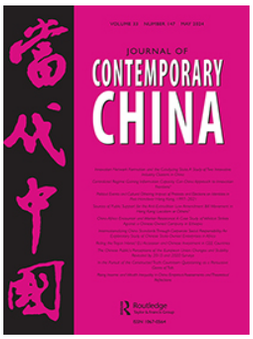

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Development of New Generation of Artificial Intelligence in China: When Beijing's Global Ambitions Meet Local Realities

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ABSTRACT

How did China become one of the leaders in AI development, and will China prevail in the ongoing AI race with the US? Existing studies have focused on the Chinese central government's role in promoting AI. Notwithstanding the importance of the central government, a significant portion of the responsibility for AI development falls on local governments' shoulders. Local governments have diverging interests, capacities and, therefore, approaches to promoting AI. This poses an important question: How do local governments respond to the central government's policies on emerging technologies, such as AI? This article answers this question by examining the convergence or divergence of central and local priorities related to AI development by analysing the central and local AI policy documents and the provincial variations by focusing on the diffusion of the New Generation Artificial Intelligence Development Plan (NGAIDP) in China. Using a unique dataset of China's provincial AI-related policies that cite the NGAIDP, the nature of diffusion of the NGAIDP is examined by conducting content analysis and fuzzy-set Qualitative Comparative Analysis (fsQCA). This study highlights the important role of local governments in China's AI development and emphasises examining policy diffusion as a political process.

Introduction

Artificial intelligence (AI) is one of the most transformative technologies of today. While countries worldwide strive to establish technological superiority in AI, China has emerged as one of the two leaders in the global AI development.[1] The country ranks first in terms of AI-related patents generated, research articles published and research articles cited worldwide. It is also rapidly developing an ecosystem that facilitates the application of AI systems in everyday life. Due to its rapid progress amidst the rising geopolitical tensions between the US and China, AI has emerged as the new frontier of the US and China rivalry.[2]

China's remarkable progress could not have been possible without the government's direct involvement. Ever since the issue of the 2017 New Generation AI Development Plan (NGAIDP), the Chinese central government has considered AI as a national strategic sector and targeted the

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[1]Hongzhou Zhang and Shaleen Khanal, 'To Win the Great AI Race, China Turns to Southeast Asia', *Asia Policy* (2024), p. 21.

[2]Jing Cheng and Jinghan Zeng, 'Shaping AI's Future? China in Global AI Governance', *Journal of Contemporary China* (2022), p. 1; Nicholas Wright, 'How Artificial Intelligence Will Reshape the Global Order', *Foreign Affairs* 10, (2018).

development of AI as a national priority.[3] Simultaneously, the Chinese government also launched the National New Generation AI Innovation and Development Pilot Zone, integrated AI as a priority sector in the fourteenth 5-year plan, and has been at the forefront of developing guidelines and regulations for developing trustworthy AI.[4] These efforts have been reflected in significant government investments in research and development and the commercialisation of AI within China.[5]

While the role of the central government in AI development in China cannot be overstated,[6] existing studies have not adequately paid attention to the important role local governments have played in this process. The dual system of responsibility characteristic of the Chinese political system implies local governments play a crucial role in technology development.[7] However, given the unequal financial and technological capacities of various local governments, the inherent interests of the local governments in promoting new and emerging technologies are likely to be very different.[8] Provinces with high economic and technological capacities are likely to be interested in sustaining their competitive edge by investing in such technologies, while the priorities of less economically developed economies are likely to be more divergent.[9] Some governments are likely to embrace new technologies as potential for lift-off, while others might opt for a safer choice of promoting such technologies once they reach a certain degree of maturity and sophistication. Under such circumstances, the interests, priorities and strategies of local governments and central government in AI development might be very different. This discussion becomes especially pertinent in the case of AI because the current narrative on China and AI has focused on the strategic interests and implications of the technology.[10]

This article addresses these gaps by comparing and contrasting central and local policy priorities and examining the nature and form of diffusion of AI policy in China. Taking the 2017 NGAIDP as a mandated central policy, it examines the responses of China's provincial governments in implementing this policy. The findings show that local provinces allocate significant financial and policy resources to advance AI development and, therefore, are important actors in the development of AI within China. However, the findings of this article also show differences in the priorities of central and local governments, where local governments prioritize local economies and do not share the security-related ambitions that the central government attaches with AI. Finally, the findings also shed light on the importance of variations in local governments' capacities in their AI-related policy design with politically and economically powerful provinces more prone to faster and localised policies than others. Overall, the findings highlight the important role played by local governments in AI development in China.

[3]Fei Wu and others, 'Towards a New Generation of Artificial Intelligence in China', *Nature Machine Intelligence* 2, (2020), p. 312.
[4]Huw Roberts and others, 'The Chinese Approach to Artificial Intelligence: An Analysis of Policy, Ethics, and Regulation', *AI & Society* 36, (2021), p. 59.
[5]Ashwin Acharya and Zachary Arnold, 'Chinese Public AI R&D Spending: Provisional Findings', (CSET 2019) CSET Issue Brief. Accessed November 28, 2023. https://cset.georgetown.edu/publication/chinese-public-ai-rd-spending-provisional-findings/; Ngor Luong, Zachary Arnold and Ben Murphy, 'Understanding Chinese Government Guidance Funds', (CSET 2021) CSET Issue Brief. accessed November 28, 2023, https://cset.georgetown.edu/publication/understanding-chinese-government-guidance-funds/.
[6]Roberts and others (n 5); Wu and others (n 4).
[7]Xufeng Zhu, 'Mandate Versus Championship: Vertical Government Intervention and Diffusion of Innovation in Public Services in Authoritarian China', *Public Management Review* 16, (2014), p. 117.
[8]JC Teets and W Hurst, 'The Politics and Patterns of Policy Diffusion in China', *Local Governance Innovation in China* (1st ed, Routledge, 2004).
[9]Cui Huang and others, 'A Bibliometric Study of China's Science and Technology Policies: 1949–2010', *Scientometrics* 102, (2015), p. 1521.
[10]Gregory A Allen, 'Understanding China's AI Strategy: Clues to Chinese Strategic Thinking on Artificial Intelligence and National Security' (Center for a New American Security (CNAS) 2019); Jinghan Zeng, 'Artificial Intelligence and China's Authoritarian Governance', *International Affairs* 96, (2020), p. 1441.

Review of Key Concepts and AI Development in China

Important Role of Local Governments in Chinese Politics

According to China's constitution, the country follows a unitary system. Nevertheless, there are significant discrepancies seen between the centre's policy mandates and local realities.[11] To explain these discrepancies and local variations, scholars have utilised the concept of central-local relations. Over the past decades, China study scholars have engaged in heated debates around how best to theorise central-local relations. Broadly speaking, there are three main perspectives. The first perspective is the localist school, which emphasizes the importance of local autonomy and argues that after years of decentralisation China has become a de facto federalist country.[12] The second perspective is the centralist school, which stresses the importance of strong central control over local governments.[13] The third perspective is the tug-of-war school, which believes that local officials continuously push the boundaries of what is considered permissible local actions.[14] Specifically, the fragmented authoritarian framework has become widely applied in studying China's politics.[15] According to the fragmented authoritarian framework, it would be necessary to include the Chinese local governments to better understand the complicated nature of China's AI development. Meanwhile, over the years, the literature on central-local relations in China has focused on various policy domains, such as fiscal reforms, fishery management, social welfare, economic development, cultural policy and foreign policy.[16] However, the issue of AI development has received scant attention. This has left a serious void in the existing literature.

Policy Diffusion

Policy diffusion entails transfer of a government policy from one body politic to another, either in terms of adoption, implementation or both.[17] Existing studies on policy diffusion have been dominated by US-based studies that have focused on the horizontal transmission of policies from one local government to another in the forms of learning, competition, imitation and, to some extent, coercion.[18] In such studies, the mechanism and not the nature of diffusion is the focus of attention. The consequence of ignoring the policy design during the diffusion process is associated with the logical implication that diffusion leads to the harmonisation of policies across various

[11]Hongzhou Zhang and Alfred M Wu, 'Central—Local Relations in China: A Case Study of Heilongjiang's GMO Ban', *The China Quarterly* (2023), p. 1.

[12]Alfred M Wu, Lin Ye and Hui Li, 'The Impact of Fiscal Decentralization on Urban Agglomeration: Evidence from China', *Journal of Urban Affairs* 41, (2019), p. 170; Yongnian Zheng, *De Facto Federalism in China: Reforms and Dynamics of Central-Local Relations* (World Scientific, 2007).

[13]Hongbin Cai and Daniel Treisman, 'Did Government Decentralization Cause China's Economic Miracle?', *World Politics* 58, (2006), p. 505; Meg E Rithmire, 'China's "New Regionalism": Subnational Analysis in Chinese Political Economy', *World Politics* 66, (2014), p. 165.

[14]Jae Ho Chung, 'Changing Norms, Issue-Variance, and Unending Tugs of War' in *Assessing the balance of power in central-local relations in China*, ed. John Donaldson (Routledge, 2016); Yasheng Huang, *Inflation and Investment Controls in China: The Political Economy of Central-Local Relations during the Reform Era* (3rd edition, Cambridge University Press, 1999).

[15]Hongzhou Zhang, 'The South China Sea Fishing Crisis: The Overlooked Role of Chinese Subnational Governments', *The Pacific Review* (2024), p. 1.

