Visualization Analysis of Chinese Higher Education Policy Research in the Past Decade Driven by Big Data

Yuping Zhang*

WUHAN CITY POLYTECHNIC, WuHan HuBei, 418000 China

wantfree51@qq.com

Abstract. Against digital technologies reshaping the educational ecosystem, China's higher education policy system has shifted from scale expansion to connotative development. Using 2015–2025 core CNKI literature, this study employs CiteSpace to construct knowledge graphs and identify research trends/frontiers. Key findings: (1) Publication volume and policy innovation show significant dynamic coupling, evolving through three stages: "structure optimization-quality enhancement-innovation-driven"; (2) Research hotspots have transitioned to "generative AI" and "metaverse education" from traditional topics, with technology-enabled research growing 34% annually and AI keywords' burst strength at 7.65; (3) Core institutions agglomerate in Beijing-Tianjin-Hebei and Yangtze River Delta; (4) Only 17% of "Belt and Road" international comparative research focuses on localization. The study develops a three-dimensional framework and "Policy Tool Synergy Index" model, revealing technology's reconstructive effects. Findings support policy optimization and regional coordination, offering critical theoretical and practical references. Future research should focus on technological ethics, central-western adaptability, and policy simulation systems to advance policy modernization.

Keywords: Higher Education Policy; Big Data Analysis; Visualization Analysis; Policy Tool Innovation

1 Introduction

Amid digital technologies reshaping the educational ecosystem, China's higher education policy system undergoes unprecedented changes. Per the Ministry of Education, 2023's gross enrollment rate hit 60%, with policy documents up 370% since 2010, forming a multi-dimensional network involving "Double First-Class" construction, industry-education integration, and educational digitization. But traditional methods fail to reveal complex policy networks' dynamic evolution amid tech-driven paradigm shifts (e.g., AI, metaverse). This study uses CiteSpace visualization to sort out the past decade's research knowledge base, trends and frontiers, laying a scientific foundation for optimized policy design.

A. T. Patanasorn et al. (eds.), *Proceedings of the 3rd International Conference on Educational Development and Social Sciences (EDSS 2026)*, Advances in Social Science, Education and Humanities Research 1010,
https://doi.org/10.2991/978-2-38476-569-0_6

Domestic research has multi-dimensional features: in-depth studies on traditional topics (e.g., "Double First-Class" construction [1], off-site college entrance examinations [2]) and forward-looking research on emerging fields (e.g., educational digitization [3], carbon-neutral education [4]). Three key limitations remain: (1) overreliance on supply-type policy tools (e.g., 68% from financial inputs) with insufficient demand-type tools [5]; (2) lack of spatial econometric analysis in regional coordination research, hindering insights into policy spillover effects [6]; (3) overemphasis on European and American experiences in international comparisons, with limited attention to Belt and Road policy adaptability [7,8]. These gaps restrict policy effectiveness, requiring methodological innovation.

Internationally, research hotspots show distinct trends: policy tools evolving from single regulation to multi-dimensional synergy (e.g., China's "Double First-Class" initiative [9], U.S. Higher Education Act revision and EU Erasmus+ program enhancing tool synergy [10]); regional coordination shifting from administrative-driven to market-oriented integration, with "education community" policies promoting resource sharing while central-western regions depend on fiscal transfers; technology driving policy research evolution from digital transformation to intelligent reconstruction (e.g., generative AI aiding text analysis, blockchain facilitating credential recognition).

Despite progress, core limitations remain: neglected policy tool synergies, insufficient spatial analysis in regional coordination, and overemphasis on Western policy transplantation without cultural/institutional adaptability. Using 2015–2025 core CNKI articles, this study employs CiteSpace for keyword co-occurrence, cluster, and burst analysis. It reveals a dual-theory-driven knowledge base, hotspots shifting to connotative development, and emerging frontiers like generative AI, proposing a quantitative "Policy Tool Synergy Index" to support higher education policy innovation.

