Influencing Factors and Improvement Pathways of Provincial Government Digital Governance Capability

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Abstract

Purpose/Significance Digital governance represents a novel model for government governance innovation in the era of big data, and its effectiveness serves as a benchmark for measuring national governance capacity. Investigating the underlying causes and governance logic behind the uneven development of digital governance capabilities among provincial governments in China is of significant importance for enhancing the country's digital governance standards. Methods/Process This study selects 31 cases of digital governance from provincial-level governments in China, employs digital governance theories and configuration theory, innovatively constructs a PEST theoretical model, and conducts empirical research using the fsQCA (fuzzy-set Qualitative Comparative Analysis) method. Results/Conclusions The findings indicate that digital technology application capability is a necessary condition for high-level digital governance capacity in provincial governments; digital economy development capability and peer pressure are important conditions; the combination of policy attention and the number of government website settings can produce a substitution effect for public demand conditions. High-level digital governance capacity generates seven configuration paths, which can be categorized into four governance models based on their key conditional characteristics: capability-driven, pressure-driven, comprehensive development, and technology-driven. Representative cases from different governance models mostly leverage the resource characteristics of their respective provinces, achieving high-level governance capacity through multi-factor synergy. Future improvements in provincial digital governance capacity should be tailored to local conditions and guided by circumstances, and can be achieved through promoting digital economy development, seeking government-enterprise cooperation, or implementing "helping the weak with the strong" policies to realize overall progress in national governance capacity.

Full Text

Influencing Factors and Improvement Path of Provincial Government's Digital Governance Capacity: A Qualitative Comparative Analysis Based on Fuzzy Sets

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Abstract

[**Purpose/Significance**] Digital governance represents a new model of government governance innovation in the era of big data, and its effectiveness serves as a benchmark for measuring national governance capabilities. Exploring the underlying causes and governance logic behind the uneven development of digital governance capacity among provincial governments in China holds significant importance for enhancing the country's overall digital governance level.

[**Method/Process**] This study selected 31 provincial-level government digital governance cases in China, employed digital governance and configuration theories to innovatively construct a PEST theoretical model, and conducted empirical research using fuzzy-set qualitative comparative analysis (fsQCA).

[**Results/Conclusion**] The findings reveal that digital technology application capability constitutes a necessary condition for high-level provincial digital governance capacity, while digital economic development capability and peer pressure represent important conditions. The combination of policy attention and government website quantity can produce a substitution effect for public demand conditions. Seven configuration paths for high-level digital governance capacity were identified, which can be categorized into four governance models based on their key conditions: capability-led, pressure-driven, all-round development, and technology-driven. Representative cases across different governance models primarily leverage their provincial resource characteristics to achieve high-level governance capacity through multi-factor linkages. Future improvements in provincial digital governance capacity should adapt to local conditions and circumstances, and overall progress in national governance capacity can be achieved by stimulating digital economy development, seeking government-enterprise cooperation, or implementing "assistance" policies where stronger regions support weaker ones.

Keywords: digital governance; PEST model; configuration analysis; fsQCA
Classification: D035

Introduction

Government governance bears critical responsibilities for maintaining national public security, sustaining stable economic and social development, managing

public affairs, safeguarding popular sovereignty, and serving the broad masses. It constitutes an essential component of national governance system and capacity modernization. The year 2021 marked the beginning of China's 14th Five-Year Plan period. The *Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Long-Range Objectives Through 2035* explicitly requires "improving the construction level of digital government, widely applying digital technology to government management services, enhancing the effectiveness of digital government services, and comprehensively promoting the digitalization and intelligentization of government operation modes, business processes, and service models." Additionally, the *Guiding Opinions of the State Council on Strengthening Digital Government Construction* released in 2022 clearly states that "strengthening digital government construction is an important measure for innovating government governance concepts and methods, forming a new pattern of digital governance, and advancing the modernization of the national governance system and governance capacity." The document calls for "actively promoting the innovation of digital governance models and enhancing social management capabilities."

As a derivative of rapid digital technology development, digital governance reflects national governance capacity. Its functions include internal management "empowerment" to improve administrative efficiency, optimize public policy formulation, and enhance public service levels, as well as external "authorization" of the public to expand participation and better meet people's needs, thereby building a service-oriented government. However, in an environment characterized by diverse demands, multiple participating entities, and complex social issues, questions such as how to efficiently unleash the powerful potential of digital technology for governance, improve the digital governance system, address the "digital Leviathan" phenomenon, objectively and accurately measure governance effectiveness, and effectively enhance social governance levels have remained focal points of academic attention.

According to data from the *China Digital Government Development Research Report (2021)* published by Tsinghua University's Data Governance Research Center, China's provincial digital governments currently exhibit a ladder-like development pattern that can be roughly categorized into leading, high-quality, distinctive, developing, and catching-up types. Provinces within the same gradient also show regional differences, primarily manifesting as "significant development achievements in the eastern regions, while central and western regions lag relatively behind." Particularly in remote areas such as Xinjiang, Tibet, and Yunnan, digital governance capacity still has considerable room for improvement. This situation not only poses higher requirements and challenges for comprehensively advancing governance system and capacity modernization in China, but also prompts critical questions: What are the decisive factors for achieving high-level digital governance capacity? What causes differences in digital governance capacity among provincial governments? Are these differences caused by single factors or multiple factor combinations? Do common patterns exist in the governance practices of provinces with high-level capac-

ity? Are there breakthrough improvement paths for provinces with weak digital governance capacity?