[16]Ting Gong and Alfred M Wu, 'Central Mandates in Flux: Local Noncompliance in China', *Publius: The Journal of Federalism* 42, (2012), p. 313; Yasheng Huang, 'Central-Local Relations in China during the Reform Era: The Economic and Institutional Dimensions', *World Development* 24, (1996), p. 655; Huang (n 15); Genia Kostka and Jonas Nahm, 'Central—Local Relations: Recentralization and Environmental Governance in China', *The China Quarterly* 231, (2017), p. 567; Genia Kostka and Chunman Zhang, 'Tightening the Grip: Environmental Governance under Xi Jinping', *Environmental Politics* 27, (2018), p. 769; Mingjiang Li, 'Central—Local Interactions in Foreign Affairs', in *Assessing the balance of power in central-local relations in China*, ed. John Donaldson (Routledge, 2016); Christine PW Wong, 'Central—Local Relations in an Era of Fiscal Decline: The Paradox of Fiscal Decentralization in Post-Mao China*', *The China Quarterly* 128, (1991), p. 691.

[17]N Goyal, A Taeihagh and M Howlett, 'Whither Policy Innovation? Mapping Conceptual Engagement with Public Policy in Energy Transitions Research', *Energy Research & Social Science* 89, (2022), p. 102, 632.

[18]Charles R Shipan and Craig Volden, 'The Mechanisms of Policy Diffusion', *American Journal of Political Science* 52, (2008), p. 840.

political domains. Indeed, studies on horizontal diffusion focus on understanding how policy innovations arise and spread across various political bodies.[19]

However, policy diffusion can take various forms.[20] For instance, diffusion can vary in terms of diffusion of goals, intensity (frequency of transmission from source to destination), speed (the time taken for transmission), breadth (the coverage of the policy being diffused) and direction (horizontal vs. vertical).[21] The dimension of coverage plays a vital role when discussing vertical diffusion (from higher levels of government to lower), since diffusion under such conditions is normally mandatory (or coerced). Therefore, drivers and diffusion mechanisms that apply to horizontal diffusion do not necessarily apply to vertical diffusion since the topic of interest is not *if* diffusion takes place but *how*.

The question of *how* becomes especially more pertinent in authoritarian countries such as China, where local governments and leaders are under severe pressure to comply with central governments' policy requirements but also have some level of discretion to redesign these policies as per their own social and economic requirements.[22] Many scholars have attributed this phenomenon to 'political centralisation and economic decentralisation'.[23] As such, local governments are, to some extent, autonomous bodies responsible for creating economic and fiscal environments for inducing growth that encourages experimentation and innovation within such local bodies.[24] At the same time, the extent of such experimentation is governed by the political and policy mandates of the central government, where performances of the local leaders and local governments become functions of such mandates and are closely monitored by the central leadership.[25] This functional requirement of following central-level policies but also having the flexibility to adapt them as per the local needs provides fertile opportunities for local leaders to redesign diffused policies. As such, policy innovations have been central features of Chinese local governance for many years.[26]

AI Policy in China

Although the earliest policies on AI in China can be traced back as early as 1956, the Chinese central government only started paying serious attention to the technology since its 13th 5-year Plan.[27] Earlier policies around 2015–2016, including the Made in China 2015 document, focused more on intelligent and autonomous systems. The Internet Plus Action Plan 2015 was the first central-level long-term plan that explicitly recognised AI and AI industries as one of the 11 emerging growth sectors. While the government issued an AI Three-Year Activities and Implementation Program in 2016, it was only when the NGAIDP was implemented in 2017 that the country had its first AI-specific long-term plan.[28] The Plan identifies AI as a sector of strategic importance and provides specific targets to be achieved by 2020, 2025 and 2030. The Plan declares that China will be able to close the

[19]Jing Chen and Cui Huang, 'Policy Reinvention and Diffusion: Evidence from Chinese Provincial Governments', *Journal of Chinese Political Science* 26, (2021), p. 723.
[20]Jian Zhang and others, 'Measurement on the Policy Diffusion: Evidence from China's Policy Documents', *Technology Analysis & Strategic Management* 34, (2022), p. 71; Lili Li, Araz Taeihagh and Si Ying Tan, 'What Factors Drive Policy Transfer in Smart City Development? Insights from a Delphi Study', *Sustainable Cities and Society* 84, (2022), p. 104, 008.
[21]Zhichao Ba and others, 'Spatio-Temporal Dynamics and Determinants of New Energy Policy Diffusion in China: A Policy Citation Approach', *Journal of Cleaner Production* 376, (2022), p. 134, 270; Zhang and others (n 21).
[22]Chen and Huang (n 20).
[23]Canfei He, Yi Zhou and Zhiji Huang, 'Fiscal Decentralization, Political Centralization, and Land Urbanization in China', *Urban Geography* 37, (2016), p. 436.
[24]Hongbin Cai and Daniel Treisman, 'Did Government Decentralization Cause China's Economic Miracle?', *World Politics* 58, (2006), p. 505; John Knight and Li Shi, 'Fiscal Decentralization: Incentives, Redistribution and Reform in China', *Oxford Development Studies* 27, (1999), p. 5.
[25]Xiaobo Zhang, 'Fiscal Decentralization and Political Centralization in China: Implications for Growth and Inequality', *Journal of Comparative Economics* 34, (2006), p. 713.
[26]Chen and Huang (n 20); Yunxiang Zhang and Sichen Wang, 'How Does Policy Innovation Diffuse among Chinese Local Governments? A Quali. . .: Business Source', *Public Administration & Development* 41, (2021), p. 34.
[27]Chao Yang and Cui Huang, 'Quantitative Mapping of the Evolution of AI Policy Distribution, Targets and Focuses over Three Decades in China', *Technological Forecasting and Social Change* 174, (2022), p. 121, 188.
[28]Roberts and others (n 5).

gap in AI technology with the leading countries around the world by 2020; by 2025, China will achieve breakthroughs in some dimensions of basic AI research; and by 2030, China will be a leading country in AI development and application in the world.[29] As an ambitious strategy set by the central government, NGAIDP was intended to incentivise local government as well as private sectors to develop AI.[30]

To be sure, before the release of NGAIDP, local governments and had already launched various sub-national AI-related policy and projects. Nevertheless, NGAIDP, as the starting point of China's AI planning at strategic and highest level, 'formalizes and definitively signals a national-level focus on AI'.[31] After its launch, more subnational policies were introduced and AI development projects were launched with massive investment in the sector (several provinces have committed over 100 billion yuan (14.7 billion USD) investment in AI).[32] In fact, following the launch of the NGAIDP, provincial governments across the country started to launch their own policy packages for the development of AI within their territories.[33] The findings of this research show that between 2017 and May 2023, more than 6000 local-level policies that mention AI within their texts and more than 500 local-level policies that directly refer to AI in their titles were launched. While many of these policies have been implemented at municipal levels, the provincial governments still form the largest sources of policies on AI. Such local government policies can take a broad spectrum of policy instruments ranging from long-term plans to financial incentives for R&D and application to the introduction of awards and awareness programs to increase the popularity of the technology among users.

Method and Data

Method: Content Analysis and Qualitative Comparative Analysis

This study focused on four forms of diffusion at the local government level: diffusion of goals and diffusion of instruments in terms of policy intensity, breadth and speed. Taking the NGAIDP 2017 as the basis of central government policy, it traced all the subsequent local government policies that cited the NGAIDP 2017 as the 'diffused' policies and examined the nature of diffusion of the central government plan. First, the study conducted qualitative content analysis to examine the substantial contents of the major policy documents. These contents included policy goals and mention of specific important topics. Subsequently, the study conducted a fuzzy-set Qualitative Comparative Analysis (fsQCA) to perform a comparative and comprehensive analysis of the diffusion of policy instruments in China. In light of a limited number of cases, fsQCA enables identification of necessary and sufficient conditions to find the causal pathways that have led to policy diffusion in China.

Content Analysis

The study used the content analysis method adopted to systematically compare and contrast Chinese central and local governments' policies on new-generation AI development to understand their priorities and goals. The analysis focuses on the qualitative and quantitative evaluation of policy documents, specifically emphasising the frequency and context of key terms related to foreign policy, national strategy, national security and defence, as well as quantifiable policy goals related to AI.

The analysis began with a careful selection of policy documents issued by central and provincial governments. Central government documents included strategic plans and official documents from pivotal government bodies shaping AI development. Similar documents from the provincial

[29]State Council. New Generation AI Development Plan (NGADP), (2017).
[30]ibid.
[31]Jeffrey Ding, 'Deciphering China's AI Dream', Future of Humanity Institute Technical Report (2018).
[32]Gregory C Allen, 'Understanding China's AI Strategy: Clues to Chinese Strategic Thinking on Artificial Intelligence and National Security', (Center for a New American Security, 2019).
[33]Jinghan Zeng, 'China's Artificial Intelligence Innovation: A Top-Down National Command Approach?', *Global Policy* 12, (2021), p. 399.

governments were gathered. The authors developed a coding scheme that classified references into predefined categories such as 'Xi Jinping', 'defence', 'international competition/national competitiveness', 'national security' and 'civil-military'. Each category has clear operational definitions to guide the coding process, ensuring that each mention or reference is accurately categorised. For instance, any explicit mention of 'Xi Jinping', 'President Xi' or 'General Secretary Xi' was coded under the 'Xi Jinping' category. Similarly, terms like 'military/defence' and 'national security' were coded under the 'defence' and 'national security' categories, respectively.

Qualitative Comparative Analysis

Existing studies on policy diffusion in China have primarily focused on the political constraints of policy diffusion, often centering on the political relationship between the local and central governments, the mobility of policy entrepreneurs and competition between provinces.[34] However, following the triple helix model of innovation, the authors argue that, in addition to the political capacity of the government, the capacity of the private sector and academia are also important drivers of policy diffusion.[35]

The authors conceptualised the outcome variables as follows. To measure the existence of diffusion, the authors took the existence of provincial AI-specific long-term or medium-term plans that directly cite the NGAIDP. Since the NGAIDP itself is a long-term plan, direct diffusion has to take place in the form of a long-term plan as well. Therefore, the authors conceptualised a dependent variable *diffusion* which takes the value 1 if the province introduced a long-term AI plan citing the NGAIDP following its launch.