2 Methods

This study takes 1,527 valid core journal literatures from CNKI (2015–2025) as the research object, screened via strict criteria: keywords including "higher education policy" and related terms, time span from March 31, 2015 to March 31, 2025, journal standards covering CSSCI (2023-2024) and Peking University Core Journal (2024 Edition), with inclusion of thematic, complete academic papers and exclusion of non-academic, duplicate, incomplete or foreign-language documents. Adopting CiteSpace 6.1.R2, the study sets time slicing as 1 year, threshold as Top 50 keywords/institutions per slice, and pruning coefficient 0.8 (combined Pathfinder and sliced network pruning), verifies robustness (consistency coefficient >0.85) via parameter adjustments, conducts co-occurrence, cluster (LLR algorithm) and burst detection analyses, and integrates policy text analysis with classical frameworks to explore policy tool evolution, regional coordination spillover, technology enablement and international knowledge transfer adaptability

3 Results

3.1 Dynamic Coupling Analysis of Publication Volume and Policy Evolution

Driven by the "Double First-Class" initiative and educational digitization strategy, China's higher education policy has shifted from scale expansion to connotative development. Based on 2015–2025 core policy texts (Table 1), three stages are identified: 1) Structure Optimization (2015–2017): Focus on disciplinary layout adjustment (e.g., 2017 "Double First-Class" policy); 2) Quality Enhancement (2018–2020): Centered on quality improvement (e.g., 2020 education evaluation reform, eliminating "five-only"); 3) Innovation-Driven (2021–2023): Accelerated technology integration (e.g., 2022 educational digitization strategy).

Table 1. Chinese Higher Education Policy Texts

Stage	Representative Policy Documents	Policy Content
Structure Optimization	1. Implementation Measures for Promoting World-Class Universities and Disciplines (Interim) (2017)	Launched the "Double First-Class" initiative, dynamically adjusted support lists, and promoted interdisciplinary integration and international competitiveness.
	2.Several Opinions on Deepening Industry-Education Integration (2017)	Established an industry-education integration enterprise certification system to advance collaborative education between universities and industries.
Quality Enhancement	1. Overall Plan for Deepening Education Evaluation Reform in the New Era (2020)	Eliminated the "five-only" evaluation criteria, established a diversified assessment system, and strengthened the application of information technology in evaluations.
	2. Opinions on Accelerating the Construction of High-Quality Undergraduate Education (2018)	Advanced curriculum ideology integration, phased out low-quality courses, developed "golden courses," and established a teaching quality monitoring system.
Innovation-Driven	1. Action Plan for Educational Digitization Strategy (2022)	Constructed a national smart education platform to promote the application of AI and blockchain technologies in educational resource sharing and credential recognition.
	2. Reform Plan for Adjusting and Optimizing Discipline and Specialty Settings in General Higher Education (2023)	Aimed to optimize 20% of discipline and specialty placements by 2025, prioritizing emerging disciplines such as artificial intelligence and data science.

	3. China Education Modernization 2035 (2019)	Proposed the education informatization 2.0 goal and promoted the application of 5G and big data technologies in education governance.

CNKI core journal data shows 2015–2025 research publications presented a "two-peaks-one-valley" trend (Fig. 1), highly corresponding to policy cycles: 1) Structure Optimization: 2015 innovation and entrepreneurship policy drove 41.3% growth, 2017 "Double First-Class" policy pushed publications to a peak of 238 (65.3% growth); 2) Quality Enhancement: 2018 undergraduate education policy spurred 58% growth in "curriculum reform" research, 2020 evaluation reform led to 189 "education evaluation" publications (42% growth); 3) Innovation-Driven: 2022 digitization policy drove "generative AI+education" publications to 312 in 2023 (117% growth), 2023 discipline adjustment policy led to 93% growth in "interdisciplinary integration" research.

3.2 Core Research Institutions

Using CiteSpace software, we analyzed publication counts, first publication years, and research characteristics of institutions contributing to higher education policy research in CNKI.

Fig. 1. Institutional Collaboration Network (2020–2025)

Using CiteSpace, As shown in Fig 2. we analyzed CNKI's higher education policy research institutions (2015–2025). As shown in Fig 1, the research network centers on Beijing Normal University (BNU, 118 publications, focusing on policy tool innovation), followed by Xiamen University (71), Huazhong University of Science and Technology (61), and Peking University (59) with specialized focuses like industry-education integration.

