Transforming the Job Market for Library and Information Science PhDs in China: An Empirical Study from an Alternative Academic (Alt-Ac) Perspective

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This study investigated the transformation of the library and information science (LIS) doctoral job market in China from an alternative academic (Alt-Ac) perspective. Using a mixed-methods approach, we analyzed supply and demand dynamics, based on data from 21 LIS programs and 10,331 job postings. The findings revealed a rapid expansion of LIS doctoral education, with an increasing enrollment in first-level disciplines and self-established interdisciplinary second-level disciplines. On the demand side, Alt-Ac positions showed significant growth across diverse institutional settings, requiring skills in data analysis, research methodology, and interdisciplinary collaboration. These results underscore the growing viability of Alt-Ac careers for LIS doctoral graduates and the need for programs to adapt curricula accordingly.

Introduction

The field of library and information science (LIS) has undergone significant transformations globally, both in terms of doctoral education and academic careers. The establishment of the first LIS doctoral program at the University of Chicago in 1928 (University of Chicago Library, 2006) marked the beginning of the professionalization and academicization of librarianship, with the aim of cultivating research-oriented scholars to advance knowledge in this emerging field.

China's modern academic system was strongly shaped by the Soviet model, particularly its centralized governance of higher education, emphasis on specialized technical training, and alignment of university planning with national economic priorities (Li, 2001). However, over the past two decades, Chinese universities have begun to adopt the American-style tenure-track system (Si, 2023), resulting in a hybrid model. The launch of the "Double First-Class" initiative in 2017, which aims to build world-class universities and disciplines, has led to rapid growth in LIS doctoral education in terms of program quantity and enrollment. By the end of 2022, the discipline name was officially changed from "Science of Library, Information, and Archival" to "Information Resources Management," expanding its scope from three to 11 subdisciplines.

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As permanent faculty positions shrink and temporary positions expand (Qing, 2019), alternative academic (Alt-Ac) careers, referring to nonteaching roles within and beyond academia that utilize the skills and expertise acquired during doctoral training (Nowviskie, 2014), have gained prominence. The emergence of Alt-Ac paths is closely tied to the changing landscape of the academic job market, with academic positions becoming increasingly saturated and the demand for diverse skills growing in the knowledge economy. These labor-market shifts are reshaping career prospects for LIS doctoral graduates and require doctoral programs to adjust training and support accordingly.

This study draws on a systematic compilation of publicly available doctoral enrollment plans from 21 LIS departments, along with doctoral-level postings collected from the "LIS Jobs" platform developed by the authors to support a comprehensive empirical analysis of the transformation of the LIS doctoral job market in China from an Alt-Ac perspective. By examining both the supply side (doctoral student cultivation) and the demand side (employer preferences), it seeks to answer the following questions:

1. What trends have emerged in the scale and structure of LIS doctoral enrollment in China, and how have these changes shaped the supply of LIS doctoral graduates in the job market?
2. What new trends are evident on the demand side of the LIS job market, and how do Alt-Ac positions contribute to meeting employers' evolving needs?
3. What new requirements does the transformation of the LIS doctoral job market impose on LIS education, and how can LIS programs adapt to better prepare graduates for diverse career paths, particularly in the Alt-Ac sector?

This study addresses a gap in empirical evidence on how doctoral training and doctoral-level hiring demands are linked in China's LIS field. It provides a supply–demand account of how doctoral enrollment expansion and Alt-Ac hiring patterns have evolved since 2017.

Literature Review

Research on Alt-Ac Careers

The concept of Alt-Ac careers has evolved significantly since its introduction by Nowviskie (2014), who described them as humanities and social science PhDs working in nontraditional academic institutions. The definition has subsequently expanded to encompass a broader range of career paths between academia and industry, emphasizing practical knowledge application, social service, and cross-boundary collaboration (Kelly et al., 2023; Rogers, 2013). Alt-Ac careers are increasingly recognized, but some researchers limit the term to non-tenure-track university employment (Brechelmacher et al., 2015; Oxley, 2019), while others advocate for a broader definition (Rogers, 2020).

Alt-Ac careers have expanded alongside structural changes in academia. These include the rise of Mode 2 knowledge production, which emphasizes transdisciplinary, application-oriented research conducted in collaboration across institutional settings (Gibbons et al., 1994), the expansion of doctoral education, and growing demand for versatile professionals (Larson et al., 2014). As universities cope with these changes, they have begun to provide Alt-Ac career support and resources for graduate students (Liu, 2014), positioning Alt-Ac as an important force in the evolving doctoral labor market. Previous studies have investigated the diverse opportunities and experiences of Alt-Ac professionals across various disciplines. Jackson (2023) provided practical guidance for quantitative social scientists pursuing nonacademic

careers, highlighting ways to maximize skills and opportunities in areas such as data analysis, consulting, and policymaking. Kansa and Kansa (2015) reflected on their Alt-Ac journey in archaeology, discussing the challenges and rewards of pursuing public engagement, digital humanities, and open-access initiatives.

Professionals with advanced LIS degrees have long navigated diverse career paths within and beyond academia. Gerke et al. (2023) explored the existence and importance of mentoring and career support for mid-career, tenure-track academic librarians, identifying several areas of support and guidance that are crucial for promotion and career growth. Buarki and Al-Omar (2019) investigated the skills and employment issues of LIS alumni in Kuwait, highlighting the need for multitasking skills to meet job market requirements. Dukic (2017) examined how the different occupational backgrounds of master's students in LIS shape their motivation to choose a career in the library profession, revealing differences in motivating factors between library- and non-library-employed students. These studies underscore the diverse career paths and experiences of LIS professionals, as well as the importance of mentoring, skill development, and understanding motivational factors in shaping successful careers within and beyond traditional academic settings. As Alt-Ac careers continue to gain prominence, LIS education and professional development must adapt and provide the necessary support and resources for graduates navigating these diverse career landscapes.