To measure the speed of diffusion, the authors calculated the difference in days between the introduction of the provincial long-term plan and the launch date of the NGAIDP for each province. For an example, since the NGAIDP was introduced on 8 July 2017, and Anhui's long-term plan was introduced on 28 July 2020, 623 days were required for the diffusion to happen. The authors ranked the provinces as per their diffusion speed, with the earliest adopters ranking at the top and the latest adopters ranking at the bottom.

The authors measured the intensity of diffusion in terms of the number of subsequent policies introduced on AI following the introduction of the provincial plan. As such, the greater the number of policies introduced, the greater the intensity of policy diffusion. Finally, the authors measured the breadth of policy diffusion in terms of the breadth of the nature of instruments introduced by the provincial government. The authors classified policy instruments introduced in each provincial government policy into one/more than one of the five categories introduced by Schneider and Ingram,[36] *authority, capacity, financial incentive, learning* and *symbolic*. *Authority-based* instruments consist of granting permissions, prohibiting or mandating certain actions. They are mostly used in hierarchical systems by senior levels to guide lower-level behaviour. *Incentive* tools are used to incentivise (negatively or positively) actions. Positive incentives like tax breaks and negative incentives like charges or fees are soft incentives, while sanctions and the use of force carry stronger implications. *Capacity-based* tools assume that although targets of policy tools are naturally included to carry out desired outcomes, they do not have the financial or knowledge capacity to do so. Tools here aim to address these gaps by providing knowledge or financial resources to required target groups. These include training, education-based tools, grants, loans and subsidies, amongst others. *Symbolic and hortatory* tools aim to appeal to the cultural and social beliefs of the target population to convince them to comply with desired policy outcomes. Tools like public pronouncements, advertisement campaigns and sloganeering, or even prioritising certain actions provide symbolic meanings to the desired actions. Finally, *learning* tools are based on information gathering, program

[34]Chen and Huang (n 20); Zhang and Wang (n 27).
[35]Aase Marthe Johansen Horrigmo, 'Why Study the Spread of Culture-Led Development Strategies?', *Regional & Federal Studies* 22, (2012), p. 553; Modris Ozoliņš and others, 'Institutional Attention to European Policy Agendas: Exploring the Relevance of Instrumental and Neo-Institutional Explanations', *Tertiary Education and Management* 24, (2018), p. 338.
[36]'Behavioral Assumptions of Policy Tools', *The Journal of Politics* 52, (1990), p. 510.

evaluations or institutional dialogues between stakeholders and allow the government to learn the situation on the ground. The authors assume that the greater the types of policy instruments the provincial government introduces, the greater the breadth of policy diffusion.

The data on policies for this research came from various sources. The authors utilised the pkulaw database of Peking University, which hosts policy documents introduced by various levels of the Chinese government. The keyword 'artificial intelligence' was used as the basis of the search, and all documents with the keyword in their title were selected. The authors also searched the CNKI policy document database using the same strategy. Finally, provincial governments' websites were also individually scraped in cases where no relevant data was found in the two databases. The authors had two criteria for the inclusion strategy: first, the document must have been issued by the provincial government, and second, the policy document must be concerned about AI. The dataset consists of 580 policy documents introduced between 2017 and 2022 at the provincial level. Beyond policy documents, relevant academic articles, industry reports, news articles and books published in both Chinese and English were collected through open search to aid data analysis.

Given the total number of cases, the authors were limited by the number of conditional variables that could be used. In this study, the authors used four AI-specific conditional variables, capacity of the private sector, capacity of the academic sector, economic size of the provinces and the political authority of the provincial government. The authors measured the private sector capacity using two indicators: the development of the private sector in the province and the size of the province's economy. The role of the private sector in the technology policy process has been extensively documented. Studies have shown that the private sector, and especially companies involved in big tech, is now directly involved in working with the government to design and shape governments' technology solutions.[37] The existence of a strong private sector can lead to a 'soft capture' of the government where the private sector can influence the policy process of the regulators.[38,39]

The authors also included academic sector capacity as a critical component of policy diffusion. Oftentimes, academics and the university can serve as part of the epistemic communities that can influence policy design and diffusion process.[40] The academic sector, through its knowledge networks, can establish its authority over the knowledge domain and thereby help establish common understandings amongst various policy actors, including policymakers.[41]

The provincial authority is also likely to play an important role in policy diffusion. A greater extent of political authority can imply two important things: a) given their authority, leaders will have some form of discretion on policies and experimentation they can conduct within their jurisdiction;[42] or b) given their close relationship with the Central Committee in Beijing, they are expected to fulfill the obligations as expected by the Centre expediently. As such, a greater extent of authority is expected to lead to faster diffusion and a greater extent of experimentation within the provinces.

To measure the capacity of the private sector and the capacity of the academic sector, the authors used data from China's New Generation AI Technology Industry Region Competitiveness Evaluation Index (NGAII). The Chinese Institute of New Generation Artificial Intelligence Development Strategies produces the annual index under the Chinese Academy of Engineering and Tianjin Municipal

[37]Per J Agrell and Axel Gautier, 'Rethinking Regulatory Capture' in *Recent Advances in the Analysis of Competition Policy and Regulation*, ed. Joseph E Harrington Jr. and Yannis Katsoulacos (1st edn, ElgarOnline, 2012); Robert G Hollands, 'Critical Interventions into the Corporate Smart City', *Cambridge Journal of Regions, Economy and Society* 8, (2015), p. 61.

[38]Agrell and Gautier (n 37).

[39]S Khanal, H Zhang, and A Taeihagh, 'Why and how is the power of Big Tech increasing in the policy process? The case of generative AI', *Policy and Society*, (2024), puae01. https://doi.org/10.1093/polsoc/puae012.

[40]David J Galbreath and Joanne McEvoy, 'How Epistemic Communities Drive International Regimes: The Case of Minority Rights in Europe', *Journal of European Integration* 35, (2013). p. 169; Alexandru Rusu and Olga Löblová, 'Failure Is an Option: Epistemic Communities and the Circulation of Health Technology Assessment' in *Public Policy Circulation*, ed. Tom Baker and Christopher Walker (Edward Elgar Publishing, 2019). accessed June 21, 2023, https://china.elgaronline.com/view/edcoll/9781788119146/9781788119146.00016.xml.

[41]Céline Mavrot and Fritz Sager, 'Vertical Epistemic Communities in Multilevel Governance', *Policy & Politics* 46, (2018), p. 391.

[42]Edmund J Malesky, 'Straight Ahead on Red: How Foreign Direct Investment Empowers Subnational Leaders', *The Journal of Politics* 70, (2008), p. 97.

Government. The index measures the competitiveness of Chinese provinces along five major indicators: the capacity of the private sector, the capacity of universities, the capital intensiveness for the AI sector, the linkages between public, private and higher education sectors and the openness of the provinces to attract human capital and technology. The detailed description of conditional variables is as follows:

Capacity of the Private Sector. The authors used the NGAII index to measure the capacity of the private sector, focusing on two indicators: enterprise scale and enterprise innovation capacity. For enterprise scale, the authors looked at the number of AI enterprises within each province and the market value of those enterprises. To measure enterprise innovation capacity, the authors considered three indicators: the average number of patents, the number of basic and technology tier enterprises within provinces and the number of technology-enabling relationships.

Capacity of the Academic Sector. The capacity of the academic sector was measured using two primary indicators: the innovation capacity of AI universities and the innovation capacity of non-university research institutions. The innovation capacity of AI universities was measured using four sub-indicators: the number of universities with AI programs, the average number of articles published in domestic journals, the average number of articles published in international journals and the average number of patents produced. The same measures were used to evaluate the capacity of non-university research institutions.

Economic Capacity. The authors measured the economic capacity of the provinces using the per capita income (GDPPC) of the respective provinces. The authors used the Statistical Yearbook of China 2019 to measure the GDPPC of respective provinces.

Political Authority of the Provincial Government. The authors used the Regional Political Power Index (RPPI) to gauge the political powers of the provincial governments.[43] The RPPI measures the degree of political authority of provinces by creating an index of the weighted score of the number of central committee full members born, studied or worked in particular provinces, which in turn allows political leaders to develop networks, alliances and political capital within those provinces providing those provinces with greater degree of power.

For the purpose of conducting fuzzy-set QCA (fsQCA), the authors ranked all the provinces based on their performances in terms of each of the outcomes/conditions with 1 being the best performer and 30 being the worst for the various indices. The outcomes and the conditions (factors) were then calibrated to range between 0 and 1 with 3 and 27 acting as inclusion and exclusion thresholds and 12.5 being the crossover point.[44] Since the outcome *instrument breadth* is an ordinal variable with values from 1 to 5, it was coded accordingly (0 if one 1 category of instrument was implemented, 0.33 if 2 categories implemented, 0.67 if 3, 0.9 if 4 and 1 if 5).[45] Figure 1 illustrates the ranking of the provinces based on the specified factors.

[43]Damien Ma and Ruihan Huang. 'Powerful Provinces: How Regional Political and Economic Power Correlate in China', *MacroPolo* (2021). https://macropolo.org/analysis/powerful-provinces-regional-political-economic-china/

[44]Adrian Duşa, *QCA with R: A Comprehensive Resource* (Springer International Publishing, 2019). Accessed February 1, 2024. https://www.bookdown.org/dusadrian/QCAbook/QCAbook.pdf; Alrik Thiem, 'Membership Function Sensitivity of Descriptive Statistics in Fuzzy-Set Relations', *International Journal of Social Research Methodology* 17, (2014), p. 625.

[45]Appendix A1 contains the calibrated values of indicators described in Table 2. Also note that since *diffusion days* is applicable to only 24 observations, the exclusion threshold was changed to 22.

