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Governance in the Digital Age: Grassroots Initiatives and Urban Commercial Vitality

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Abstract: ***Under the new development paradigm, grassroots digital governance has emerged as a pivotal direction for urban modernization, offering a robust mechanism to stimulate commercial vitality. This study constructs a fixed-effects model by integrating panel data from Chinese prefecture-level cities with micro-survey data on grassroots digital governance, empirically examining its impact on urban commercial vitality. Results reveal a significant positive effect that persists across multiple robustness tests. Mechanism analysis identifies business environment optimization and entrepreneurial activity enhancement as the primary pathways through which grassroots digital governance stimulates commercial vitality. Consequently, the study recommends strengthening digital technology promotion in grassroots governance, fostering a favorable business environment, and encouraging urban innovation and entrepreneurship to enhance commercial vitality.***

Keywords: Grassroots digital governance, Urban commercial vitality, Business environment, Entrepreneurial activity.

1. Research Background and Literature Review

Grassroots governance is the cornerstone of national governance, and the coordinated promotion of governance at the township (street) and urban-rural community levels is a fundamental project for achieving the modernization of the national governance system and governance capacity. With the development of digital technology, grassroots digital governance has emerged. Grassroots digital governance refers to a new governance model that fully utilizes digital technology to handle grassroots social affairs, aiming to enhance the efficiency, precision, and public satisfaction of grassroots social governance, achieving harmony, stability, and sustainable development in grassroots society. In 2024, the "Opinions of the CPC Central Committee and the State Council on Strengthening the Modernization of Grassroots Governance Systems and Governance Capacity" emphasized the need to improve the standards system for grassroots smart governance, promote technologies such as intelligent sensing, and strengthen the construction of grassroots smart governance capabilities. At the same time, revitalizing urban commercial vitality is an important channel for enhancing urban attractiveness and competitiveness, expanding employment, and promoting urban economic growth. The stimulation of urban commercial vitality is not only related to consumers and commercial entities but also cannot be separated from the systematic governance of the government and the guidance and regulation of commercial activities by policies and regulations. Especially in the digital age, the capability and effectiveness of grassroots digital governance are directly related to the optimal allocation of urban commercial resources, profoundly affecting operational efficiency and consumer experience, and are closely related to the growth of emerging industries and business models, all of which have significant impacts on urban commercial vitality. Against this backdrop, whether and how grassroots digital governance can influence urban commercial vitality has become an important issue with both theoretical and practical significance.

Currently, the literature related to grassroots digital governance and urban commercial vitality mainly focuses on three aspects: First, research on the value implications, practical dilemmas, and optimization paths of grassroots digital governance. Gao Mingzi et al. (2024) found that digital governance lowers the entrepreneurial threshold for enterprises, enabling more entrepreneurs to start small and micro businesses, thereby enhancing agricultural entrepreneurship levels; Zhou Xiangying (2024) proposed that digital empowerment of grassroots governance faces ethical dilemmas caused by the pursuit of efficiency supremacy, collaborative dilemmas caused by departmental interests, and capability dilemmas caused by digital resistance. To fully empower grassroots governance with digital technology, efforts can be made in three dimensions: value, structure, and subject. Second, measurement of urban commercial vitality and analysis of influencing factors. Wang Chao and Li Hongyan (2020) constructed an index system from three aspects: hotel hardware conditions, location environment, and traveler demand, established a mathematical statistical model based on online big data to explore factors affecting hotel occupancy, further conducted an empirical study using Nanjing as an example, and provided policy recommendations to strengthen the commercial center system and enhance commercial space vitality; Li Jing (2021) believed that digital finance can influence urban commercial vitality by empowering real economic growth, promoting financial system reform, and optimizing the business environment. From the perspective of industrial integration, the coupled development of digital finance and urban commerce will significantly positively impact the commercial vitality of both the local area and neighboring cities. Third, discussion on the urban economic empowerment effect of digital governance. Zhang Leilei and Song Lin (2024) found that digital governance can effectively alleviate market failures by reducing transaction costs, maintaining orderly competition, and encouraging market innovation, and can positively impact urban economic resilience; Zeng Junping and Cao Qianwen (2024) found that intellectual property governance significantly enhances urban entrepreneurial vitality, and the impact of intellectual property governance on urban entrepreneurial vitality has significant regional heterogeneity.

Overall, the current academic research on grassroots digital

governance and urban commercial vitality is insufficient, lacking in-depth studies on the impact and mechanisms of grassroots digital governance on urban commercial vitality. Notably, many scholars have revealed the business environment optimization effect of digital governance, finding that digital governance positively promotes the business environment and urban entrepreneurial vitality, and digital governance can positively influence urban entrepreneurial vitality through the indirect role of the business environment (Sun Ping and Hu Zhen, 2024; Zeng Junping and Cao Qianwen, 2024; Zhao Shu and Liu Jun, 2023). Therefore, this paper will empirically study the relationship between grassroots digital governance and urban commercial vitality and the transmission mechanisms of the business environment and entrepreneurial activity, aiming to provide useful references for strengthening grassroots digital governance and enhancing urban commercial vitality.