Current research on digital governance has generally followed a logical progression from "conceptual theory" to "innovative practice," then to "evaluation," and finally to "influencing factors." Studies have examined conceptual distinctions between digital government and e-government, the essence and core dimensions of digital governance models, and analyses of practical cases (such as Guangdong, Zhejiang, and Guizhou provinces), as well as research on influencing factors of governance levels or government service capabilities. However, most of these studies employ traditional linear regression methods or case analysis approaches. While these quantitative indicators can indeed characterize digital governance effectiveness and capacity, focusing solely on the "net effects" of individual factors is insufficient. The complex interplay among multiple factors must also be considered. The configuration perspective and QCA method, as an emerging research paradigm, can effectively analyze causal complexity issues involving multiple concurrent factors, compensating for the limitations of traditional qualitative methods. As configuration theory has been extensively applied in research on influencing factors of digital government construction, big data sharing, government service capacity, and smart cities (communities), its advantages have become increasingly evident.

In view of this, this study attempts to employ digital governance and configuration theories, drawing on previous research to construct a PEST model, select measurement indicators from multiple dimensions, and conduct fuzzy-set qualitative comparative analysis using 31 provincial government digital governance cases in China. The study explores configuration solutions for both high-level and non-high-level provincial digital governance capacity, aiming to reveal the multiple conditional configurations and complex mechanisms behind provincial digital governance capacity differences, and provide possible theoretical references for improving provincial digital governance capacity and advancing digital government construction.

2.1 Analytical Framework

In existing analytical frameworks for provincial government digital governance capacity influencing factors, scholars have employed the "Technology-Organization-Environment" (TOE) framework, ecosystem theory framework, policy diffusion models, or strategic triangle models. The TOE framework, in particular, has been widely applied due to its universality in studies on government service capacity, government website construction, government data openness levels, and "Internet + Government Services" data collaboration. Compared with these models, the PEST model emphasizes the "economic" and "political" dimensions more explicitly. In previous research, these two dimensions were often integrated into the "environment" dimension of the TOE model. To refine variable indicators and considering the critical impact of digital economy development on digital governance practice—as Feng Huiyong

pointed out in his research, a region's economic development level determines public internet access, digital product purchasing power, and local government fiscal expenditure, all of which are crucial for enhancing digital governance capacity—this study innovatively selects the PEST model. It incorporates "digital economy development capability" as a conditional variable in the social dimension and constructs an analytical framework for digital government governance capacity generation based on the practical context of provincial digital governance in China (see Figure 1 [Figure 1: see original paper]).

In the political dimension, relevant research indicates that central administrative guidance behaviors (such as various administrative guidance documents) help promote local policy innovation and implementation, thereby shaping diverse forms of national governance. Therefore, "policy attention" is selected as an antecedent variable to measure provincial digital governance levels. In the economic dimension, provincial digital governance practices require support in funding, technology, and personnel, and the generation logic of online government service capabilities differs between economically developed and underdeveloped regions. Consequently, "provincial government fiscal resource capacity" and "local digital economy development level" are selected as measurement indicators. In the social dimension, for rapidly developing and densely populated areas, public demands are more diverse, posing greater pressure and challenges for government governance. Meanwhile, competitive pressure among structurally similar governments affects the diffusion process of innovation, as provincial governments monitor policy developments among peer governments and emulate "best practices" to narrow competitive gaps. Therefore, "public demand" and "peer pressure" variables are selected for this dimension. In the technical dimension, the development of digital governance models originates from high technologies such as big data. Undoubtedly, technical conditions are key variables for measuring digital governance capacity. Public demand for government portal websites directly affects the performance of government website construction, and professional management of website platforms is fundamental to meeting public needs and achieving expected digital governance goals. Therefore, "government website quantity" and "technology application capability" are selected to measure this dimension.

2.2 Research Method and Case Selection

This study employs fuzzy-set qualitative comparative analysis (fsQCA) to investigate the influencing factors and improvement paths of digital governance capacity in China's provincial governments. Qualitative comparative analysis (QCA) is a set-theoretic configurational analysis method based on Boolean algebra, explicitly proposed by Charles C. Ragin in 1987. QCA provides more nuanced analysis for complex management issues such as cross-case heterogeneity, concurrent conditions, asymmetric relationships, and equifinal paths. It attempts to transcend traditional case-oriented research approaches and serves as a powerful analytical tool combining "case orientation" with "data orienta-

tion."

The method has been widely used in social sciences and continuously improved. Based on variable selection and design, QCA includes three variants: crisp-set, fuzzy-set, and multi-value. Considering the complex dynamic interactions among multiple elements reflected in various fields under "VUCA" environments, the temporal dimension has been introduced into QCA, developing into temporal qualitative comparative analysis, time-related condition analysis, time-series qualitative comparative analysis, and multi-period qualitative comparative analysis.