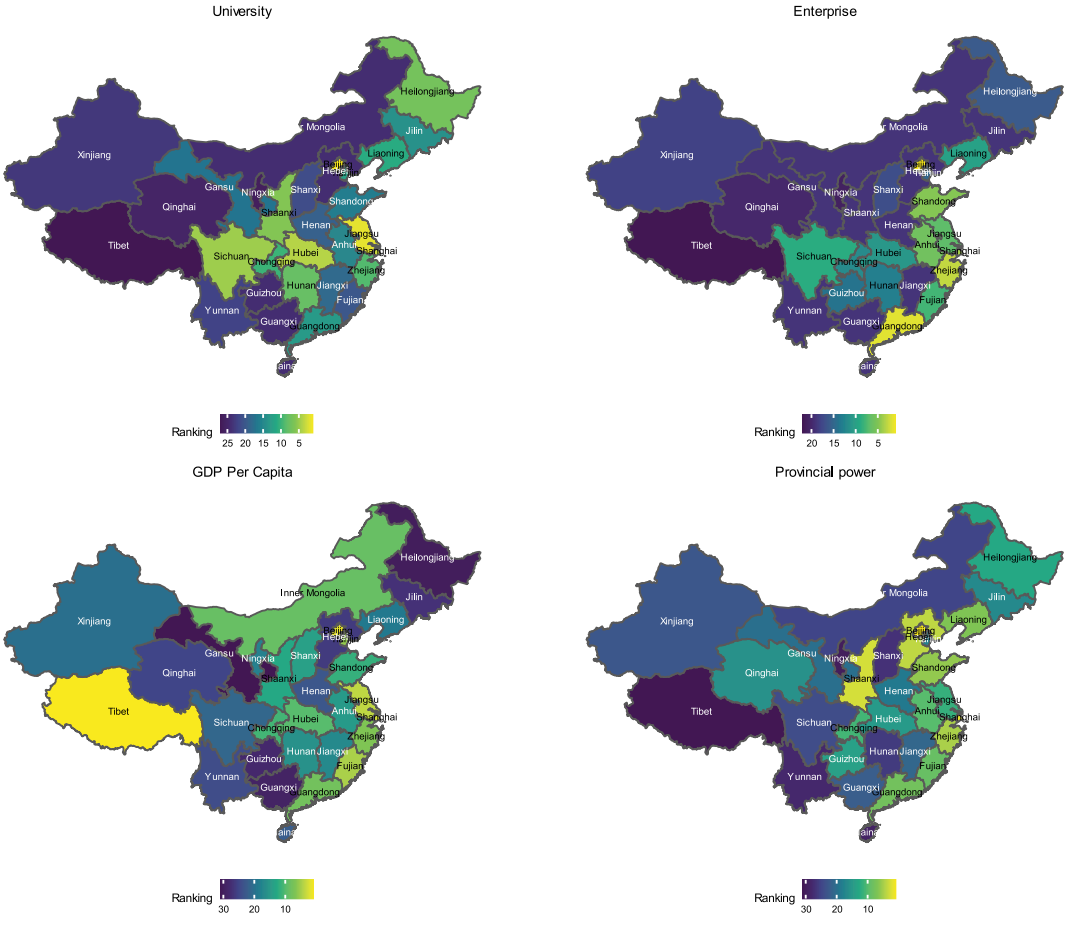

Figure 1. Provincial rankings of the four factors used for fsQCA.

Findings

Divergences Between Central and Local Priorities in AI Development

The State Council introduced a comprehensive development plan entitled 'New Generation Artificial Intelligence Development Plan' (NGAIDP) on 28 July 2017. The NGAIDP set the national AI agenda and provided strategic direction for AI development across the country. Shortly after the introduction of NGAIDP by the State Council, policy documents on the new generation of AI were introduced by most Chinese provincial governments. The authors examined the nature and content of the plans to understand the diffusion of policy goals. In the NGAIDP, while introducing the background and reasons for its strategic plans, the Chinese central government has prioritised the geostrategic and security importance of AI development. For instance, in the background section, the strategic importance of AI was mentioned before the discussion of AI as the new engine for economic development. It states:

> Artificial intelligence has become the new focus of international competition. Artificial intelligence is thought to be the strategic technology leading the future, the world's major developed countries regard the development of artificial intelligence as the major strategy to increase national competitiveness and enhance national security … China's national security and international competition situation are more complex, so [China] must look at the world, lay out the artificial intelligence development on the national strategic level, grasp firmly the strategic initiative of international competition during the new stage of artificial intelligence

development, create new competitive advantage, open up new spaces of development, and effectively protect national security.

In the NGAIDP, as Figure 2 shows, the term 'Competition/Competitiveness (as in phrases such as 'International Competition' (*guoji jingzheng*), 'National Competitiveness (*guojia jingzhengli*), "Technological Competition" (*keji jingzheng*), "Technological Power" (*keji qiangguo*))' appears 14 times, 'National Security (*guojia anquan*)' appears 8 times and 'Defense (*guofang*)' is mentioned 11 times. These findings suggest that AI development at the central level is driven by a combination of geopolitical concerns, national security interests and considerations related to national defence. On the other hand, the Chinese local governments have collectively only made 11 mentions of 'International Competition/Competitiveness', 4 mentions of 'National Security' and 14 mentions of 'Defense' in their new AI policy documents. In the AI policy documents issued by many provincial governments, such as Beijing, Shanghai, Jiangsu, Gansu and Heilongjiang, these terms are not mentioned even once. Even more interestingly, while the central government cares most about international competition and the need to win the global economic and tech rivalry, the provincial governments are concerned about AI as a new focus of regional competition within China. For instance, in the background section of Anhui province's new generation of AI development plan, it cited regional AI competition and the fact that some provinces have already introduced AI development plans or action plans to achieve an advantage in regional competition as a main reason for its own AI plan. Furthermore, the relatively high number of mentions of 'Defense' and 'Civil-Military' (*junmin*) is primarily related to the application of AI in defense-related sectors, especially by those provinces such as Shaanxi, Jilin and Sichuan, which have large military-related industries, rather than due to concerns about national defense.

The limited reference to the terms 'National Security' and 'International Competition' goes in stark contrast with the ubiquitous emphasis by local governments on AI as the new driver for their local

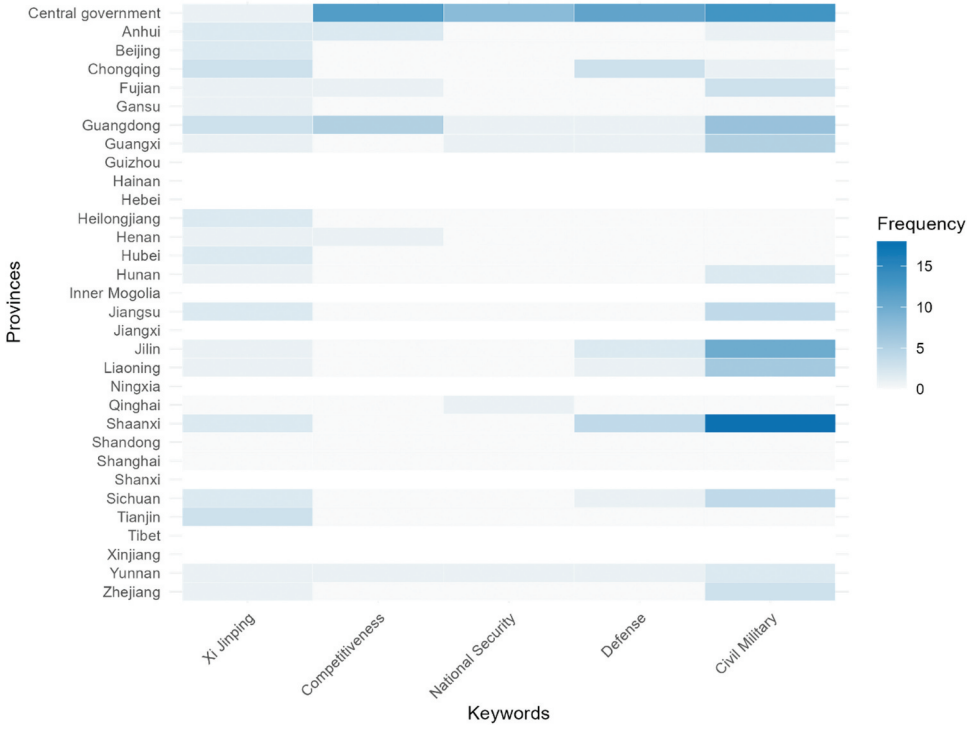

Figure 2. Divergence of drivers and concerns towards the development of AI.

economic development in their AI policy documents. As Zeng[46] points out, because a booming AI industry is considered a key driving force of regional economies, subnational actors, including provincial governments have shown great enthusiasm for supporting AI development. This is evidenced by Table 1, which represents the AI core and associated sectors' output targets set by various levels of the Chinese government for the years 2020 and 2025.

As Table 1 shows, for 2020, the central government had set an output target of RMB 150 billion for the core AI industries and RMB 1000 billion for all associated AI sectors. Even more ambitious targets for both the core AI sectors and associated sectors were set for 2025 and 2030, respectively. In contrast, the local governments collectively set much higher targets. Take the targets for 2020, for example. Compared with the central government's goals, the sum of the targets set by the local governments was approximately RMB 432 billion for core AI sectors and around RMB 1,958 billion for associated AI sectors. Table 1 also provides the targets set by individual provinces. Notably, Beijing has set the highest target for the core AI industry for 2020, aiming for RMB 112 billion, which on its own is comparable to the national goal of RMB 150 billion. Shanghai and Sichuan followed, each aiming for RMB 100 billion and RMB 50 billion, respectively. Looking at the 2025 targets for AI sectors, the Centre has set a higher target of RMB 400 billion for the core AI sectors and RMB 5,000 billion for associated AI sectors. The local governments, collectively, have also set a higher target of RMB 704 billion for the core AI sectors and 4670 billion RMB for associated AI sectors. However, it is important to note that not all provinces have introduced quantifiable goals, and only half of the 31 provinces are included in Table 1. Therefore, the total targets set by provincial governments would be even higher if the other provinces also set their own targets for AI sectors. Consequently, analysis of provincial long-term plans' political and economic goals show a clear divergence in political ambitions and prioritisation towards economic goals compared to the Centre's long-term priorities.