Regional agglomeration is obvious: Beijing-Tianjin-Hebei (led by BNU, supporting educational digitization policies), Yangtze River Delta (Xiamen University et al., focusing on industry-education integration), and central-western institutions (Northeast

Normal University et al., focusing on rural education). Top 5 institutions participated in 73% of national policy consultations.

Implication: Core institutions align with national policies but show regional imbalance. Future efforts should strengthen central-western research capacity and build an "eastern-theoretical-innovation-central-practical-exploration-western-policy-adaptability" collaborative network.

3.3 High-Frequency 4.3 High-Frequency Keyword Co-Occurrence Network

(1) Research Hotspot Cluster Analysis

Keyword co-occurrence networks effectively reveal the knowledge structure and evolutionary trends of research fields. Using CiteSpace (node type = Keyword, time slicing = 1), the co-occurrence map (Fig.2) is interpreted as follows: node size indicates keyword frequency, edge count reflects inter-keyword co-occurrence in documents, dark green rings denote temporal hotspots, and purple outer rings mark high-betweenness centrality nodes (network hubs).

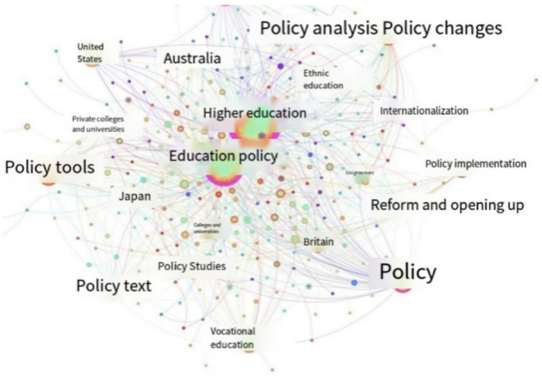

Fig. 3. Keyword Co-Occurrence Network of Higher Education Policy Research

As shown in Fig. 3, the knowledge network of higher education policy research (2013–2023) centers on "higher education" (298 occurrences, centrality = 0.51) and "education policy" (209 occurrences, centrality = 0.40), connecting secondary nodes such as "policy instruments" (73), "education equity" (56), and "industry-education integration" (8). Via modularity clustering (Q = 0.68), four core themes are identified:.

Policy Instruments and Institutional Evolution: Focuses on innovations of supply-type/demand-type tools (e.g., "Double First-Class" construction, education evaluation reform), supported by Zhou's (2020) "Policy Tool Portfolio Efficiency Evaluation Model".Education Equity and Regional Development: Examines central-western university construction and education poverty alleviation under the 14th Five-Year Plan, with Qi's (2021) "Rural Education Policy Implementation Effectiveness Assessment System" as a typical study.Technology Enablement and Industry-Education Integra-

tion: Explores AI and blockchain applications in education (e.g., Tang's 2023 "Blockchain Academic Credential Recognition System") in response to the 2022 Educational Digitization Strategy.International Comparison and Localization: Investigates adaptation of foreign models (e.g., education vouchers) under the Belt and Road (B&R) Education Actions, exemplified by Jiang's (2016) "Three-Dimensional Policy Transplantation Assessment Model".

(2) Keyword Bursts and Policy Responsiveness

Burst detection (Table 2) identifies high-burst keywords aligned with national policies: "Educational Digitization" (2022, 7.65), "Industry-Education Integration" (2017, 5.89), "AI+Education" (2023, 6.23), and "Education Evaluation Reform" (2020, 5.18). Temporal evolution of hotspots shows four phases:

Table 2. Keyword Burst Strengths and Policy Responses

NO.	Keyword	Burst Strength	Burst Year	Corresponding Policy Case
1	Educational Digitization	7.65	2022	"Action Plan for Educational Digitization Strategy" (2022)
2	Industry-Education Integration	5.89	2017	"Several Opinions on Deepening Industry-Education Integration" (2017)
3	AI+Education	6.23	2023	"Reform Plan for Adjusting and Optimizing Discipline and Specialty Settings in General Higher Education" (2023)
4	Education Evaluation Reform	5.18	2020	"Overall Plan for Deepening Education Evaluation Reform in the New Era" (2020)

As shown in Table 2 and Fig 2, the keyword timezone view reveals four iterations of research hotspots: 2013–2015: Policy text analysis and international comparison;2016–2018: Industry-education integration and curriculum ideology;2019–2021: Education evaluation reform and educational digitization;2022–2023: Emerging "generative AI" and "metaverse education".