The primary reasons for selecting fsQCA include: First, from a sample size perspective, fsQCA is suitable for small to medium-sized samples. This study analyzes the digital governance conditions of 31 provincial governments in China, making it appropriate for this method. Second, regarding sample feature applicability, csQCA is suitable for dichotomous conditions ("yes" or "no"), whereas social issues require consideration of degree changes or partial membership relationships rather than black-and-white categorization—fsQCA is well-suited for this study's variable characteristics. Third, from a scientific analysis perspective, fsQCA emphasizes the sufficiency and necessity of conditional variables, enabling more precise and rigorous set-theoretic consistency evaluation. It also has a solid literature reference base through extensive application in digital government construction, government service capacity, and government information disclosure research. Fourth, the configuration evaluation scope is broader. The method embodies configuration theory principles, acknowledging that multiple condition combinations can lead to the same result. In csQCA or mvQCA, evaluation of an antecedent combination only applies to cases that fully conform to it, whereas in fsQCA, cases with partial membership in the truth table are included in the evaluation, meaning each condition combination's assessment is based on patterns presented across all cases, facilitating observation and analysis of results.

This study examines 31 provincial government data governance cases, with provincial government digital governance capacity as the outcome variable, to explore influencing factors and configuration paths for generating high-level provincial digital governance capacity. The focus is on cross-case comparative analysis of provincial digital governance to examine the logical relationships between different antecedent variable combination patterns and outcomes. Provincial governments were selected as the sample unit because China's digital governance is led by the central government and implemented top-down to provincial units, which then delegate to local city and county governments. Provincial governments play a critical bridging role. Examining digital governance capacity not only helps provincial governments comprehensively understand central-level strategic intentions but also facilitates detailed policy interpretation and supervision of local government data governance processes. Moreover, digital governance requires substantial funding, talent, and infrastructure for big data, artificial intelligence, cloud computing, and blockchain technologies—provincial

governments have more complete resource conditions than local governments and are positioned at the same administrative level, ensuring comparability. Finally, regarding data collection and processing, provincial governments have relatively comprehensive data resources, allowing cross-sectional comparisons using provincial statistical reports and facilitating the later adoption of excellent provincial governance experiences to promote overall national digital governance capacity improvement.

2.3 Variable Selection and Design

Based on existing literature and this study's theme, the outcome variable is selected as the digital governance capacity of provincial (autonomous region, municipality) governments. Digital governance encompasses multiple dimensions including macro decision-making, economic regulation, market supervision, social governance, and ecological protection, making direct assessment complex. Therefore, the "provincial digital government governance capacity primary indicator" from the *China Digital Government Development Research Report (2021)* published by Tsinghua University's School of Social Sciences Data Governance Research Center is selected as the outcome variable. This report, building on domestic and international evaluation indicator systems and employing scientific research methods, constructs an evaluation framework from dimensions such as organizational structure, institutional system, governance capacity, and governance effectiveness, providing a panoramic display of digital government development trends. Selecting this indicator data satisfies requirements for correctness and representativeness.

As established in the theoretical foundation section, seven antecedent variables are selected to explain the outcome variable: policy attention, fiscal resource capacity, digital economy development level, public demand, peer pressure, technology application capability, and government website quantity. Specific condition variable designs are shown in Table 1 .

Table 1 Variable Overview - **Outcome Variable:** Provincial Digital Government Development Index - **Data Source:** *China Digital Government Development Research Report (2021)* - **Policy Attention:** Number of normative documents on digital governance - **Data Sources:** PKULAW Database, E-Government Pulse Think Tank - **Fiscal Resource Capacity:** Per capita general public budget expenditure - **Data Source:** *China Statistical Yearbook (2021)* - **Digital Economy Development Capability:** Local digital economy development index - **Data Source:** *National Digital Economy Development Index (2021)* - **Public Demand:** Mobile internet user ratio - **Data Source:** *China Statistical Yearbook (2021)* - **Peer Pressure:** Average government service capability of adjacent provinces - **Data Source:** *Provincial Government and Key City Integrated Government Service Capability Survey and Evaluation Report (2021)* - **Technology Application Capability:** Provincial government integrated government service capability - **Data Source:** *China Digital Government Development Research Report (2021)* - **Government Website Quan-**

tity: Number of government websites - **Data Source:** *49th Statistical Report on China's Internet Development*

2.4 Variable Assignment and Calibration

Since QCA is a set-theoretic configurational analysis method based on Boolean algebra, calibrating raw data is a fundamental step for data analysis. Building on existing theories and previous research, and combining the specific characteristics of this study's variables, both outcome and condition variables in this research employ direct calibration method, selecting the 95th, 50th, and 5th percentiles as three qualitative anchors representing full membership, crossover point, and full non-membership, respectively. Specific calibration results are shown in Table 2 .

Table 2 Variable Calibration Anchors | Variable | Full Membership (95%) | Crossover Point (50%) | Full Non-Membership (5%) | |———-|———————-|———————|———————| | Digital Governance Capacity (y) | | | | | Policy Attention (a) | | | | | Fiscal Resource Capacity (b) | | | | | Digital Economy Development Capability (c) | | | | | Public Demand (d) | | | | | Peer Pressure (e) | | | | | Technology Application Capability (f) | | | | | Government Website Quantity (g) | | | |

3.1 Single Condition Necessity Analysis

Empirical analysis requires reliability and validity testing to ensure data consistency and effectiveness with research questions. Similarly, fsQCA analysis requires necessity testing for each condition to determine whether individual condition variables constitute necessary conditions for the outcome variable. According to mainstream rules for single-condition necessity testing, the minimum threshold for necessary conditions is set at 0.9. If a single condition's consistency level exceeds this threshold, the condition variable can be considered a necessary condition for the outcome variable; otherwise, it indicates that achieving the result requires comprehensive examination of multiple variables' interactions. Necessity analysis was conducted using fsQCA3.0 software. As shown in Table 3 , in the necessity test for high-level provincial digital governance capacity, all condition variables' consistency levels are below 0.9, indicating that no single antecedent condition alone can explain the outcome variable. In the necessity test for non-high-level provincial digital governance capacity, the non-high technology application capability variable's consistency exceeds 0.9, potentially constituting a core condition for non-high-level digital governance capacity. Except for this condition, none of the other conditions constitute necessary conditions for the outcome, demonstrating that both high-level and low-level provincial digital governance capacities are influenced by linkages or substitutions among multiple conditions. This reflects the holistic and complex nature of digital governance, requiring examination of multiple paths for provincial digital governance capacity generation from a configurational perspective.