In addition, the central government clearly acknowledges the lack of basic theory and core algorithm development as significant gaps in China's AI competency compared to other developed

Table 1. AI industrial development targets set by the Chinese central and local governments.

	2020 (RMB billions)		2025 (RMB billions)	
Entity	Core AI industry	Associated AI industries	Core AI industries	Associated AI industries
Central government's targets	150	1000	400	5000
Sum of local governments' targets	432	1958	704	4670
Beijing*	112	373	300	1000
Shanghai**	100			
Guangdong	50	300	150	1800
Sichuan	50	300	100	500
Zhejiang*	34	260		
Chongqing*	34	130		
Anhui	15	100	50	450
Jiangsu		100		
Fujian		100		
Shaanxi*		55		
Hubei*	10	60	60	600
Hunan	8	80		
Liaoning	6	40	16	20
Jilin	5	40	20	200
Heilongjiang	5			
Guangxi	3	20	8	100

*These provinces did not directly list their output targets for 2020 or 2025; rather, they listed their output target by 2022, 2023 or 2024. The 2020 or 2025 numbers were obtained by using the annual growth rate.

**Shanghai does not use the term core AI industry in this Plan. Instead, it uses 'important AI industry'..

[46]Zeng, J, 'Artificial intelligence and China's authoritarian governance', *International Affairs*, 96(6), (2020), p. 1441–1459. https://doi.org/10.1093/ia/iiaa172.

countries. Thus, one of the priorities listed in the NGAIDP is to achieve major breakthroughs in basic theories for AI. Therefore, in terms of key priorities for the central government, the country aspires to achieve important progress in new-generation AI theories and technologies by 2020, realize significant breakthroughs in the basic theories of AI by 2025, and, by 2030, reach the world's leading level in AI theories. However, for the Chinese provincial governments, the centrality of their AI development has clearly been on the industrial application of AI, as terms such as 'service', 'application' and 'enterprise' appear far more frequently, and far fewer references are made to basic theory or core algorithms in provincial policy documents.[47] Even for provinces where basic AI research or basic

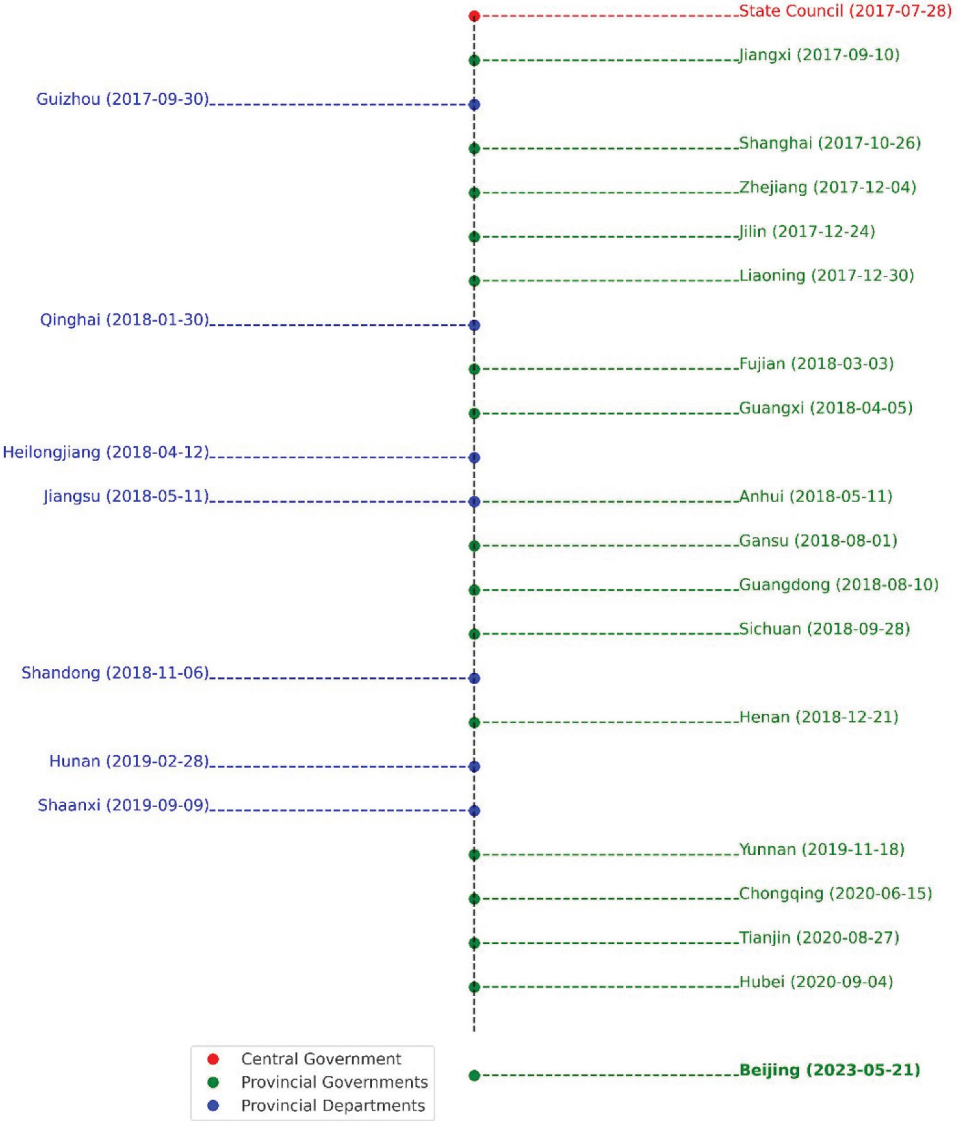

Figure 3. New generation of AI development plan timeline.

[47]W Song and H Xia, 'A Quantitative Study on the Text of Local Government Artificial Intelligence Industry Policy', *Science Technology Management and Research* 39, (2019), p. 192.

theories in AI are mentioned, the focus has clearly been on either cutting-edge (*qianyan*) or applied (*yingyong*) basic AI theories or research. For instance, Yunnan stated that it intends to accelerate applied basic research and technological innovation and strengthen cutting-edge basic theory research. Similarly, Shanghai intends to improve cutting-edge basic research in AI.

Variations of AI Policy Diffusion at the Provincial Level

Within Chinese provinces, there are also great variations in the speed, type and content of their AI policies. Firstly, as Figure 3 shows, these documents vary greatly in terms of the date of issuance. The first local new AI plan was issued by Jiangxi just one and a half months after the NGAIDP. Subsequently, between 2017 and 2019, 17 provinces or municipalities introduced their own version of the new generation of AI development plans. In contrast, some other provinces, including Chongqing, Tianjin and Hubei, introduced their AI policy in 2020, with the latest being Beijing in May 2023. As of May 2023, the rest of the provinces and regions, including Inner Mongolia, Shanxi, Hebei, Hainan, Tibet, Xinjiang and Ningxia, had not issued policy documents related to the new generation of AI development.

Table 2 provides a descriptive overview of the variables used for the fsQCA analysis. The variable *enterprise capacity* describes the ranking of the province in terms of enterprise capacity, and *university capacity* is concerned with the ranking of the province in terms of university capacity. *GDPpc* provides the level of income per capita of the province in 2018. The *Power* indicator ranks provinces as per the regional power parity index. Four outcome variables consist of the existence of diffusion (*Diffusion*), the speed of transmission (*Diffusion days*), the variety of instruments introduced (*instrument breadth*) and the number of policies introduced (*policy intensity*).

Table 2. Summary table of the relevant indicators.

Provinces	Enterprise capacity	University capacity	GDPpc	Power	Diffusion	Diffusion Days	Instrument breadth	Policy intensity
Anhui	6	15	10943	10	1	623	5	15
Beijing	1	1	28294	1	1	2123	4	13
Chongqing	12	10	13479	11	1	206	5	24
Fujian	8	20	18856	9	1	219	4	22
Gansu	19	17	6686	20	1	373	1	1
Guangdong	2	13	15151	8	1	368	4	16
Guangxi	19	24	7755	22	1	251	5	20
Guizhou	14	24	7779	14	1	70	2	4
Hainan	19	24	9902	29	0		3	6
Hebei	19	24	8474	4	0		4	9
Heilongjiang	16	7	7717	13	1	248	1	2
Henan	19	19	9233	19	1	685	4	12
Hubei	11	4	13686	15	1	1114	5	19
Hunan	13	8	10942	26	1	575	2	9
Inner Mongolia	19	24	14343	25	0		2	8
Jiangsu	7	2	21467	12	1	286	2	9
Jiangxi	19	18	10544	21	1	81	2	6
Jilin	19	14	8229	17	1	154	3	10
Liaoning	10	11	10225	7	1	158	1	4
Ningxia	21	26	10374	30	0		3	3
Qinghai	20	25	9028	16	1	149	1	3
Shaanxi	19	6	12319	3	1	765	4	6
Shandong	5	16	12786	6	1	158	4	16
Shanghai	4	3	26747	2	1	412	4	31
Shanxi	17	21	10954	27	0		1	5
Sichuan	9	5	10077	24	1	435	3	14
Tianjin	15	12	17727	18	1	962	5	27
Xinjiang	18	23	10191	23	0		0	1
Yunnan	19	22	9176	28	1	834	0	0
Zhejiang	3	9	17617	5	1	136	3	15

The next set of outputs shows the results of fsQCA, where the outcome is the actual transmission of the policy in the form of a long-term provincial plan (see Table 3). Although the test results for necessary conditions are not shown here (see Appendix B for results of truth tables and necessary conditions of all the fsQCA conducted), findings show that no necessary and non-trivial conditions exist for the diffusion of long-term plans. Meanwhile, seven provinces—Hainan, Hebei, Inner Mongolia, Ningxia, Shanxi, Tibet and Xinjiang do not have a long-term AI-based plan. The results from the solutions table also show the trivialness of the results of sufficiency tests. There are two sufficient conditions for the diffusion of long-term plans, but the cases often overlap across the two conditions. Overall, the results show two paths through which policy diffusion is likely to take place. The general findings show the importance of private sector capacity, academic sector capacity and political authority in determining the success of long-term policy transmission and also show the non-requirement of income (development) of provinces. The authors also tested if there are certain pathways that lead to non-transmission of long-term policy, but the results were not conclusive.