Several studies have examined the skills and preparation needed for Alt-Ac success and the attitudes and perceptions toward these careers. Kent-Johnson (2024) qualitatively analyzed Alt-Ac professionalization opportunities for humanities PhD students, identifying the specific challenges and strategies in this domain, such as developing transferable skills, building professional networks, and navigating identity transitions. Lesiuk (2013) discussed the role of "small bets" and experimentation in the PhD process for those considering Alt-Ac careers, emphasizing the importance of adaptability, risk-taking, and self-directed learning. While Gemme and Gingras (2012) found that traditional academic careers remain a strong attraction for graduate students, Beres (2015) argued for embracing Alt-Ac opportunities as more than just a "consolation prize," highlighting their potential for meaningful career fulfillment and societal impact. Schechter (2017) drew on their own Alt-Ac career transition to engage the public, claim space, challenge traditional notions of academic success, and promote a more inclusive and varied vision of research.

As the literature on Alt-Ac careers grows, exploring the specific challenges and opportunities within different disciplines and sectors is crucial. More research is needed to fully understand the long-term outcomes and impacts of Alt-Ac careers, as well as the institutional and disciplinary support structures needed to facilitate successful transitions. Rogers' (2013) analysis of humanities graduate education and Alt-Ac professions revealed the abilities, career trajectories, and support structures needed for success, emphasizing the need for mentorship, networking, and professional growth. Alt-Ac professionals can shape doctoral education and talent development by linking academia, industry, and the public sphere as universities and society grow increasingly interconnected.

Chinese LIS Doctoral Education and Job Market

LIS advanced degree education in China has undergone rapid changes since the first doctoral programs in library science, information science, and archival science were established in 1990. The 2017 "Double First-Class" initiative has led to a significant expansion of LIS

doctoral programs, increasing from fewer than 10 before 2016, to 16 and 21 in 2019 and 2024, respectively (Ministry of Education of China, 2024). Currently, Chinese LIS doctoral education is in a transitional period. For decades, China's graduate education followed a national discipline system. However, since 2016, the Ministry of Education has revised the guidelines for setting discipline catalogs, changing from the traditional three-level discipline catalog of "disciplinary categories–first-level discipline–second-level discipline" (e.g., management studies–library and information science–library science) to a two-level discipline catalog of "disciplinary categories–first-level discipline" (e.g., management studies–library and information science). Simultaneously, universities have been granted the autonomy to establish second-level disciplines (e.g., data science under the LIS first-level discipline) based on labor market demands and environmental changes. Thus, significant differences in enrollment practices exist among LIS departments, with the coexistence of old and new discipline names and a mix of first- and second-level discipline enrollment. Some scholars argue that the current second-level disciplines have lost their disciplinary identity and are merely research directions (Liu & Jiang, 2019). Conversely, providing students with a "broad-based professional education" based on the first-level discipline helps them better adapt to the labor market, particularly by establishing emerging second-level disciplines to meet the needs of economic development across all sectors (Chang et al., 2022). This approach aligns with the fundamental essence of Alt-Ac, which emphasizes the acquisition of transferable skills and the ability to navigate diverse career paths beyond traditional academic roles.

As of July 2024, 21 universities offered LIS doctoral programs, admitting 251 doctoral students in the 2024 cohort (Table 1). Across 2016–2024, cumulative enrollment across cohorts totaled 1,820 students. Among these, first-level disciplines serve as the primary enrollment category (53%). In the past few years, some LIS departments have actively established new interdisciplinary second-level disciplines. For instance, Peking University offers doctoral programs in editing and publishing, while Wuhan University has programs in data sciences and confidential management. Furthermore, Renmin University of China offers programs in data management, digital humanities, and information analysis.

Moreover, several universities admit LIS-oriented doctoral students under other disciplines, including management science and engineering (MS&E) and public administration. Examples include "information resource management" at Hangzhou Dianzi University, "public information resource management" at Zhejiang University, "historical archives" at Yunnan University, "information organization" at Nanjing University of Science and Technology, and "scientometrics" at Dalian University of Technology. These initiatives leverage interdisciplinary strengths and cultivate new growth points for the field. Numerous LIS departments have extended their doctoral programs from three to four years and emphasized publishing in prestigious journals like those indexed in the Social Sciences Citation Index as part of the research output graduation requirements to prioritize high-quality development.

While dedicated research on the Chinese LIS doctoral job market is limited, previous studies provide insights into the saturation of the academic job market and the increasing demand for diverse skills (Tian, 2022). Teaching roles in the Chinese LIS academic market saturated between 2016 and 2020, but postdoctoral and full-time project assistant positions grew rapidly. Emerging markets are also rapidly developing, particularly in various types of libraries. For example, Zhejiang Normal University Library has established information

TABLE 1
LIS Doctoral Programs in China (as of July 2024)

	Name of Departments	Library Science	Information Science	Archival Science	Date of Approval for Doctoral Degree Granting
1	Department of Information Management, Peking University (PKU-IM)	V	V	X	2000
2	School of Information Management, Wuhan University (WHU-SIM)	V	V	V	2000
3	School of Information Resource Management, Renmin University of China (RUC-SIRM)	V	V	V	2006
4	School of Information Management, Nanjing University (NJU-SIM)	V LIS First-Level Discipline			2006
5	PLA National Defense University (NDU-PLA)	V LIS First-Level Discipline			2010
6	School of Management, Jilin University (JLU-SOM)	V LIS First-Level Discipline			2010
7	National Science Library, Chinese Academy of Sciences (CAS-NSL)	V	V	X	2010
8	Northwest Institute of Environment and Ecological Resources, Chinese Academy of Sciences (CAS-NIEER)	X	V	X	2016
9	College of Information Management, Nanjing Agricultural University (NAU-IM)	V LIS First-Level Discipline			2019
10	School of Management, Hebei University (HBU-SOM)	V LIS First-Level Discipline			2019
11	School of Public Administration, Xiangtan University (XTU-SPA)	V LIS First-Level Discipline			2019
12	School of Information Management, Sun Yat-sen University (SYSU-SIM)	V LIS First-Level Discipline			2019
13	Nankai University Business School (NKU-BS)	V	V	X	2019
14	School of Information Management, Huazhong Normal University (CCNU-SIM)	V LIS First-Level Discipline			2019
15	Faculty of Economics and Management, East China Normal University (ECNU-FEM)	V LIS First-Level Discipline			2021
16	School of Library, Information and Archives of Shanghai University (SHU-LIA)	V LIS First-Level Discipline			2021