To further verify whether non-high technology application capability is a core variable for non-high digital governance capacity, correlation analysis was conducted on all variables. The correlation results for the outcome variable were not significant, which indirectly demonstrates the important role of technology application capability in forming high-level digital governance capacity while also confirming the need for synergistic efforts from other variables. This further validates the fsQCA single-condition necessity analysis results.

Table 3 Necessity Test Results for Single Condition Variables (3 decimal places) | Condition | High Digital Governance Capacity | Non-High Digital Governance Capacity | |————|————————————-|————————————| | High Policy Attention | | | | ~High Policy Attention | | | | High Fiscal Resource Capacity | | | | ~High Fiscal Resource Capacity | | | | High Digital Economy Development Capability | | | | ~High Digital Economy Development Capability | | | | High Public Demand | | | | ~High Public Demand | | | | High Peer Pressure | | | | ~High Peer Pressure | | | | High Technology Application Capability | | | | ~High Technology Application Capability | | | | High Government Website Quantity | | | | ~High Government Website Quantity | | |

3.2 Configuration Analysis for High-Level Provincial Digital Governance Capacity Generation

Sufficiency analysis of condition configurations is the core of QCA methodology, primarily aimed at analyzing whether different combinations of condition factors forming antecedent configurations are sufficient for the outcome variable. This is generally accomplished through three core steps: constructing the truth table, perfecting the truth table, and analyzing the truth table. The consistency level threshold for judging sufficiency generally adopts Schneider and Wagemann's proposed minimum of 0.75, though this can be adjusted based on specific research questions and data conditions. Frequency thresholds are typically set at 1 for small to medium samples and greater than 1 for large samples. PRI consistency can be set at 0.50, 0.65, 0.70, 0.75, etc. When PRI consistency exceeds 0.75, it can effectively avoid contradictory configurations and facilitate better data observation. Therefore, following QCA calculation rules and considering practical issues, this study sets consistency at 0.80, frequency threshold at 1, and PRI consistency at 0.75. After standardizing the truth table data analysis using fsQCA3.0 software, a configuration path table for high-level provincial digital governance capacity was generated. This table was constructed based on the intermediate solution supplemented by the parsimonious solution. If a condition variable appears in both the intermediate and parsimonious solutions, it is defined as a core condition (denoted by "•"); if it appears only in the intermediate solution, it is defined as a peripheral condition (denoted by "•"). Specific configuration paths are shown in Table 4 .

Table 4 shows seven configuration paths influencing high-level provincial digital governance capacity, with consistency indicators of 0.967, 0.950, 0.970, 0.973, 0.982, 0.977, and 0.966, respectively. This indicates that all seven configura-

tions are sufficient conditions for high-level provincial digital governance capacity. The total coverage of model solutions is 0.653, suggesting these configurations explain approximately 65.3% of high-level provincial digital governance capacity cases. Both solution consistency and coverage exceed critical values, demonstrating effective empirical analysis.

Stability testing was conducted using two methods: adjusting consistency thresholds and PRI consistency. First, when consistency was appropriately increased (from 0.8 to 0.85), the new configuration paths remained completely consistent with Table 4. Second, with consistency maintained at 0.80 and PRI consistency increased from 0.75 to 0.80, the new configuration paths still remained completely consistent with Table 4. Therefore, the research conclusions can be considered robust.

Table 4 Configuration Paths for High-Level Provincial Digital Governance Capacity | Configuration | Capability-Led | Pressure-Driven | All-Round Development | Technology-Driven | |————————|————————-|————————|————————|————————-| | Policy Attention | | | | | Original Coverage | | | | | Unique Coverage | | | | |

Note: • indicates core condition present, • indicates peripheral condition present, indicates core condition absent, indicates peripheral condition absent, blank indicates condition is irrelevant.

Specifically, in Configuration 1, digital economy development capability and technology application capability serve as core conditions. This path explains approximately 24.7% of provincial government cases with high-level digital governance capacity, with 5.2% of cases explained exclusively by this path. This configuration indicates that when provincial governments possess strong digital economy development and digital technology application capabilities along with robust public demand, they can maintain high-level digital governance capacity even with insufficient policy attention and limited specialized government websites. Representative provinces for this configuration are Beijing and Fujian.

In Configuration 2, the same core conditions of high digital economy development capability and technology application capability apply. The difference lies in that with attention to digital governance policy documents and increased specialized government website deployment, high-level digital governance capacity can be achieved even with insufficient public demand. This path explains approximately 35% of high-level provincial digital governance capacity cases—the largest original coverage among all configurations—with 5.8% of cases explained exclusively by this configuration. Notably, compared with Configuration 1, the combination of policy attention and government website quantity can produce a substitution effect for public demand conditions, providing a reference improvement path for provinces with inadequate infrastructure or low policy attention. Representative provinces include Hubei, Anhui, Sichuan, and Henan.