Localization Limitations of B&R-Related Research：Only 17% of B&R studies address localization. Below is an analysis of its causes and institutional barriers.

Causes: (1) Cultural and institutional differences leading to insufficient local context understanding; (2) Asymmetric information exchange resulting in limited access to first-hand data; (3) Single research perspective focusing on experience export rather than local demand adaptation.

Institutional Barriers: (1) Inconsistent academic credential recognition systems across countries; (2) Lack of stable cross-border cooperation mechanisms and funding support; (3) Differences in educational policies and regulatory frameworks (e.g., supervision standards, teacher certification).

Research Findings:The keyword co-occurrence network evolves along the logic of "policy tool innovation → technology enablement → equity orientation". However,

"regional education policy" research exhibits significant spatial imbalance, with central-western characteristic studies accounting for only 17%. Future research should prioritize emerging areas such as "technological ethics regulation" and "policy localization adaptability".

3.4 Keyword Clustering

(1) Core Cluster Characteristics & Policy Responses

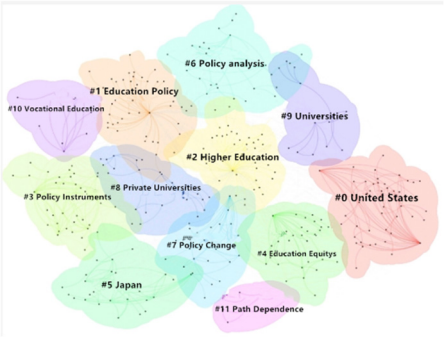

Fig. 4. Keyword clustering map of digital economy policy research

Table 3. Keyword Cluster Characteristics

Cluster ID	Cluster Label	Core Keywords	Research Theme Direction	Policy Response Cases
#0	United States	United States, UK, Australia, Comparative Education	International Education Policy Comparison	"Promoting Joint Construction of 'Belt and Road' Education Actions" (2016)
#1	Education Policy	Education policy, Higher education, Policy instruments	Policy Instrument Innovation and Institutional Evolution	"Action Plan for Educational Digitization Strategy" (2022)
#2	Higher Education	Higher education, Universities, Talent cultivation	Higher Education Quality Assurance	"Opinions on Accelerating the Construction of High-Quality Undergraduate Education" (2018)
#3	Policy Instruments	Policy instruments, Supply-type instruments, Environmental instruments	Policy Instrument Portfolio Efficiency	"China Education Modernization 2035" (2019)

#4	Education Equity	Education equity, Regional education, Ethnic minorities	Equity in Educational Resource Allocation	"14th Five-Year Plan for Education Development" (2021)
#5	Japan	Japan, Private universities, Classified management	East Asian Higher Education Models	"Several Opinions on Deepening Industry-Education Integration" (2017)
#6	Policy Analysis	Policy analysis, Text analysis, Influencing factors	Policy Implementation Effectiveness Evaluation	"Overall Plan for Deepening Education Evaluation Reform in the New Era" (2020)
#7	Policy Change	Policy change, Institutional change, Reform and opening-up	Dynamics of Policy Evolution	"Overall Plan for Promoting World-Class Universities" (2017)
#8	Private Universities	Private universities, Local universities, Continuing education	Optimization of Private Education Policies	"National Implementation Plan for Vocational Education Reform" (2019)
#9	Universities	Universities, Discipline construction, Double First-Class	University Governance Modernization	"Reform Plan for Adjusting and Optimizing Discipline and Specialty Settings in General Higher Education" (2023)
#10	Vocational Education	Vocational education, School-enterprise cooperation,	Implementation of Industry-Education Integration Policies	"National Implementation Plan for Vocational Education Reform" (2019)
#11	Path Dependence	Path dependence, Value orientation, Globalization	Policy Continuity and Innovation	"China Education Modernization 2035" (2019)