	Name of Departments	Library Science	Information Science	Archival Science	Date of Approval for Doctoral Degree Granting
17	School of Information Management, Zhengzhou University (ZZU-SIM)	V LIS First-Level Discipline			2021
18	The School of Public Administration of Sichuan University (SCU-SPA)	V LIS First-Level Discipline			2023
19	Institutes of Science and Development, Chinese Academy of Sciences (CASISD)	X	V	X	2023
20	School of Information Management, Heilongjiang University (HLJU-SIM)	V LIS First-Level Discipline			2024
21	Management School, Tianjin Normal University (TNU-MS)	V LIS First-Level Discipline			2024

Note: V = program offered; X = program not offered.

analyst positions with an initial four-year term and provides research start-up funds. Dongguan Library offers literature development positions with a housing subsidy of up to one million yuan for doctoral graduates. These LIS employment market trends show the growing importance of Alt-Ac occupations and the need for doctoral programs to prepare graduates for diverse professional roles.

The literature on Alt-Ac careers and Chinese LIS doctoral education provides valuable insights into changes in the field. However, significant research gaps remain. Most studies focus on Alt-Ac careers and structural changes in doctoral education, with little empirical data on how these elements relate to academic labor market supply and demand. This research aims to bridge this gap by empirically investigating the dynamics between LIS doctoral training and Alt-Ac career trajectories in China, revealing the ongoing transformation of the LIS doctoral job market. By using advanced natural language processing techniques and quantitative analysis of original datasets, it identifies the key factors that shape the career paths and professional identities of Chinese LIS PhDs in Alt-Ac roles, considering the ongoing reforms in doctoral education and the changing demands of the job market. As China's abundant human resources have facilitated the transformation of the LIS field, these findings can offer valuable insights and experiences for the global LIS community, contributing to a better understanding of the Alt-Ac phenomenon and its implications for the future of LIS education and workforce development.

Research Methods

This study employed a mixed-methods approach, quantitatively analyzing LIS doctoral enrollment data and job recruitment information and qualitatively analyzing career trajectories. We utilized natural language processing techniques to extract and analyze large-scale recruitment text data and manual coding to cluster entities and examine the supply and demand dynamics of the Chinese LIS job market.

Data Collection

Table 2 presents an overview of the data sources and sample sizes used in this study.

TABLE 2
Data Sources and Sample Sizes

Data Type	Data Source	Sample Size	Time Period
LIS Doctoral Enrollment Data	21 LIS departments	Total enrollment 1,820 students	2016–2024
LIS Job Recruitment Information	"LIS Jobs" WeChat platform	585 institutions and 10,331 job postings	2016–2023

Supply-Side Data: LIS Doctoral Enrollment Data

We collected doctoral enrollment data from 21 LIS departments between 2016 and 2024, sourced from publicly available annual enrollment plans or admission lists. We assessed LIS doctoral education's adaptation to labor-market demand by analyzing changes in disciplinary structures, particularly the creation of new second-level disciplines.

Demand-Side Data: LIS Job Recruitment Information

The demand-side data were obtained from the "LIS Jobs" platform, developed and operated by the authors since 2015. This platform uses semantic web crawlers to gather LIS-related job postings from over 1,782 websites. The platform has been used as a data source in multiple peer-reviewed studies (Tian & Zhang, 2021; Zhi et al., 2023; Zhou & Lin, 2021). We selected 10,331 doctoral-level job postings from 585 institutions.

Data Analysis

We employed a mixed-methods approach, combining quantitative analysis of LIS doctoral enrollment data and job recruitment information with qualitative analysis of career trajectories. The data analysis process consisted of manual coding of institutions, named entity recognition (NER), and iterative clustering of similar entities.

Manual Coding of Institutions

We systematically coded 585 employers based on their institutional types, such as universities, cultural institutions, military and police organizations, government agencies, and other relevant categories. This step allowed us to distinguish between academic and alternative academic positions, providing a foundation for subsequent analysis.

Named Entity Recognition (NER)

We applied the bidirectional encoder representations from transformers (BERT)-bidirectional long short-term memory (BiLSTM)-conditional random field (CRF) model, a state-of-the-art deep learning architecture for NER, to automatically extract key entities from the 10,331 job postings, including specific departments, job titles, required disciplines and specializations, knowledge and skill requirements, and other relevant attributes. The BERT-BiLSTM-CRF model used in this study is a deep learning-based named entity recognition model that integrates the advantages of three key components:

1. BERT, as a pre-trained language model, learns contextual representations of words from massive text data;

2. BiLSTM is a bidirectional recurrent neural network that effectively captures long-distance dependencies in text sequences;
3. CRF is a probabilistic graphical model that considers the constraints between adjacent named entity labels.

By integrating these three components, the BERT-BiLSTM-CRF model can accurately identify key information even in the presence of complex language phenomena and domain-specific terminology, making it particularly suitable for analyzing unstructured text data, such as job postings.

This method has been effectively applied in the LIS sector and beyond. Tian and Zhang (2021) leveraged a BiLSTM-CRF model to analyze employment discrimination within LIS job postings in China, successfully extracting key discriminatory factors such as political status and age. Similarly, Gnehm and Clematide (2020) utilized a BERT-BiLSTM-CRF model to structure and classify job postings across German, French, and English, demonstrating the model's adaptability and effectiveness in handling multilingual data. Our experiments demonstrated the model's robustness, achieving a precision of 85.4%, a recall of 87.2%, and an F1 score of 86.3%, indicating its suitability for our research purposes.

Iterative Clustering of Similar Entities

To ensure the validity and reliability of the extracted entities, a team of five LIS doctoral candidates conducted a systematic manual review and coding of the model outputs. The team employed a multi-round iterative coding approach, discussing and resolving discrepancies until reaching a consensus, particularly for job titles and disciplinary specializations. This step refined the automatically extracted entities and ensured the consistency and accuracy of the data. The resulting structured dataset after the NER and clustering process had the following fields: {ID, Institution Type, Province, Institution, Department, Job Title, Job Description, Required Discipline, Education Requirement, Quantity, and Other Entities}. This dataset served as the foundation for our subsequent analyses, including descriptive statistical analysis to examine trends in LIS doctoral education scale, disciplinary structure, and the quantity and distribution of academic and Alt-Ac positions across different types of institutions.