The next dimension of policy diffusion the authors tested was the speed of transmission. The authors ranked the provinces according to the speed of the transmission of the long-term policies and defined the outcome variable *speed* according to this rank (Table 4). The authors found one pathway for faster diffusion. The pathway was characterised by higher levels of political authority and private sector capacity of the provinces and lower levels of academic sector capacity. Anhui, Fujian, Guangdong and Shandong were the four cases that represented this pathway that led to faster policy diffusion.

The authors measured the intensity of policy diffusion using two different indicators: a) the number of policies introduced between 2017 (after the introduction of the central AI plan) and 2022 and b) the growth of policies in AI between the given period annually. Results from the fsQCA show two different pathways to a higher intensity of policy diffusion. The authors did not find any necessary conditions for a greater extent of the intensity of policies introduced to support AI. The findings showed that, unlike the case of the speed of diffusion, the existence of strong political authority predicts success in only one of the pathways. Additionally, the authors

Table 3. Paths of long-term plan diffusion.

Contributing factors	Path 1	Path 2
Private sector capacity		Yes
Academic sector capacity	Yes	
Income per capita		
Political authority		Yes
Inclusion score	0.979	0.983
Proportional reduction in inconsistency	0.979	0.983
Case provinces	Jilin; Heilongjiang; Tianjin; Shaanxi; Hunan, Sichuan; Liaoning; Hubei; Beijing, Chongqing, Guangdong, Jiangsu, Shanghai, Zhejiang	Guizhou; Anhui, Fujian, Shandong; Liaoning; Beijing, Chongqing, Guangdong, Jiangsu, Shanghai, Zhejiang

Table 4. Speed of transmission.

Contributing factors	Path 1
Private sector capacity	Yes
Academic sector capacity	No
Income per capita	
Political authority	Yes
Inclusion score	0.856
Proportional reduction in inconsistency	0.739
Case provinces	Anhui, Shandong; Fujian, Guangdong

Table 5. Intensity of transmission.

Contributing factors	Path 1	Path 2
Private sector capacity	Yes	
Academic sector capacity	No	Yes
Size of economy	Yes	Yes
Political authority	Yes	No
Inclusion score	0.948	0.867
Proportional reduction in inconsistency	0.895	0.806
Case provinces	Fujian, Anhui, Shandong	Tianjin, Hubei

Table 6. Breadth of diffusion.

Contributing factors	Path 1	Path 2
Private sector capacity	Yes	No
Academic sector capacity	No	Yes
Size of economy	Yes	Yes
Political authority	Yes	Yes
Inclusion score	0.888	0.867
Proportional reduction in inconsistency	0.860	0.806
Case provinces	Fujian, Anhui, Shandong	Shaanxi

also find that strong economic capacity was present in both pathways of sufficient condition (Table 5). Of the two pathways, the first path consisted of having strong private sector capacity, economic sector capacity and political authority and consisted of cases of Fujian, Anhui and Shandong. Meanwhile, Tianjin and Hubei, which represented path 2, were characterised by strong academic sector capacity and economic sector capacity but relatively weaker political authority.

The authors measured the breadth of diffusion using the variety of policy instruments as per the categorisation, where the authors divided all policy instruments into five categories and ranked the provinces as per the number of different categories of instruments they had applied for the governance of AI. The authors do not find any of the four conditions necessary for the increased breadth of instruments. Furthermore, the results showed that two primary paths lead to policy diffusion in the form of increased breadth (Table 6). The first, as with the case of intensity, involved the three provinces, Fujian, Anhui and Shandong, with lower levels of political authority and high levels of private sector capacity and high per capita income. The second path was highlighted by Shaanxi's case that also involved higher levels of political capacity, income per capita and academic sector capacity but lower levels of private sector capacity.

Discussion

This article examined how central and local government priorities in AI development align (or misalign) and the role of local economic and political factors in influencing AI-specific policy diffusion in China. Taking the case of the NGAIDP, the authors looked at more than 500 AI-specific provincial policies to understand the central and local priorities in AI development and investigate the nature of policy diffusion within China's provinces. A number of crucial pointers emerge from the above analysis.

First, as China emerges as a global power, the study of central and local relations in China is hugely important, not only to China observers but also to the global policy community. This is particularly the case in relation to global AI development and governance. Academic conversation on AI development has largely focused on the role of the central government's motivations, its strategic alignment and its policy approach to advancing AI development in China. This is understandable against the recent recentralization push under Xi Jinping, which has greatly undermined the autonomy of the local governments. Nevertheless, this research reveals provincial governments'

important role in advancing AI within China. Specifically, the findings of this research reveal some interesting differences between how central and local governments in China perceive and discuss AI. The Chinese central government seems to take a more holistic view, emphasising the role of AI in international rivalry, national security, national defense and economic development. In fact, as Zeng[48] argues, State Council's NGAIDP is a clear attempt to securitise AI against the backdrop of growing US–China tech rivalry and the wider geopolitical competition. Since the release of NGAIDP, there is no doubt that provincial governments 'have got onboard with the central government's AI plan, and are enthusiastically supporting its AI campaign'.[49] As shown in Figure 3, some of the provincial AI policies were introduced immediately after NGAIDP launch. Nevertheless, it should be noted that the provinces jumped onto the bandwagon with the primary objective of boosting their local economy. The provincial governments have shown little interest in the aspects of international rivalry, national security and defence; suggesting the broader geopolitical landscape and the ongoing global AI race against the US seems to be irrelevant in the local contexts. This could be due to the more localised focus of these governments, which often tend to prioritise more immediate or tangible benefits of AI, such as its potential to drive economic growth or improve public services. Indeed, as Table 1 shows, while both the central government and local governments in China have set ambitious targets for the development of the AI industry, reflecting the importance they attach to AI in their future economic growth plans, the local governments have set particularly high targets, indicating strong local-level support for the AI industry. These findings highlight the complex and multifaceted nature of AI policy in China, with different government levels having different strategic focuses. In particular, as pointed out by Ding,[50] provincial governments have been pursuing their own economic interests to stake out their claims to China's AI dream. The above suggests that the Chinese approach towards AI development should not be seen as a coherent, well-coordinated national-concerted endeavour, and that the central government's capacity to drive the country's AI development need not be overstated.[51]

Second, one of the key objectives of the central government's new AI plan is to develop the country into a global AI powerhouse by 2030 and win the global AI race, particularly against the backdrop of the intensifying rivalry between China and the US in AI leadership. This study shows that this goal has not been commonly shared by the Chinese local governments. The Chinese provincial governments can be categorised into five types based on the extent of their global ambitions in the development of AI. As Figure 4 shows, Beijing, the capital and leading AI hub in China, has a clear and explicit ambition to become a global leader in AI development. This is evident by the title of its 2023 AI policy document- *Implementation Plan to Accelerate the Construction of an Artificial Intelligence Innovation Hub with Global Influence (2023–2025)*. Its detailed plans and specific goals reflect a strategic vision that aligns with the central government's objective to become a world leader in AI. Beijing's predominant role in China's AI landscape also places it in a strong position to compete globally. Shanghai and Guangdong follow closely, reflecting their national leadership in AI and aspirations to become a global leader. Their ambitions are likely fueled by their robust AI industries, which position them favourably in the global AI race. For instance, in terms of long-term objectives for AI development, both Guangdong and Shanghai aim to reach international advanced level in terms of their overall AI development by 2030. Following that, a group of provinces and cities, including Anhui, Zhejiang, Jiangsu, Guangxi, Shaanxi, Tianjin, Sichuan, Liaoning, Fujian, Hubei and Hunan, have aspirations to become global leaders in certain AI fields and theory development. This specialisation strategy could help these provinces stand out in the global competition by capitalising on their unique strengths and expertise. For instance, Shaanxi aspires to be an

[48]Jinghan Zeng, 'Securitization of Artificial Intelligence in China', *The Chinese Journal of International Politics* 14, (2021), p. 417.
[49]Jinghan Zeng, 'Securitization of Artificial Intelligence in China', *The Chinese Journal of International Politics* 14, (2021), p. 417.
[50]Ding J, 'Deciphering China's AI Dream', Future of Humanity Institute Technical Report (2018).
[51]ibid.

Figure 4. Categorisation of China's provinces by global AI ambition.

international leader in developing AI applications in the defence sector. Hubei aims to achieve major breakthroughs in fields such as deep learning, brain-like intelligence, cross-media analysis and reasoning, and autonomous unmanned intelligence and accomplish several leading research outputs with international influence. Anhui, with its existing lead in perceptual intelligence and cognitive intelligence, intends to focus on developing a few AI industry clusters with international competitiveness. Meanwhile, many Chinese provinces show far lesser global ambitions or have not articulated a new generation of AI policies, indicating a more regionalised/localised or nascent approach to AI development. Among them, Gansu indicated in its AI development plan that it intends to provide bilateral and multilateral cross-border and cross-regional e-commerce and other services for the international markets of Central Asia and West Asia, whereas Yunnan aims to actively utilize its location advantages to develop AI products and services for South Asia and Southeast Asia. At the bottom of the pyramid are the provinces which have not introduced their AI plans. Therefore, this diversity in global ambition levels across provinces underscores the complexity of AI development in China. While a few provinces are setting their sights on global AI leadership, mirroring the country's grand AI aspirations amid the China–US AI rivalry, most Chinese provinces either focus on local economic development or are yet to define their AI strategy. This could indicate the varying resources, industrial strengths and strategic priorities across different provinces. In the context of the China–US AI rivalry, the provinces and cities, such as Beijing, Shanghai and Guangdong, with global ambitions, are set to play key roles in driving China's AI advancement. Their success could bolster China's standing in the global AI race. Nevertheless, the provinces with lower rankings highlight areas where more work could be done to elevate AI development and competitiveness on a broader scale.