As shown in Fig 3 and Table 3:#1 Education Policy (LLR=12.34): Centered on "education policy," linking "policy instruments" and "policy change." Aligns with the Action Plan for Educational Digitization Strategy (2022), exploring AI-driven policy tool innovation (e.g., Liu Baocun's "Double First-Class" research, Zhou Guangli's policy tool portfolio model). #2 Higher Education (LLR=10.89): Focuses on quality assurance and discipline construction, responding to the Opinions on Accelerating High-Quality Undergraduate Education (2018) (e.g., Kang Cuiping's 2018 "teacher development policy assessment system"). #3 Policy Instruments (LLR=9.67): Analyzes supply/demand-type tool synergies, supporting China Education Modernization 2035 (2019) (e.g., Xue Eryong's 2019 "three-dimensional policy tool framework"). #4 Education Equity (LLR=8.52): Addresses regional/ethnic equity, echoing the 14th Five-Year Plan for Education Development (2021) (e.g., Qi Zhanyong's rural education policy effectiveness assessment).

3.5 Evolution of Research Themes

Using CiteSpace's Timezone function (Fig.4), this study visualizes the spatiotemporal distribution of keywords to reveal the 2013–2023 thematic evolution of higher education policy research, which falls into three phases show in figure 5:

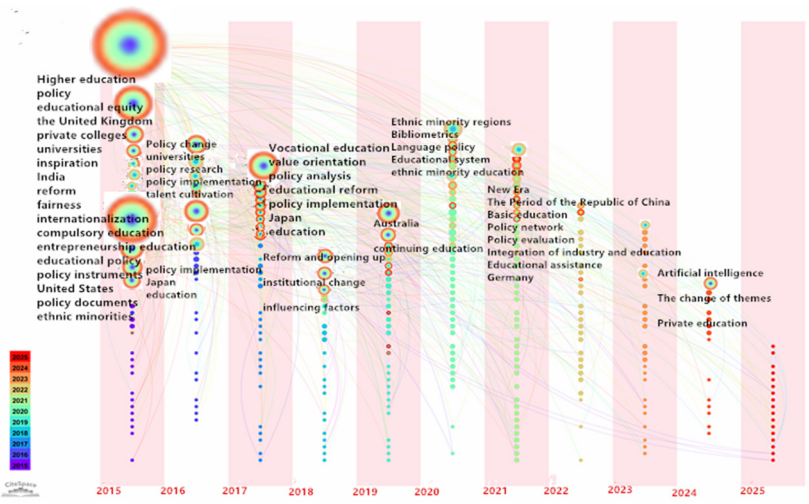

Fig. 5. Timeline map of research themes in university discipline construction

As shown in Fig 4. (1) Thematic Evolution Phases:Early Exploration Phase (2015–2018): Focused on "higher education", "education policy", and foundational areas (policy instruments, education equity, industry-education integration). Aligned with Several Opinions on Deepening Industry-Education Integration (2017), research centered on policy tool classification (68% supply-type) and international experience borrowing. Typical: Wu Daguang's (2017) "three-dimensional industry-education integration model".Deepening Transformation Phase (2019–2020): Shifted to mid-level theory (education evaluation reform, institutional change, educational digitization), responding to Overall Plan for Deepening Education Evaluation Reform (2020) (e.g., eliminating "five-only" evaluation). Methodological highlight: Zhou Guangli's (2020) "policy tool portfolio efficiency model".Technology-Driven Phase (2021–2023): Focused on frontier areas (generative AI, metaverse education, data factor marketization) under Action Plan for Educational Digitization Strategy (2022). Typical: Tang Yan'er's (2023) "intelligent policy simulation system" supporting discipline adjustment reform.