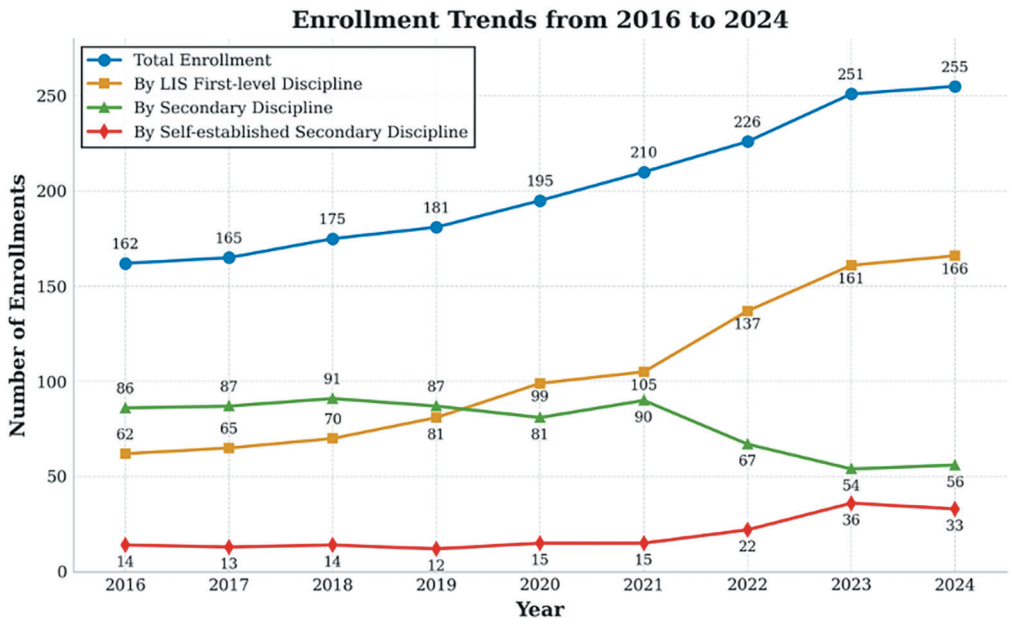
Results

Supply Side: Enrollment Scale and Structure of LIS Doctoral Programs

LIS doctoral education in China underwent significant transformations between 2016 and 2024, particularly in terms of enrollment scale and structure (see Figure 1), with LIS doctoral students growing steadily, marked by two major waves. The first occurred between 2020 and 2023, characterized by the expansion of doctoral programs, with six new LIS departments established at Hebei University, Xiangtan University, Nanjing Agricultural University, Zhengzhou University, East China Normal University, and Sichuan University. These programs have gradually stabilized their enrollment numbers from 1 to 3 students to 8 to 10 students annually. The second wave occurred after the 2021 discipline catalog standards, which led LIS departments to strategically combine secondary disciplines under the LIS first-level discipline.

A further examination of the data reveals a notable trend: since 2020, the proportion of students enrolled in the LIS first-level discipline has consistently surpassed the 50% threshold, reaching 65.1% in 2024, compared to the institutional-level proportion of 53%. Concurrently, the enrollment proportion of traditional secondary disciplines has declined markedly,

FIGURE 1
Enrollment Scale and Structure of LIS Doctoral Programs in China (2016–2024).



falling from a peak of 53.09% in 2016, to 21.96% in 2024. However, the surge in enrollment within self-established secondary disciplines, which reached a record high of 36 students in 2023, offset this downward trajectory, with a strong focus on emerging areas, including data management, information analysis, digital humanities, and publishing. As of July 2024, the LIS departments with the highest enrollment numbers are Wuhan University (52 students annually), Nanjing University (48 students annually), and the National Science Library of the Chinese Academy of Sciences (19 students annually). Collectively, these three institutions account for a substantial 46.7% of the total enrollment, underscoring the enduring influence of traditional LIS departments in attracting doctoral students. Consistent with the Ministry of Education's policies, nearly all LIS doctoral students in recent years have enrolled under the full-time system, establishing them as essential contributors to the supply side of the labor market.

To better understand the supply-side changes and their implications for Alt-Ac careers, two aspects merit further discussion.

1. The expansive LIS first-level discipline and responsive secondary disciplines as a catalyst for Alt-Ac growth.
2. Tightening academic opportunities and the resulting acceleration of Alt-Ac expansion.

First, the expansive nature of the LIS first-level discipline, coupled with the strategic establishment of secondary disciplines by LIS departments, contributes to Alt-Ac growth. By embracing diverse subfields and emerging areas of specialization, LIS doctoral programs are effectively aligning themselves with evolving market demands, equipping graduates with the versatile skill sets and interdisciplinary knowledge required to thrive in diverse professional settings beyond traditional academia. This approach to curriculum design and program development reflects and shapes the changing information professions, producing LIS doctoral graduates prepared for Alt-Ac complexities.

Moreover, the self-establishment of secondary disciplines within LIS departments demonstrates a responsiveness to market trends and a commitment to innovation. By carving out niche areas of expertise, such as data management, information analysis, and publishing, LIS programs are positioning themselves to meet the evolving needs of various industries and sectors. This flexibility in responding to market demands not only enhances the employability of LIS doctoral graduates but also contributes to the discipline's overall vitality and relevance. As Alt-Ac careers become more common, the ability of LIS programs to anticipate and respond to emerging trends will be critical in ensuring their graduates' long-term success and impact.

Second, the increasing saturation of academic positions has accelerated the expansion of the Alt-Ac movement. As traditional faculty positions become scarce, LIS doctoral graduates are discovering diverse career opportunities. Case studies reveal a wide range of alternative career destinations in university libraries (e.g., Renmin University of China, Xiamen University), specialized institutions (e.g., CPC Party School in Nanjing, PLA Archives, National Marine Information Center), public libraries (e.g., Dongguan Library, Sichuan Library), cultural heritage organizations (e.g., National Art Museum of China), and corporate archives (e.g., China North Industries Group Corporation). As the Alt-Ac movement gains momentum, LIS doctoral programs must recognize and embrace these shifting dynamics by proactively preparing graduates for diverse career paths, fostering interdisciplinary collaborations, and forming partnerships with industry and government.