This study also shows that provincial governments within the country are instrumental in materialising national policies. For instance, the long-term AI plan of Guangdong province envisions that at least a third of the national government's target for the establishment of AI firms will take place within Guangdong. Beyond specific targets, *inter alia*, provincial governments set aside subsidies and investments, develop human resource capacity, incentivise research and development, and perhaps, most importantly, provide regulatory space for piloting the use of AI within their domain. Although not part of the analysis in this article, several provinces had developed their AI

development policies before the NGAIDP was even launched.[52] Indeed, some studies even go as far as to suggest that the current focus of scholars on the strategic approach of AI taken by the central government vastly exaggerates the potential geopolitical risks given the current (in)capacity of Beijing to align or coordinate its agenda with those of the local governments.[53]

Third, the results of this research show the importance of local capacities in policy diffusion in China, and the authors find subtle differences in pathways to policy diffusion. In the case of diffusion speed, provinces' private sector capacity and political authority play an important role. Interestingly, in the case of transmission speed, it is not just the presence of political capacity but also the absence of academic and economic capacity that led to faster transmission speed. In the view of the authors, the reasons could be that in the presence of economic capacity, governments are responding to the administrative instructions of the central government to show political loyalty and simply 'copy and paste' the central policy without much effort for localisation (lack of detailed plans for implementation at the local level). However, in the case of diffusion intensity, the economic conditions of the province become crucial.

In contrast, provinces with strong economic capacity and the private sector can design and tailor their long-term plans according to the province's needs and, therefore, take longer to implement such policies. Indeed, when the authors examine the correlation between the number of days between the introduction of national policy and provincial policy (speed of diffusion) and various contributing factors, there is a clear positive relationship between these factors and the number of days taken for diffusion. This suggests that provinces with higher capacities take a longer time to implement long-term plans. This preliminary finding corresponds with the results of earlier studies, which have found that provinces with less favourable economic conditions often tend to imitate policies and, therefore, introduce central policies faster, while wealthier provinces (and even counties) tend to 'dilute growth targets and prioritise social goals' of the central governments' policies as per their own needs.[54]

Fourth, despite the outcomes of the fsQCA, there are a few provinces whose diffusion performances are not covered here, primarily because they are outliers. To illustrate, Guangxi is, at least in terms of policies, one of the best-performing provinces for designing AI policies. Guangxi ranks amongst the top 5 in terms of speed of transmission and the number of policies introduced, and it has introduced all five varieties of policies. However, none of the contributing factors explain the performance of Guangxi since it has historically been one of the more disadvantaged regions in China. The results show evidence of agency amongst such provinces, who, despite their lack of existing capacities, have attempted to use AI development as a potential instrument to improve their economic and political capital. Guangxi's provincial leaders, including the former party secretary and chairman Chen Wu, are enthusiastic supporters of technological development, especially digital tech and growing AI in the province. In addition, they have been hoping to leverage AI to improve their economic ties and cooperation with ASEAN to boost local economic development. In terms of local technology development, the provincial government's strategic planning is considered of critical importance. Guangxi provincial leaders' strong and exceptional interest in prioritising technology development is evidenced by the fact that the earliest to formulate policy documents for digital government construction at the local level was Guangxi, which in 2018 promulgated the Three-Year Action Plan for Promoting Digital Government Construction in Guangxi (2018–2020). In 2019, Guangxi specifically set up a digital government leadership group to coordinate the guidance and deployment of Guangxi's digital government reform and construction work and formulate development strategies, special plans and major policies related to the construction of digital Guangxi.

[52]Roberts and others (n 5); Wu and others (n 4).
[53]Zeng, 'China's Artificial Intelligence Innovation' (n 33).
[54]Yuen Yuen Ang, 'Domestic Flying Geese: Industrial Transfer and Delayed Policy Diffusion in China', *The China Quarterly* 234, (2018), p. 420.

Similarly, in regard to AI development, the initial focus for Guangxi has been to enhance its AI-specific technology capacity. This has involved a range of policy initiatives aimed at fostering AI growth within the region. Key steps include the launch of an AI-focused development plan with ambitious goals over 2, 7 and 12 years in areas such as research, market expansion and international engagement. Additionally, the province has rolled out various AI-supportive policies. These encompass offering financial incentives for AI research and development by businesses, the establishment of the China-ASEAN blockchain innovation centre in 2020, collaborating with Huawei to create an AI innovation hub and implementing strategies to bridge AI knowledge and educational gaps in government, educational institutions and the market at large.[55]

Furthermore, Guangxi has capitalised on its geographic closeness to ASEAN countries. It has embarked on numerous significant projects at both multilateral and bilateral levels to position itself as a leading AI collaborator for ASEAN members. For instance, in 2019, Guangxi conducted the inaugural China-ASEAN Artificial Intelligence Summit, drawing participants from ASEAN and China, including government officials and private sector entities. During the AI summit, the then Guangxi Chairman, Chen Wu, said in his opening speech of the summit that 'Relying on the China-ASEAN Expo, Guangxi will actively promote AI technology cooperation, product trade, investment and industrial exchange with ASEAN countries'. This summit, having completed its fourth session in 2023, exemplifies Guangxi's commitment to AI collaboration. Another major endeavour is the China-ASEAN Information Harbour, conceived as the Digital Silk Road originating from Guangxi. This platform offers digital services and connectivity to clients in China and ASEAN.

Additionally, the province organises the China-ASEAN Information Harbour Forum annually, akin to the AI summit, to promote technical and economic partnerships in AI among participants from member states and China. Guangxi also hosts other events like the Forum on China-ASEAN Technology Transfer and Collaborative Innovation, now in its eleventh year, to further technological cooperation.[56] More evidently, in Guangxi's new generation of AI development plan issued in 2018, one of the guiding principles is *Creating an ASEAN-oriented Artificial Intelligence Innovation and Application Highland*, and one of the key goals stated it clearly that Guangxi aims to turn itself into an ASEAN-oriented base for AI science and technology innovation.

On the other hand, there are subnational governments like Beijing, which are among the leading regions in terms of AI development and possess strong capacities across all four dimensions. Their successes in AI development are not reflected in terms of policy initiatives. This could be explained by Beijing's unique features. First, Beijing enjoys an unparalleled lead in domestic AI research and industrial development. For instance, according to research conducted by AlShebli et al.[57] in terms of AI research capacity, Beijing emerges as a clear outlier not just domestically but internationally, as 'the most impactful city since 2007, the most productive since 2002, and the one housing the largest number of AI scientists since 1995', and it houses nearly 30% of the AI enterprises in China.[58] The huge success of Beijing's AI development could have enabled the City Government to follow its own development pathways rather than being limited by the national development plan. Thus, it is not surprising that, rather than swiftly introducing its own local New Generation of AI development plan, on 18 February 2019, it established the Beijing National New Generation Artificial Intelligence Innovation and Development Pilot Zone, which is China's first National New Generation

[55]Zhang and Khanal (n 2).
[56]ibid.
[57]'Beijing's Central Role in Global Artificial Intelligence Research', *Scientific Reports* 12, (2022), p. 21,461.
[58]Beijing Municipality Government, '7 he 5000+ Beijingren gong zhineng chanye lingpao quanguo [7 and 1500+ Beijing's Artificial Intelligence Industry Leads the Nation] (*Beijing Municipality Government*, June 6, 2021). accessed December 9, 2023. https://www.beijing.gov.cn/fuwu/lqfw/gggs/202106/t20210609_2409514.html.

Artificial Intelligence Innovation and Development Pilot Zone. At the launching of Beijing's Pilot Zone, Mr. Wang Zhijun, vice minister of the Ministry of Information Technology, delivered a speech. In this speech, Wang fully affirmed Beijing's efforts to create a national AI innovation and application pioneer from the perspective of the national development strategy. Second, Beijing enjoys a special political status. As compared to the other Chinese provincial leaders, including some of those who govern other provincial-level cities, such as Tianjin, Shanghai and Chongqing, Cai Qi, Beijing's Party Secretary between 2017 and 2022 (Cai was Beijing Mayor between 2016 and 2017) has been widely considered to be one of Xi Jinping's most trusted confidants. Given his political ties with the paramount leaders, there is little need for him to show his political loyalty constantly and explicitly to the central government by swiftly responding to the central mandate, as seen in the case of the State Council New Generation of AI Development Plan. Instead, Beijing can afford to focus more on AI development on the ground while taking time to develop its local AI plan. Beijing introduced its new generation of AI development as late as May 2023, after nearly 6 years of the national AI plan. In this plan, Beijing set a very ambitious goal of building a core AI industry with a scale of RMB 300 billion (USD 42.37 billion) by 2025.

Conclusion

In this study, the authors examined the role of provincial governments in AI development in China. For this purpose, the authors conducted a detailed analysis of the diffusion of the 2017 NGAIDP. Overall, the findings of this research show that the focus on central and provincial governments does not necessarily align in terms of their AI development goals. While the central government prioritises issues of national security, defence and global competition, provincial governments are more concerned with the economic potential of AI. The authors also found that the private sector's capacity and the provincial leaders' political authority are crucial variables that determine the speed and quality of diffusion of AI policies. The findings show a complex interplay between provincial governments' economic and political capacities and their strategic priorities in determining their role in promoting AI. This study also examined the role of provincial governments in AI development in China by looking at the diffusion of the 2017 NGAIDP. The authors show that the capacity of the private sector on the demand side and the political authority of the provincial leaders are crucial variables that determine the speed and quality of the diffusion of AI policies.

