. It is an important issue for school management to understand the current status of disciplines, clarify directions, identify gaps, and formulate countermeasures. As a literature and information service center, the library can provide decision-makers with decision support services for

discipline competitiveness based on abundant information resources and information analysis talents. [Method/process] A scientific and reasonable discipline competitiveness analysis indicator system and research method can lay a good foundation for scientific decision-making. The discipline competitiveness analysis system includes constructing the overall framework, screening the indicator system, identifying benchmarking institutions, and focusing on the availability of data sources and the richness of analysis methods. Taking the discipline competitiveness analysis report completed by Peking University Library as an example for comprehensive explanation. [Result/conclusion] Based on user demand research, the report adopts a comprehensive and objective indicator system, conducts in-depth processing and standardized operations on multimodal source data, and performs multi-dimensional analysis of the data through various analysis databases, data analysis software, and visualization analysis tools, forming a set of scientific and effective processes and methods for university discipline competitiveness analysis. This approach is highly operable and can provide in-depth discipline intelligence consultation and decision-making services for university leaders, research teams, teachers, students, and relevant university institutions, and can also provide reference for more university libraries to carry out such services.

Keywords: discipline competitiveness; process and method; information service innovation; decision-making support; Peking University

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