Demand Side: Trends and Patterns in the LIS Job Market

To gain a comprehensive understanding of the demand-side dynamics, we manually classified all the recruiting institutions and referred to the classification standards outlined in Kelly et al.'s (2023) *Going Alt-Ac*. This process resulted in the categorization of institutions into seven major types (see Table 3). The analysis revealed that Alt-Ac positions are highly diverse, spanning various settings, including libraries, archives, journal offices, administrative departments, museums, corporate research and development departments, and more. In contrast, traditional academic library positions in Chinese universities primarily focus on reader services, reference services, and supporting the institution's teaching and research activities. Conversely, Alt-Ac positions encompass diverse emerging fields—such as information analysis, data management, digital humanities, and intellectual property—emphasizing cross-disciplinary collaboration and social services. Furthermore, Alt-Ac positions require a broader skill set from doctoral graduates, combining domain expertise with general competencies such as data analysis, project management, and team collaboration. In some unique cases, faculty positions and Alt-Ac positions with specific orientations coexist, such as in certain university libraries or medical research institutes.

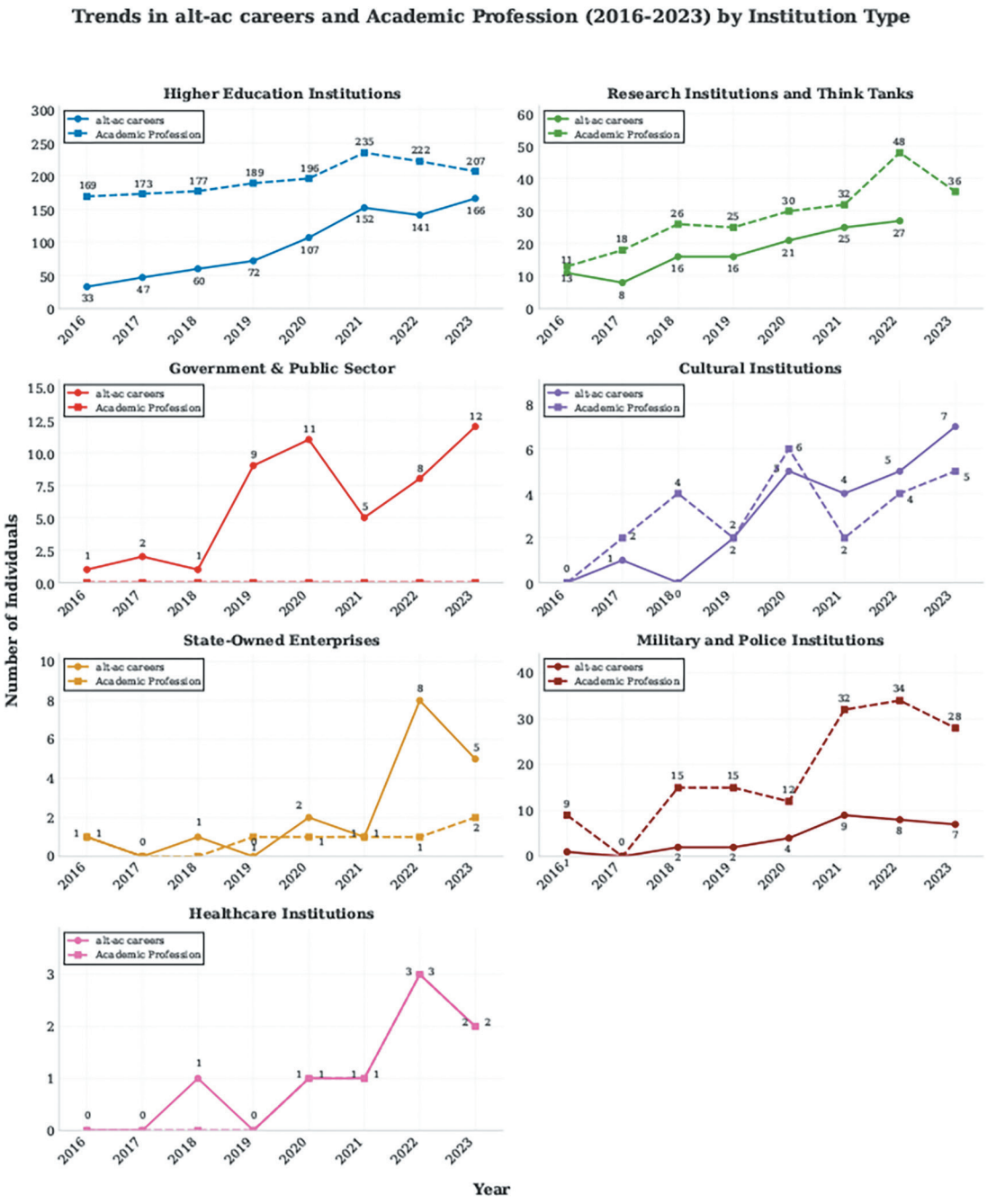
The classification of academic and Alt-Ac positions in Table 3 is based on a comprehensive review of job descriptions and institutional contexts. Academic positions are those that primarily involve teaching, research, and service responsibilities within traditional academic settings, such as university faculties and research institutes. Conversely, Alt-Ac positions are characterized by an emphasis on practical application, interdisciplinary collaboration, and engagement with diverse stakeholders beyond academia. These positions often require doctoral-level expertise but may not adhere to conventional academic norms and expectations. The research team validated the categorization of positions into academic and Alt-Ac roles through iterative coding and consensus.