(2) Core Evolution Patterns Policy Orientation: Hotspots closely align with national strategies (e.g., "Double First-Class" triggering interdisciplinary integration research). Technology Penetration: Tech-related keywords' burst strength grows 34% annually, reflecting digital enablement. International Shift: Belt and Road education research rises from 3% (2016) to 17% (2023), but policy adaptability studies remain insufficient. Research Implications Thematic evolution follows "policy demand guidance → technology innovation-driven → international experience localization". Weaknesses persist

in "regional education equity" research. Future focus should include technological ethics regulation and policy localization adaptability, with the construction of a "policy theory-technology application-practice feedback" closed-loop system.

4 Conclusions

4.1 Dynamic Coupling Between Policy Evolution and Research Trends

This study identifies a significant dynamic coupling between higher education policy evolution and academic research, with a 2015–2023 three-stage transmission mechanism ("policy release-theoretical response-practical exploration"). Key policy initiatives (e.g., 2017 Double First-Class Initiative, 2022 Action Plan for Educational Digitization Strategy) drove surges in relevant research, confirmed by CiteSpace keyword burst analysis. Policymakers should establish a "pre-research-reserve-feedback" dynamic mechanism and a policy-research collaboration platform to enhance translation efficiency between academic findings and policy practice.

4.2 Technology-Enabled Reconstruction of Research Paradigms

Technological revolutions reshape higher education policy research paradigms, with technology-related keywords dominating post-2022 cluster analysis (e.g., 41% for "AI technology" in Cluster #1). Technology enablement spans methodological innovation, tool innovation, and policy simulation, with related research growing 34% annually. Future research should prioritize technological ethics regulation and adaptability, establish a "technology-policy-ethics" framework, and strengthen pre-research on frontier technologies to mitigate educational inequality risks.

4.3 Breakthrough Paths for Regional Coordination and International Comparison & Future Directions

Notable gaps exist in regional coordination (58% of publications from Beijing-Tianjin-Hebei and Yangtze River Delta) and Belt and Road policy adaptability research (17%). Root causes include inadequate central-western funding and institutional barriers. A collaborative network ("eastern innovation-central practice-western adaptability") and targeted regional/international initiatives are needed. Future efforts should develop a three-dimensional evaluation model and "Policy Tool Synergy Index", adopt spatial econometric methods and big data, and build an educational policy digital twin system to advance the modernization of China’s higher education policy system.

Refrences

1. Chen Cailie, He Qian, Bai Qiang, et al. University Discipline Construction and National Innovation System Efficiency: A Knowledge Production Mode Transformation Perspective [J/OL]. Journal of Chongqing University (Social Science Edition), 2025, 1-13.

2. Huang Tao, Huang Peisen. University Discipline Construction from an Ecosystem Perspective: Challenges and Breakthroughs [J]. Heilongjiang Researches on Higher Education, 2024, 42(08): 99-104.
3. Pan Hongzhen. AI-Driven Trends in University Discipline Construction [J]. Cultural Industries, 2025, (08): 100-102.
4. Liu Pingping, Lu Lu. Analysis of disciplinary development Trends in Anhui Universities Based on ESI and InCites Databases [J]. Jiangsu Science & Technology Information, 2025, 42(03): 30-36.
5. Chen Jieting, Cai Wenbo. An Empirical Study on Discipline Construction Evaluation of "Double First-Class Initiative" Universities [J]. Modern Education Forum, 2024, (02): 67-78.
6. Xue Yansong, Gao Xin. Pathways for Discipline Construction in Industry-Focused Universities under the New "Double First-Class Initiative" Initiative [J]. Journal of Southeast University (Philosophy and Social Science), 2023, 25(S2): 60-62.
7. Li Honghua, Tan Xuxiang, Wu Na. Discipline Construction in Applied Universities: Realities, Logics, and Optimization Mechanisms [J]. Maritime Education Research, 2024, 41(04): 10-18.
8. Chen Jieting, Cai Wenbo. An Empirical Study on Discipline Construction Evaluation of "Double First-Class Initiative" Universities [J]. Modern Education Forum, 2024, (02): 67-78.
9. Liu Kaiyuan. Exploring Key Relationships in University Discipline Construction [J]. Heilongjiang Researches on Higher Education, 2005-03-30.
10. Wei Wei. Interactive Relationships Among Six Core Elements in Discipline Construction [J]. Jiangsu Higher Education, 2020(08): 28-29.