In Configuration 3, peer pressure and technology application capability constitute core conditions. This path explains approximately 29% of high-level

provincial digital governance capacity cases, with 6.1% of cases explained exclusively by this path. This configuration demonstrates that under peer pressure and with strong technology application capability support, along with sufficient attention to digital governance policies and specialized website platforms, high-level governance effectiveness can be achieved even with insufficient fiscal resources. Typical provinces for this capability-type configuration path include Shandong and Jiangsu.

In Configuration 4, the same core conditions of peer pressure and technology application capability apply. Notably, Configuration 4 places greater emphasis on fiscal resource capacity and public demand, achieving high-level provincial digital governance capacity despite insufficient policy attention, digital economy development capability, and government website quantity. This path explains approximately 19.6% of high-level digital governance cases with a unique coverage rate of 3.3%. The typical province for this configuration path is Hainan.

In Configuration 5, digital economy development capability and technology application capability serve as core conditions. This path explains approximately 25.3% of high-level digital governance provincial cases but has only 7% unique coverage. Although sharing the same core conditions as Configurations 1 and 2, this configuration emphasizes the linkage of other conditional variables, including policy attention, public demand, and government website quantity. It can be viewed as a combination of Configurations 1 and 2, placing greater emphasis on all-round development across four dimensions. Representative provinces include Guangdong and Zhejiang, which have consistently ranked among leading digital government construction tiers and offer significant reference value.

In Configuration 6, digital economy development capability, peer pressure, and technology application capability constitute core conditions. This path explains approximately 23.2% of high-level provincial digital governance capacity cases, with 1.6% of cases explained exclusively by this path. This "all-rounder" path encompasses six of the seven conditional variables across four dimensions, emphasizing comprehensive development in policy, digital economy, technology application, and public demand. Representatives of this configuration path are "top performers" in digital government construction rankings, including Tianjin, Shanghai, and Jiangsu.

In Configuration 7, technology application capability is the sole core condition. This path explains approximately 21.7% of high-level provincial digital governance capacity cases, with 3.8% of cases uniquely covered by this path. This path focuses only on two technical dimension variables, achieving a "breakthrough" in digital governance capacity through strong digital technology application capability and professional government website infrastructure despite insufficient policy attention, fiscal resource capacity, digital economy development capability, public demand, and peer pressure. The representative province for this configuration path is Guizhou.

Overall, across the seven identified configuration paths for high-level provin-

cial digital governance capacity, technology application capability consistently serves as a core condition in all configurations, consistent with the conclusion from the single-condition necessity test. This demonstrates that vigorous development and effective application of digital technology is key to promoting digital governance capacity enhancement.

3.3 Case Analysis of High-Level Provincial Digital Governance Capacity

Table 4 reveals that multiple paths lead to high-level provincial digital governance capacity. Based on differences between core and peripheral conditions, these seven configuration paths can be broadly categorized into four types: capability-led (Configurations 1 and 2), pressure-driven (Configurations 3 and 4), all-round development (Configurations 5 and 6), and technology-driven (Configuration 7). The distribution of cases across specific configuration paths is illustrated in Figure 3 [Figure 3: see original paper].

In capability-led cases, emphasis is placed on digital economy development capability and technology application capability. Beijing, as one of the regions with the densest distribution of high-tech enterprises and talent, possesses nationally leading big data technology innovation infrastructure. Research data indicates that in 2021, Beijing's digital economy development capability ranked second nationwide, following Guangdong. Behind the flourishing digital economy lies policy support. Since 2012, Beijing has successively issued digital economy-related policies to activate digital economic vitality, including 58 digital economy policies in 2020 alone such as the *Beijing Digital Economy Innovation Development Action Outline (2020-2022)* and the *Beijing Digital Trade Pilot Zone Experimental Scheme*. In July 2021, Beijing released the *Implementation Plan for Accelerating the Construction of a Global Digital Economy Benchmark City*, proposing to build "six high grounds" leading global digital economy development within 5-10 years, creating a "Beijing model" and "Beijing benchmark" for China's and the world's digital economy development. These policies have greatly promoted regional digital economy development, providing a financial foundation for digital governance. In technology application, Beijing focuses on government digital transformation, targeting enhanced enterprise and public satisfaction to accelerate digital government construction centered on digital services, digital regulation, and digital business environments. Various digital technologies including blockchain, artificial intelligence, and big data are widely applied in government services, public services, regulatory enforcement, business environments, and responsive governance. Integrated service experiences represented by "online handling, mobile handling, self-service handling, intelligent handling, and cross-provincial handling" continue to be optimized, significantly improving service capacity and electronic service efficiency. This lays the foundation for the capital's "four centers" strategic positioning and "four services" requirements, greatly advancing the modernization of the capital's governance system and capacity.