TABLE 3
Distribution of Academic and Alt-Ac Positions Across Institution Types

Institution Type	Secondary Department	Position Type
Higher Education Institutions	Archives	Alt-Ac Positions
	Museums	
	Journal Editorial Offices	
	Administrative Departments (Research Management, Development Planning, etc.)	
	Libraries	
	Faculties	Academic Profession
	Postdoctoral Positions	
Research Institutions and Think Tanks	Administrative Departments	Alt-Ac Positions
	Journal Editorial Departments	
	Research Departments	Academic Profession
	Postdoctoral Positions	
Government & Public Sector	Public Institutions	Alt-Ac Positions
	CPC Party Schools	
	Civil Service	
Cultural Institutions	Public Libraries	Alt-Ac Positions
	Museums	
	Archives	
	Art Galleries	
	Postdoctoral Positions	Academic Profession
State-Owned Enterprises	Industry Intelligence Analysis Departments	Alt-Ac Positions
	Publishing Enterprises	
	Libraries	
	Archives	
	Postdoctoral Positions	Academic Profession
Military and Police Institutions	Libraries	Alt-Ac Positions
	Archives	
	Administrative Departments	
	Faculties	Academic Profession
Healthcare Institutions	Public Hospitals	Alt-Ac Positions
	Medical Research Institutes	
	Postdoctoral Positions	Academic Profession

To better understand the macro-level supply and demand dynamics, we created a trend graph comparing the growth patterns of academic and Alt-Ac positions (see Figure 2). The overall market demand for both types of positions has been on an upward trajectory, suggesting rising demand for LIS-trained expertise across sectors. The high demand for information-related professions across various industries explains this trend. Specifically, the expansion of LIS degree programs has led to a surge in the demand for faculty, thereby driving the growth

FIGURE 2
Growth Trends of Academic and Alt-Ac Positions in the LIS Job Market (2016–2023).



in demand for academic positions. Moreover, other fields, such as journalism and communication, public administration, and big data, are increasingly recognizing and valuing the LIS discipline. However, while academic positions still constitute most of the academic labor market, many of them are postdoctoral or temporary, indicating that officially budgeted posts are saturated, potentially limiting long-term career prospects in the traditional academic track.

Further elucidating the demand-side dynamics, and their implications for the LIS job market, necessitates examining the growth patterns and distribution of Alt-Ac positions

across different types of institutions. The data revealed that Alt-Ac positions have experienced significant growth across all institution types, although the pace and magnitude of growth vary. Higher education institutions have witnessed the most substantial increase in Alt-Ac positions, reflecting the evolving nature of academic libraries and the increasing importance of data-driven research and digital scholarship. Alt-Ac positions in research institutions and think tanks have also grown steadily, driven by the demand for specialized expertise in areas such as research data management, knowledge management, and policy analysis. Alt-Ac positions in government and public sector organizations have grown more modestly but still significantly, recognizing the value of LIS expertise in information policy, e-governance, and public service delivery. Cultural institutions, state-owned enterprises, military and police institutions, and healthcare institutions have all witnessed lesser growth in Alt-Ac jobs, each with its specific LIS needs.

The analysis of demand-side trends and patterns in the LIS job market highlights the growing importance and diversity of Alt-Ac career paths across various institutional contexts. Doctoral programs must adjust their curricula and career support services to meet job market demands as the LIS field evolves and expands. LIS education can help doctoral graduates succeed in academic and Alt-Ac careers by promoting interdisciplinary collaborations, transferable skills, and industry and government partnerships.

Institutional Differences in Alt-Ac Position Preferences

Alt-Ac positions in China's LIS field are unevenly distributed across institution types. Table 4 reports the nine position categories across seven institution types; Appendix A provides the full subcategory breakdown. These distributions reveal three broad patterns.

TABLE 4
Distribution of Alt-Ac Positions by Category and Institution Type

Category	Higher Education	Research Inst. & Think Tanks	Government & Public	Healthcare	Military & Police	Cultural	State-owned Enterprises
Subject services & research support	287	20	2	0	25	0	0
Collection development & digital humanities	116	18	0	3	0	53	0
Scholarly communication & publishing	58	34	2	0	20	0	0
Academic & industry research	69	60	60	0	35	42	11
Research data management	58	72	8	8	0	4	3
Intelligence & patent analysis	78	133	15	0	16	0	110
Archival management & compilation	70	35	17	8	6	0	32
Information systems & technical services	30	43	0	0	34	15	0
Administrative management	8	69	20	20	10	5	2
Total	774	484	124	39	146	119	158

Pattern 1: Research support and collections (higher education; cultural institutions). Higher education accounts for the largest volume of postings (774). Demand concentrates in subject services and research support (287) and collection development and digital humanities (116), with further demand in archival management and compilation (70) and scholarly communication and publishing (58). At the subcategory level, these roles center on research support and scholarly infrastructure (e.g., information literacy education; institutional repository; see Appendix A). Cultural institutions (119) show a narrower mix, led by collection development and digital humanities (53) and academic and industry research (42), with a smaller technical component (information systems and technical services, 15). Subcategory results indicate that collection-centered work is the main driver (e.g., ancient book and special collections; see Appendix A).

Pattern 2: Intelligence and data services (research institutions/think tanks; state-owned enterprises). Research institutions and think tanks (484) are led by intelligence and patent analysis (133) and research data management (72), alongside substantial shares in administrative management (69) and academic and industry research (60). Appendix A shows that this sector's intelligence demand often appears together with knowledge-management and data-mining tasks, while research administration is also prominent. State-owned enterprises (158) are markedly more concentrated. Intelligence and patent analysis dominates (110), and archival management and compilation forms the second-largest category (32). In Appendix A, industrial intelligence and project/archival functions account for much of this demand, indicating a narrower hiring profile compared with research institutions.

Pattern 3: Administration, policy, and systems (government/public; healthcare; military/police). Government and public sector postings (124) center on academic and industry research (60), with secondary demand in administrative management (20), archival management and compilation (17), and intelligence and patent analysis (15). Appendix A indicates that policy- and data-oriented research roles are a major component of this category. Healthcare postings (39) concentrated in administrative management (20), with research data management (8) and archival management and compilation (8) as the next category. Military and police institutions (146) split demand between academic and industry research (35) and information systems and technical services (34), with additional postings in subject services and research support (25) and scholarly communication and publishing (20). Subcategory results show a clear technical component (engineer roles) alongside research and internal dissemination roles (Appendix A).

These patterns have direct implications for doctoral training, as they reflect distinct combinations of skills and tasks. University and cultural settings draw heavily on research support, collections, and scholarly communication; research organizations and enterprises concentrate on intelligence- and data-related work; government, healthcare, and military/police settings place greater weight on administrative functions, policy-oriented research, and technical systems. Doctoral programs can respond by helping students identify target sectors early, demonstrate relevant competencies through applied projects or placements, and translate LIS skills into sector-specific language.