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Appendices

Appendix A. Qualitative Comparative Analysis Variables

Summary table of the relevant indicators.

Provinces	Enterprise capacity	University capacity	GDPpc	Power	Diffusion	Diffusion Days	Instrument breadth	Policy intensity
Anhui	0.95	0.47276	0.37315	0.33158	1	0.15385564	1	0.64311
Beijing	0.99077	0.99077	0.99752	0.03824	1	0.19865304	0.9	0.52941
Chongqing	0.70392	0.82618	0.63282	0.39637	1	0.82380248	1	0.93755
Fujian	0.90479	0.23155	0.92576	0.2726	1	0.77935342	0.9	0.90359
Gansu	0.05	0.36696	0.06864	0.85404	1	0.46133473	0	0.03824
Guangdong	0.987	0.62706	0.76129	0.22065	1	0.53499553	0.9	0.69518
Guangxi	0.05	0.05	0.11074	0.90359	1	0.66842206	1	0.85404
Guizhou	0.54319	0.05	0.11191	0.58743	1	0.97083776	0.33	0.08443
Hainan	0.05	0.05	0.26317	0.9799	0		0	0.1391
Hebei	0.05	0.05	0.15054	0.08443	0		0.9	0.2726
Heilongjiang	0.41893	0.93073	0.10892	0.52941	1	0.72740171	1	0.05
Henan	0.05	0.2726	0.20459	0.82217	1	0.11767684	0.33	0.465
Hubei	0.77073	0.97435	0.65034	0.64311	1	0.03716982	0.33	0.82217
Hunan	0.62706	0.90479	0.37304	0.96007	1	0.2526	0.33	0.2726
Inner Mongolia	0.05	0.05	0.70315	0.95	0		0.67	0.22065
Jiangsu	0.93073	0.987	0.97024	0.465	1	0.60363498	0	0.2726
Jiangxi	0.05	0.31791	0.3286	0.88103	1	0.96175922	0	0.1391
Jilin	0.05	0.54319	0.1358	0.74269	1	0.91556764	0.9	0.33158
Liaoning	0.82618	0.77073	0.29503	0.1762	1	0.86089553	0.9	0.08443
Ningxia	0.03291	0.03291	0.31047	0.98405	0		0.9	0.06513
Qinghai	0.0406	0.0406	0.1887	0.69518	1	0.93486964	0.67	0.06513
Shaanxi	0.05	0.95	0.52932	0.06513	1	0.08910947	1	0.1391
Shandong	0.96411	0.41893	0.57182	0.1391	1	0.86089553	0	0.69518
Shanghai	0.97435	0.98172	0.99563	0.05	1	0.38582135	0.67	0.98736
Shanxi	0.36696	0.19502	0.37442	0.96819	0		1	0.10879
Sichuan	0.87048	0.96411	0.28016	0.93755	1	0.31543038	0.9	0.58743
Tianjin	0.47276	0.70392	0.89166	0.78509	1	0.05	1	0.96819
Xinjiang	0.31791	0.13541	0.29157	0.92225	0		0.9	0.03824
Yunnan	0.05	0.16304	0.20007	0.97469	1	0.06695092	0	0.02916
Zhejiang	0.98172	0.87048	0.88769	0.1087	1	0.95	0.9	0.64311

Appendix B. Truth tables of the fsQCA

Table A1. Truth table regarding the existence of policy diffusion.

Enterprise capacity	University capacity	GDPpc	Power	Out	N	Incl	PRI	Cases
1	1	1	1	1	6	0.975	0.975	Beijing, Chongqing, Guangdong, Jiangsu, Shanghai, Zhejiang
1	0	1	1	1	3	0.949	0.949	Anhui, Fujian, Shandong
0	1	0	1	1	1	0.934	0.934	Heilongjiang
1	1	0	1	1	1	0.933	0.933	Liaoning
0	1	1	1	1	1	0.93	0.93	Shaanxi
1	0	0	1	1	1	0.921	0.921	Guizhou
0	1	0	0	1	1	0.909	0.909	Jilin
1	1	1	0	1	1	0.907	0.907	Hubei
1	1	0	0	1	2	0.9	0.9	Hunan, Sichuan
0	1	1	0	1	1	0.891	0.891	Tianjin
0	0	0	1	0	1	0.697	0.697	Hebei
0	0	0	0	0	9	0.688	0.688	Gansu, Guangxi, Hainan, Henan, Jiangxi, Ningxia, Qinghai, Xinjiang, Yunnan
0	0	1	0	0	2	0.436	0.436	Inner Mongolia, Shanxi

Table A2. Truth table regarding the speed of policy diffusion.

Enterprise capacity	University capacity	GDPpc	Power	Out	N	Incl	PRI	Cases
1	0	1	1	1	2	0.895	0.762	Fujian, Guangdong
1	0	0	1	1	2	0.862	0.661	Anhui, Shandong
0	1	0	1	0	2	0.799	0.554	Heilongjiang, Hunan
1	1	0	1	0	1	0.797	0.54	Chongqing
0	1	0	0	0	1	0.752	0.466	Shaanxi
1	1	0	0	0	2	0.736	0.431	Liaoning, Sichuan
1	1	1	0	0	1	0.732	0.375	Hubei
0	0	0	0	0	8	0.725	0.593	Gansu, Guangxi, Guizhou, Henan, Jiangxi, Jilin, Qinghai, Yunnan
0	1	1	0	0	1	0.664	0.256	Tianjing
1	1	1	1	0	4	0.664	0.378	Beijing, Jiangsu, Shanghai, Zhejiang

Table A3. Truth table regarding the speed of policy diffusion.

Enterprise capacity	University capacity	GDPpc	Power	Out	N	Incl	PRI	Cases
1	0	1	1	1	3	0.948	0.895	Anhui, Fujian, Shandong
1	1	1	0	1	1	0.91	0.772	Hubei
0	1	1	0	1	1	0.869	0.886	Tianjin
1	1	1	1	0	6	0.817	0.694	Beijing, Chongqing, Guangdong, Jiangsu, Shanghai, Zhejiang
0	1	1	1	0	1	0.739	0.435	Shaanxi
1	0	0	1	0	1	0.719	0.244	Guizhou
1	1	0	0	0	2	0.703	0.244	Hunan, Sichuan
0	1	0	1	0	1	0.635	0.105	Heilongjiang
0	1	0	0	0	1	0.634	0.087	Jilin
1	1	0	1	0	1	0.633	0.172	Liaoning
0	0	0	1	0	1	0.557	0.065	Hebei
0	0	1	0	0	2	0.507	0.161	Inner Mongolia, Shanxi
0	0	0	0	0	0	0.359	0.127	Gansu, Guangxi, Hainan, Henan, Jiangxi, Ningxia, Qinghai, Xinjiang, Yunnan

Table A4. Truth table regarding the breadth of policy diffusion.

Enterprise capacity	University capacity	GDPpc	Power	Out	N	Incl	PRI	Cases
1	0	1	1	1	3	0.888	0.86	Anhui, Fujian, Shandong
0	1	1	1	1	1	0.867	0.806	Shaanxi
1	1	1	0	0	1	0.847	0.746	Hubei
1	1	1	1	0	6	0.839	0.8	Beijing, Chongqing, Guangdong, Jiangsu, Shanghai, Zhejiang
0	1	1	0	0	1	0.832	0.697	Tianjin
1	0	0	1	0	1	0.711	0.551	Guizhou
0	0	0	1	0	1	0.701	0.538	Hebei
0	1	0	0	0	1	0.65	0.39	Jilin
1	1	0	0	0	2	0.642	0.446	Hunan, Sichuan
0	1	0	1	0	1	0.61	0.397	Heilongjiang
0	0	1	0	0	2	0.564	0.25	Inner Mongolia, Shanxi
0	0	0	0	0	9	0.564	0.4	Gansu, Guangxi, Hainan, Henan, Jiangxi, Ningxia, Qinghai, Xinjiang, Yunnan
1	1	0	1	0	1	0.539	0.422	Liaoning

Table A5. Necessity of conditions in explaining the diffusion of policies.

Contributing factors	InCLN	RON	CoVN
Enterprise capacity	0.544	0.96	0.95
University capacity	0.586	0.981	0.979
GDPpc	0.508	0.872	0.843
Power	0.554	0.93	0.919
~Enterprise capacity	0.456	0.721	0.673
~University capacity	0.414	0.716	0.636
~GDPpc	0.492	0.795	0.76
~Power	0.446	0.749	0.689

Table A6. Necessity of conditions in explaining speed of diffusion.

Contributing factors	InCLN	RON	CoVN
Enterprise capacity	0.582	0.741	0.633
University capacity	0.536	0.688	0.56
GDPpc	0.457	0.813	0.63
Power	0.609	0.771	0.676
~Enterprise capacity	0.601	0.715	0.621
~University capacity	0.669	0.786	0.72
~GDPpc	0.748	0.636	0.644
~Power	0.598	0.7	0.607

Table A7. Necessity of conditions in explaining the intensity of diffusion.

Contributing factors	InCLN	RON	CoVN
Enterprise capacity	0.726	0.766	0.638
University capacity	0.714	0.732	0.601
GDPpc	0.798	0.763	0.667
Power	0.716	0.728	0.599
~Enterprise capacity	0.406	0.548	0.302
~University capacity	0.51	0.603	0.394
~GDPpc	0.42	0.58	0.326
~Power	0.486	0.599	0.378

Table A8. Necessity of conditions in explaining the breadth of diffusion.

Contributing factors	InCLN	RON	CoVN
Enterprise capacity	0.576	0.809	0.721
University capacity	0.583	0.783	0.698
GDPpc	0.649	0.825	0.722
Power	0.635	0.815	0.755
~Enterprise capacity	0.495	0.64	0.524
~University capacity	0.502	0.672	0.552
~GDPpc	0.467	0.658	0.517
~Power	0.466	0.657	0.515