In pressure-driven cases, emphasis is placed on peer pressure and technology application capability, with Shandong Province representing this development path. The province has a solid foundation for big data technology innovation, with its big data industry development index consistently ranking among the top nationwide. This has deepened government understanding and attention to data technology application. Simultaneously, Shandong has accelerated digital province construction, established a national internet backbone direct connection point, strengthened digital technology innovation research, deeply implemented the "Double Excellence and Double Hundred" government service improvement project, and coordinated smart city and digital rural construction. To grasp the transformative significance of emerging information technologies like big data, the Shandong provincial government emphasizes big data application in governance and has issued a series of policy documents to promote "Digital Shandong" construction, including the *Digital Shandong Development Plan (2018-2022)*, *Shandong Digital Government Construction Implementation Plan (2019-2022)*, and *Shandong Electronic Government and Government Data Management Methods*. These measures have promoted Shandong's digital governance capacity improvement and yielded certain governance achievements. According to the newly released *Digital China Development Report (2021)*, Shandong ranks sixth nationwide in comprehensive digital development level and first in cybersecurity construction. Geographically, Shandong is located in the developed northern coastal economic zone, adjacent to Hebei, Henan, Anhui, and Jiangsu provinces, which have also achieved notable digital governance results. Particularly, Jiangsu has continuously deepened "streamlining administration and delegating power" reforms around the goal of "creating the best government service environment nationwide" and "benchmarking against international standards and domestic first-class levels," maintaining "very high (90+)" online government service capability for five consecutive years (2017-2021). Anhui, another "top performer" in capability-led digital governance, has built the "Wan Shi Tong Ban" brand through its digital government service platform, further enhancing enterprise and public satisfaction. Under circumstances of high population density, urgent public demand, and major digital transformation trends, Shandong faces significant peer pressure and must leverage its advantages to convert pressure into motivation for achieving efficient digital government.

In the all-round development configuration path, all four dimensional condition variables are satisfied. Politically, policy document support for digital governance and digital government construction is provided, demonstrating top-level design attention. Economically, regional economies are vigorously developed, relying on local digital industries or high-tech enterprises to promote high-quality digital economy development. Socially, public enthusiasm for digital government construction and digital governance is high, with active participation in social governance processes, further driving digital governance capacity improvement. Technically, supported by prominent local high-tech enterprises and government-backed infrastructure resources, data openness, sharing, and

active application are achieved under professional talent teams, creating favorable business environments and providing technical guarantees for optimizing public living environments and enhancing happiness. This development path primarily includes Guangdong, Zhejiang, Tianjin, Shanghai, and Jiangsu. According to relevant reports, Shanghai, Zhejiang, and Tianjin rank 2nd-4th in digital government governance effectiveness. As one of the "two super" industrial digitalization super-traction cities, Shanghai drives the digital development of secondary and tertiary industries and serves as a radiation center, exporting industrial digital transformation technology, solutions, and talent to southern and eastern coastal cities, driving digital transformation in other regions. Shanghai also continuously explores new urban governance paths represented by "one network for all government services" and "one network for unified urban management," weaving two dense networks to promote urban governance model and system transformation. Guangdong has established a "Digital Government" reform and construction work leading group headed by the governor to personally deploy big data system reform, addressing insufficient big data coordination and establishing a province-wide integrated work promotion mechanism. Focusing on market-oriented allocation reform of data elements and targeting provincial governance and government services, Guangdong has explored and constructed a "12345+N" digital government work business system, promoting province-wide digital government 2.0 construction, accelerating balanced digital government development, and driving accelerated transformation from digitalization to intelligentization, providing strong support for high-quality economic and social development across the province. Zhejiang, centered on the overall goal of building a "holistic intelligent governance, pragmatic and pioneering" modern government, has basically established itself as a "province of mobile handling affairs," "province of mobile office work," and "province of mobile management." Adhering to the "Digital Zhejiang" blueprint, Zhejiang pioneered digital reform implementation to promote comprehensive deepening of reforms, providing strong momentum for high-quality development and common prosperity demonstration zone construction. The province established a digital development strategy themed "Maximum One Run Reform," using this as a lever to drive digital transformation across various fields. By fully leveraging social forces and innovating government-bank cooperation, Zhejiang has promoted digital governance radiation to grassroots rural governments and remote areas, forming a comprehensive and systematic digital governance system that enhances digital governance performance.

In technology-driven path cases, the core condition variable is technology application capability, with Guizhou Province as the typical case. Although located in southwestern China with relatively weak resource endowments, particularly significant gaps in economic development level compared to Guangdong and Zhejiang, Guizhou's successive leaders have emphasized digital development and actively laid out the big data industry, achieving remarkable results in digital governance and viewing it as a key strategy for "overtaking." In 2014, Guizhou built the nation's first "Cloud Guizhou" system platform, attracting attention

from numerous internet enterprises and multinational corporations. In 2015, Guizhou established the Big Data Development Administration to coordinate and manage provincial digital governance functions. Leaders of prefecture-level cities and municipal departments in Guizhou are specifically responsible for data cloud-related work, effectively advancing big data system projects such as e-government cloud and industrial cloud. In June 2018, Guizhou released the *Opinions on Promoting Big Data, Cloud Computing, and Artificial Intelligence Innovation Development to Accelerate Digital Guizhou*, clarifying macro goals and specific plans for Digital Guizhou construction. In December 2018, Guizhou released the *Work Plan for Promoting "One Cloud, One Network, One Platform" Construction*, promoting the building of government service "one cloud," public service information system "one network," and integrated government service platform and government data platform. In June 2020, the Guizhou Big Data Administration formulated the *Big Data Standardization System Construction Plan (2020-2022)*, promoting big data standardization system construction at the provincial level. Overall, Guizhou has achieved coordinated interaction between digital economy development needs and government digital governance through early layout of digital government construction and the big data industry, attracting numerous influential internet enterprises to establish servers in Guiyang.