Analysis of Alt-Ac Position Requirements: Skills and Qualifications

We further investigated the specific skills and qualifications required for Alt-Ac positions discussed in the previous section. To gain a comprehensive understanding of the job

requirements, we employed the BERT-BiLSTM-CRF model to perform entity recognition on the job descriptions, including sections such as "characteristic duties and responsibilities." Due to the unique nature of different institutions, only one-third of the job announcements included detailed job responsibilities, with military and police institutions rarely providing such explanations. Table 5 presents the top 30 most frequently mentioned entities after entity recognition and manual clustering.

TABLE 5
Top 30 Entities in Alt-Ac Job Descriptions

Entity	Frequency
Research skills	107
English proficiency	99
Journal publication	88
Data analysis and mining	86
Statistical analysis tools	81
Programming skills	74
Literature and data collection	72
Team collaboration	70
Scientific research training	66
Coordination and communication	61
Information analysis	60
Project management	53
Digital technology	52
Communist Party member	48
Bibliometric (patent) analysis	47
Strategic planning	40
Patent agent certification	39
Age not exceeding 35	37
Organizational planning	36
Stress resistance	36
Project report writing	33
Intelligence monitoring	33
Science and technology consulting	31
Text mining	27
Professional literature	26
Journal manuscript planning	25
Curatorial skills	22
Innovative thinking	18
Knowledge services	16
Insight	15

Based on the data presented in Table 5, we classified the identified entities into five categories to analyze the skills and qualifications required for Alt-Ac positions.

1. **General Skills**: General skills encompass diverse competencies that are applicable across various Alt-Ac positions. These include "English proficiency" (99), "data analysis and mining" (86), "statistical analysis tools" (81), "programming skills" (74), "literature and data collection" (72), "information analysis" (60), "digital technology" (52), and "text mining" (27). The high frequency of these skills highlights the increasing importance of language proficiency, data literacy, technical competence, and information management abilities in the Alt-Ac job market. LIS doctoral programs should emphasize these transferable abilities to improve graduates' employability in varied institutional settings.
2. **Research Capabilities**: Research capabilities are central to many Alt-Ac positions, particularly those in higher education institutions and research institutes. Key entities in this category include "research skills" (107), "journal publication" (88), "scientific research training" (66), and "project report writing" (33), highlighting the importance of equipping LIS doctoral students with a strong foundation in research methodology, academic writing, and scholarly communication. Alt-Ac professionals are expected to contribute to knowledge production and dissemination, often collaborating with researchers from various disciplines. Therefore, developing a strong research skill set is crucial for success in these roles.
3. **Professional Knowledge**: Alt-Ac positions often require specialized professional knowledge specific to the LIS field and the institutional context. Entities such as "bibliometric (patent) analysis" (47), "patent agent certification" (39), "intelligence monitoring" (33), "science and technology consulting" (31), "professional literature" (26), "curatorial skills" (22), and "journal manuscript planning" (25) reflect the diverse domain expertise sought by employers, highlighting the need for LIS doctoral programs to provide students with opportunities to develop deep subject knowledge and practical skills aligned with the needs of different institutional sectors. Collaboration with industry partners and interdisciplinary coursework can help connect academic training and professional practice.
4. **Personal Qualities and Soft Skills**: Beyond technical competencies and domain knowledge, Alt-Ac positions also strongly emphasize personal qualities and soft skills. Entities such as "project management" (53), "team collaboration" (70), "coordination and communication" (61), "strategic planning" (40), "organizational planning" (36), "stress resistance" (36), "innovative thinking" (18), and "insight" (15) highlight the importance of leadership, teamwork, communication, problem-solving, and resilience in Alt-Ac roles. LIS doctoral programs should incorporate opportunities for students to develop these essential soft skills through experiential learning, internships, and professional development workshops. In addition to technical competencies, candidates are expected to adapt to heterogeneous role demands, given the project-based nature of the work and frequent cross-sector collaboration.
5. **Specific Position Preferences**: Some Alt-Ac job announcements express specific preferences or requirements for candidates. For example, positions within Chinese institutions frequently mention "Communist Party member" (48) and "age not exceeding 35" (37). These preferences may reflect the unique organizational culture, values, and demographic considerations of the employing institutions. Such preferences are not universal throughout Alt-Ac positions, but they emphasize the significance

of understanding the institutional setting and personalizing one's application and professional development.

The analysis of Alt-Ac position requirements revealed a range of skills and qualifications that LIS doctoral graduates must possess to succeed in these roles. The findings emphasize the necessity for an integrated approach to doctoral education that develops general skills, research ability, professional knowledge, and personal attributes. LIS doctoral programs should regularly review and adapt their curricula to meet Alt-Ac job market demands, preparing graduates who can adapt to diverse professional contexts.

Implications for LIS Doctoral Education

The findings of this study highlight the need for LIS doctoral education to better align with the evolving labor market for alternative-academic (Alt-Ac) careers. Doctoral training that implicitly assumes a primarily tenure-track trajectory may not sufficiently prepare graduates for the diverse skill sets and work contexts associated with Alt-Ac roles. Accordingly, LIS doctoral programs may benefit from complementing deep disciplinary expertise with broader preparation for interdisciplinary collaboration, applied research, and professional practice across varied organizational settings.

Drawing on our literature review and empirical results, we propose a framework to strengthen LIS doctoral education for Alt-Ac job seekers along four dimensions:

1. Training objectives: Clarify program goals beyond academic placement by explicitly incorporating transferable competencies (e.g., research design, data analysis, project management, and stakeholder communication) alongside scholarly productivity.
2. Curriculum design: Balance theoretical foundations with applied learning by integrating interdisciplinary coursework and structured experiential opportunities (e.g., practicums, internships, or project-based collaborations) that mirror Alt-Ac work environments.
3. Career development support: Institutionalize career guidance through mentorship and professional networks by leveraging Alt-Ac alumni, strengthening faculty awareness of nonfaculty career pathways, and providing dedicated advising resources within LIS departments.
4. Policy and institutional ecosystem: Expand support beyond individual programs by fostering partnerships among universities, professional associations, and employers, and by advocating for institutional and policy mechanisms that recognize and value doctoral-level contributions in Alt-Ac roles.

Limitations and Future Directions

This study has several limitations. First, the conceptualization and operationalization of Alt-Ac careers in LIS would benefit from further clarification and greater disciplinary consensus, particularly regarding boundary cases that blur academic and professional roles. Second, job-posting data may contain noise and may not fully reflect hiring outcomes or informal recruitment channels, which can affect measurement validity. Third, cross-institutional comparisons may be influenced by unobserved confounders (e.g., regional labor-market conditions, institutional resources, or differences in program structures) that are difficult to control with available data. Future research could improve robustness by triangulating postings with

additional data sources (e.g., placement records, employer interviews, or longitudinal career trajectories) and by developing refined classification schemes for Alt-Ac roles in LIS.

Conclusion

This study provides an empirical examination of the transformation of the LIS doctoral job market in China from an Alt-Ac perspective. On the supply side, analysis of 21 LIS doctoral programs indicates rapid enrollment expansion following the 2017 "Double First-Class" initiative, alongside a structural shift toward first-level disciplines and self-established interdisciplinary second-level tracks (e.g., data science and digital humanities). On the demand side, analysis of 10,331 job postings shows notable growth in Alt-Ac opportunities across multiple institutional settings—including academic libraries, research institutes, government agencies, and technology companies—with employers increasingly emphasizing skills related to data analysis, research methods, and interdisciplinary collaboration.

Beyond the Chinese context, our findings speak to broader discussions in the international LIS community regarding the relationship between doctoral education and changing career structures. The framework proposed here—focused on training objectives, curriculum design, career development infrastructure, and broader ecosystem support—offers a set of actionable considerations for LIS programs seeking to prepare graduates for diverse career pathways as the information professions continue to evolve amid artificial intelligence and digital transformation.

Taken together, the results address the study's three research questions: (RQ1) LIS doctoral enrollment in China has expanded rapidly with a growing emphasis on first-level and interdisciplinary training, reshaping the supply of graduates; (RQ2) Alt-Ac positions constitute a significant and growing component of employer demand beyond conventional faculty roles; and (RQ3) this transformation suggests that LIS doctoral programs should broaden their educational mission to prepare graduates with transferable skills, applied experience, and adaptability for an expanding range of professional contexts.

Competing Interests

Author Ye Tian is the developer and administrator of the "LIS Jobs" platform, which was used as a data source in this study. The platform aggregates publicly available job postings and is operated on a non-commercial basis. The authors declare that this relationship did not influence the study design, data analysis, interpretation, or reporting of results.

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APPENDIX A
Subcategory Distribution by Institution Type

Category	Subcategory	HE	RI	Gov	Health	MP	Cult	SOEs
Collection Development & Digital Humanities	Ancient Book and Special Collections	41	4	0	2	0	14	0
	Digital Humanities	26	11	0	0	0	3	0
	Document Development	16	3	0	1	0	14	0
	Ancient Book Restoration	23	0	0	0	0	10	0
	Collection Curation	10	0	0	0	0	12	0
	Total	116	18	0	3	0	53	0
Research Data Management	Data Literacy	26	22	0	1	0	2	1
	Data Curation	23	25	0	2	0	0	0
	Data Ethics	7	11	5	3	0	2	0
	Data Policy	2	7	3	1	0	0	0
	Data Security	0	7	0	1	0	0	2
	Total	58	72	8	8	0	4	3
Subject Services & Research Support	Information Literacy Education	85	0	0	0	0	0	0
	Subject Librarians	48	5	0	0	20	0	0
	Science and Technology Novelty Search	64	5	1	0	0	0	0
	Academic Evaluation	59	3	1	0	0	0	0
	Subject Intelligence	31	7	0	0	5	0	0
	Total	287	20	2	0	25	0	0
Archival Management & Compilation	Archival Compilation	43	5	3	0	4	0	2
	Archival Big Data	5	16	10	1	0	0	3
	Project Archival Management	0	10	0	0	0	0	16
	Archival Informationization	0	4	1	7	2	0	11
	University History Research	22	0	3	0	0	0	0
	Total	70	35	17	8	6	0	32
Intelligence & Patent Analysis	Intellectual Property	52	24	15	0	0	0	0
	Intelligence Analysis	24	11	0	0	9	0	40
	Knowledge Management	0	66	0	0	0	0	0
	Industrial Intelligence	0	0	0	0	0	0	65
	Data Mining	2	32	0	0	7	0	5
	Total	78	133	15	0	16	0	110

Category	Subcategory	HE	RI	Gov	Health	MP	Cult	SOEs
Information Systems & Technical Services	Semantic Technologies	10	25	0	0	0	0	0
	Engineers	0	0	0	0	4	0	0
	Knowledge Service Systems	4	15	0	0	0	2	0
	Systems Maintenance	13	3	0	0	0	1	0
	Smart Library	3	0	0	0	0	12	0
	Total	30	43	0	0	4	15	0
Scholarly Communication & Publishing	Journal Editing	26	8	1	0	20	0	0
	Institutional Repository	24	1	0	0	0	0	0
	Open Publishing	1	12	0	0	0	0	0
	Science Communication	0	11	1	0	0	0	0
	OA Transformation Agreements	7	2	0	0	0	0	0
	Total	58	34	2	0	20	0	0
Academic & Industry Research	Academic Research	56	9	2	0	0	18	11
	Industry Research	13	34	15	0	0	3	0
	Policy Research	0	17	20	0	0	6	0
	Researchers	0	0	0	0	35	3	0
	Data Research	0	0	23	0	0	12	0
	Total	69	60	60	0	35	42	11
Administrative Management	Research Management	4	68	0	0	0	0	0
	Development Planning	4	0	0	19	10	5	0
	General Management	0	1	13	1	0	0	0
	E-Governance	0	0	7	0	0	0	2
	Total	8	69	20	20	10	5	2

Note: HE = Higher education; RI = Research institutions and think tanks; Gov = Government and public sector; Health = Healthcare; MP = Military and police; Cult = Cultural institutions; SOEs = State-owned enterprises.