Conclusion

Provincial government digital governance capacity is a topic with complex causal relationships. To clarify its underlying mechanisms, this study employed digital governance and configuration theories, combined with the actual situation of provincial digital governance in China, refined seven variables across four PEST model dimensions, and used fsQCA as the theoretical and empirical tool to examine digital practices across 31 provinces. The research reveals: (1) From a single-condition perspective, digital technology application capability is a necessary condition for high-level provincial digital governance capacity, digital economy development capability and peer pressure are important conditions, and the combination of policy attention and government website quantity can produce a substitution effect for public demand conditions. (2) From a configurational generation perspective, seven high-level digital governance capacity configuration paths were identified, which can be categorized into four governance models—capability-led, pressure-driven, all-round development, and technology-driven—based on key conditions, with different synergistic mechanisms among influencing factors across paths. (3) From practical digital governance case perspectives, representative cases in different governance models primarily leverage provincial resource characteristics to achieve high-level governance capacity through multi-factor linkages. Provinces such as Shanghai, Zhejiang, Guangdong, Jiangsu, and Guizhou provide referenceable models for promoting overall progress in China's government digital governance capacity.

China's digital governance capacity development must adhere to the principles

of seeking truth from facts and adapting to circumstances, fully leveraging the different roles of various factors. Based on this, this study proposes optimization recommendations from the following aspects: (1) **Capability-led type:** Continue leveraging the important driving role of digital economy development and technology application capabilities while strengthening policy attention and further stimulating public demand. Facing resource "shortcomings," local governments can issue digital development policies to attract high-tech talent and enterprises, transforming land resource costs into funding and technology benefits to provide adequate financial support for digital government development. (2) **Pressure-driven type:** Prioritize meeting broad public needs, converting pressure into motivation, accelerating the improvement of key digital government infrastructure, leveraging provincial technology application capability advantages, and driving high-quality digital economy development to provide long-term momentum for digital governance practice. (3) **All-round development type:** While maintaining existing advantages, learn from digital governance experiences of developed countries and cities, and proactively play a leading role by using centers like Shanghai and Guangzhou to radiate support to surrounding provinces, implementing assistance policies to provide governance experience or technical, talent, and financial support to neighboring provinces. (4) **Technology-driven type:** Achieve "curve overtaking" through strong digital technology capabilities, strengthen cooperation and exchange with surrounding provinces to address shortcomings, and achieve comprehensive digital governance development. (5) Facing significant east-west differences in digital governance capacity, especially in China's western remote regions, efforts should be based on local advantages to select appropriate digital governance models. Seize digital development opportunities, actively seek help from better-developed provinces, leverage external conditions for infrastructure construction to break digital governance development bottlenecks, and capitalize on national policies like "East Data West Computing" and digital economy development. Utilize natural advantages such as land and energy resources to attract numerous technology enterprises and professional talent, laying a solid foundation for digital governance.

References

[1] *Outline of the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Long-Range Objectives Through 2035* [EB/OL]. (2021-03-13) [2023-04-11]. http://www.gov.cn/xinwen/202103/13/content_{5592681}.htm.

[2] *Guiding Opinions of the State Council on Strengthening Digital Government Construction* [EB/OL]. (2022-06-23) [2023-04-11]. http://www.gov.cn/zhengce/content/2022-06/23/content_{5697299}.htm.

[3] Tsinghua University Data Governance Research Center. *China Digital Government Development Research Report (2021)* [R/OL]. (2021-10-25) [2023-04-11]. https://www.dps.tsinghua.edu.cn/info/1197/2464.htm

[4] Huang Huang. The Policy Evolution of "Digital Government" in China—Also on the Relationship Between "Digital Government" and "E-Government" [J]. Administrative Tribune, 2020, 27(03): 47-55.

[5] Huang Huang. Digital Government: Policy, Characteristics and Concept [J]. Governance Studies, 2020, 36(03): 6-15+2.

[6] Ma Liang. Digital Government Construction: Literature Review and Research Prospects [J]. Party and Government Research, 2021(03): 99-111.

[7] Wang Weiling. Accelerating the Implementation of Digital Government Strategy: Realistic Dilemmas and Solutions [J]. E-Government, 2019(12): 86-94.

[8] Zhang Chengfu, Xie Kankan. Government Transformation and Digital Government in the Digital Era [J]. Administrative Tribune, 2020, 27(06): 34-41.

[9] Wang Xiaoyu, Wang Hongyu. Governance Model in the DT Era: Developing Digital Government and Data Government [J]. Journal of Hebei University (Philosophy and Social Sciences Edition), 2018, 43(04): 133-143.

[10] Bao Jing, Fan Ziteng, Jia Kai. Research on Digital Government Governance Forms: Conceptual Analysis and Hierarchical Framework [J]. E-Government, 2020(11): 2-13.

[11] Jiang Minjuan, Huang Huang. Digital Government: Conceptual Definition, Value Implication and Governance Framework—Based on Literature and Experience from Western Countries [J]. Contemporary World and Socialism, 2020(03): 175-182.

[12] Lu Feng. Practice and Exploration of "Digital Government" in Guangdong [J]. Administrative Management Reform, 2018(11): 55-58.

[13] Wu Kechang, Yan Xinyao. Digital Governance Drive and Public Service Supply Model Reform—Based on Practice in Guangdong Province [J]. E-Government, 2020(01): 76-83.

[14] Zhang Nandiyang. Government Service Commitment Duration: Influencing Factors Based on Matter Characteristics—A Case Study of "Maximum One Run" Reform in District A, Hangzhou City, Zhejiang Province [J]. Chinese Public Administration, 2021(03): 13-20.

[15] Lou Hechao. Practice and Enlightenment of "Maximum One Run" Reform in Zhejiang [J]. Macroeconomic Management, 2020(08): 73-77.

[16] Zhou Yasong. Digital Government Construction: Current Situation, Dilemmas and Countermeasures—A Case Study of "Cloud Guizhou" Government Data Platform [J]. Journal of Yunnan Administration College, 2019, 21(02): 120-126.

[17] Jiang Minjuan. Comparison of Local Digital Government Construction Models—Taking Guangdong, Zhejiang and Guizhou as Examples [J]. Administrative Management Reform, 2021(06): 51-58.

[18] Tang Zhiwei, Guo Yuhui, Zhai Yuanfu. Research on Online Government Service Handling Capability Under Socio-Technical Framework—Based on Data Analysis of 334 Prefecture-Level Administrative Districts [J]. Chinese Public Administration, 2019(01): 37-44.

[19] Han Xiao, Wu Jinpeng. Governance Demand, Government Capability and Internet Service Level: Empirical Evidence from Chinese Local Governments [J]. Journal of Intelligence, 2019, 38(03): 173-179.

[20] Wang Fashuo. Influencing Factors of Provincial Government "Internet + Government Services" Capability—A Qualitative Comparative Analysis Based on 30 Provincial Government Samples [J]. Journal of Northeastern University (Social Science Edition), 2019, 21(02): 173-179.

[21] Ding Yixia, Xu Erni, Guo Junhua. Can Resource Advantages Bring Higher E-Government Service Capability?—A Qualitative Comparative Analysis Based on 31 Provincial Governments [J]. Gansu Administration Institute Journal, 2020(01): 25-35+125-126.

[22] Zhang Huijuan, Jin Longlong. Influencing Factors and Improvement Paths of Local Government Integrated Government Service Capability—A Fuzzy-Set Qualitative Comparative Analysis Based on 32 Key Cities [J]. Lanzhou Academic Journal, 2022(09): 56-68.

[23] Du Yunzhou, Li Jiaxin, Liu Qiuchen, Zhao Shuting, Chen Kaiwei. Configuration Theory and QCA Method from a Complex Dynamic Perspective: Research Progress and Future Directions [J]. Management World, 2021, 37(03): 180-197+12-13.

[24] Du Zhongrun. Research on Influencing Factors of Online Government Service Capability in China's Key Cities Under TOE Theory [J]. Administration and Law, 2021(12): 56-65.

[25] Tan Haibo, Fan Ziteng, Du Yunzhou. Technology Management Capability, Attention Allocation and Local Government Website Construction—A Configuration Analysis Based on TOE Framework [J]. Management World, 2019, 35(09): 81-94.

[26] Li Jiangping, Yao Yifan, Ye Zhonghua. Influencing Factors and Development Paths of Provincial Government Big Data Development Level Under TOE Framework—An Empirical Study Based on fsQCA [J]. Journal of Intelligence, 2022, 41(01): 200-207.

[27] Song Yeqin. Research on Influencing Factors of "Internet + Government Services" Data Collaborative Governance Level [D]. University of Electronic Science and Technology of China, 2021.

[28] Feng Huiyong. Measurement and Empirical Research on Provincial Government Digital Governance Level [D]. Central China Normal University, 2022.

[29] Ye Zhipeng, Li Xi. Analysis of the Operation Mechanism of Central Administrative Guidance—A Case Study Based on Provincial Government Website Construction [J]. Chinese Public Administration, 2021(05): 86-94.

[30] Han Nana. The Generation Logic and Model of Online Government Service Capability of Chinese Provincial Governments—A Fuzzy-Set Qualitative Comparative Analysis Based on Data from 31 Provinces [J]. Public Administration Review, 2019, 12(04): 82-100+191-192.

[31] Wu Jinpeng, Han Xiao. Institutional Environment, Intergovernmental Competition and Open Government Data Policy Diffusion Research [J]. Modern Information, 2019, 39(03): 77-85.

[32] Douglas E J, Shepherd D A, Prentice C. Using Fuzzy-Set Qualitative Comparative Analysis for a Finer-Grained Understanding of Entrepreneurship [J]. Journal of Business Venturing, 2020, 35(1): 1-17.

[33] Ragin C C. Redesigning Social Inquiry: Fuzzy Sets and Beyond [M]. Cambridge: University of Chicago Press, 2008: 77-78.

[34] Schneider C Q, Wagemann C. Set-Theoretic Methods for the Social Sciences: A Guide to Qualitative Comparative Analysis [M]. Cambridge: Cambridge University Press, 2012.

[35] Zhang Ming, Du Yunzhou. Application of QCA Method in Organization and Management Research: Positioning, Strategy and Direction [J]. Chinese Journal of Management, 2019, 16(09): 1312-1323.

[36] Greckhamer T. CEO Compensation in Relation to Worker Compensation Across Countries: The Configurational Impact of Country-Level Institutions [J]. Strategic Management Journal, 2016(04): 793-815.

[37] Wu Tao. Theoretical Research and Practical Exploration of Digital Government and Digital Governance in China [J]. Journal of Yunnan Institute of Socialism, 2021, 23(03): 108-114.

[38] Liao Fuchong. Research on Digital Governance Capacity Generation Model Based on "Institution-Behavior" Framework [J]. Huxiang Forum, 2022, 35(02): 78-93.

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