2. Empirical Design

To explore the interactive relationship between grassroots digital governance and urban commercial vitality, this paper sets the investigation period from 2010 to 2023 based on the principles of sample representativeness and data availability, and randomly selects 50 prefecture-level cities from the eastern, central, western, and northeastern regions respectively to form a sample pool. Initial data acquisition is mainly through two channels: one is extracting the required data for urban commercial vitality from the "China Urban Statistical Yearbook" and the official websites of municipal statistics bureaus; the other is obtaining grassroots digital governance data of sample cities via questionnaire surveys with the assistance of third-party professional research institutions. The specific method is: randomly selecting 3 communities in the main urban areas under each prefecture-level city, and inviting 2 community officials from each community to fill out the grassroots digital governance measurement scale, with specific measurement items shown in Table 1. Due to the wide scope of the survey, the research period starts from early June 2024 and ends at the end of December, lasting about 6 months in total. A total of 1200 questionnaires were distributed, and after manual screening, 1128 valid questionnaires were retained, with an effective rate of 94%.

To test the impact of grassroots digital governance on urban commercial vitality, this paper designs the following fixed-effects model:

$$\mathrm{Chl}_{it} = \beta_0 + \beta_1 \mathrm{Bzl}_{it} + \beta_2 \mathrm{X}_{it} + \rho_i + \sigma_t + \mu_{it}$$

Where Bzl_{it} refers to the independent variable grassroots digital governance; Chl_{it} refers to the dependent variable urban commercial vitality, β_1 refers to the regression coefficient used to measure the impact of grassroots digital governance on urban commercial vitality; X_{it} refers to the control variables listed in the data introduction section; ρ_i refers to city fixed effects, σ_t refers to time fixed effects, and μ_{it} refers to the error term.

The dependent variable is urban commercial vitality. Urban commercial vitality is an important indicator for measuring the frequency of goods and services transactions in a city. To objectively and systematically measure urban commercial vitality, this paper references the method by Wang Chao and Li Hongyan (2020), writing Python programs to statistically gather basic information such as names, addresses, coordinates, and categories of commercial outlets in catering, retail, leisure, and entertainment via web scraping, then using ArcGISPro 3.4 software to calculate the kernel density of urban commercial outlets, and finally multiplying the kernel density of urban commercial outlets by the urban area to obtain a composite index to measure urban commercial vitality.

The independent variable is grassroots digital governance. Grassroots digital governance refers to a new governance model that utilizes digital technologies such as big data, cloud computing, the Internet of Things, and artificial intelligence to manage, make decisions, and provide services for grassroots affairs. In view of the comprehensive conceptual nature and extensive influence of grassroots digital governance, its measurement needs to balance comprehensiveness, scientific rigor, and representativeness. To this end, this article draws on the research of Yang Xiuyong et al. (2023), selecting observation indicators from four aspects: field construction, resource integration, concept reshaping, and information services, designing a grassroots digital governance measurement scale containing 16 items, and revising the scale multiple times based on suggestions from five experts in the field of urban community digital governance. The comprehensive index of grassroots digital governance for each city is calculated using questionnaire surveys and the Likert five-point scoring method to characterize grassroots digital governance.

The mechanism variables are the business environment and entrepreneurial activity. Among them, the business environment refers to the various institutional and systemic factors and conditions faced by market entities during entry, operation, and exit. Drawing on the research of Zhao Shu and Liu Jun (2023), initial data was obtained from the "China City Business Environment Research Report" published by the Peking University-Wuhan University joint team, matched with sample cities, and for a very small number of missing data points, supplemented using trend analysis based on the previous year's data. Entrepreneurial activity refers to the number and activity level of newly established enterprises in a region. This article follows the approach of Xie Guogen et al. (2025), measuring entrepreneurial activity by the number of new urban enterprises per hundred people.

The selection and measurement of control variables refer to the research of Wang Chao and Li Hongyan (2020) and Chen Yutao (2023), including four variables: economic development level (Jkf), residents' consumption capacity (Jmx), urban-rural integrated development (Cxg), and regional connectivity (Qlx). Among them, Jkf is measured by per capita GDP; Jmx is measured by per capita disposable income; Cxg is measured by the ratio of urban per capita income to rural per capita income; Qlx is measured by per capita passenger turnover.

3. Empirical Results Analysis

3.1 Baseline Regression Analysis

Table 2 presents the baseline regression analysis results of the impact of grassroots digital governance on urban commercial vitality. Panel (1) shows the baseline regression results of grassroots digital governance on urban commercial vitality when only controlling for city and time fixed effects; the coefficient of grassroots digital governance is positive at the 1% significance level, confirming a significant positive impact of grassroots digital governance on urban commercial vitality. Panels (2) to (5) present regression results with control variables gradually added based on Panel (1). Compared to Panel (1), as the number of control variables increases, the coefficient of grassroots digital governance decreases but remains positive at the 1% significance level. This indicates that grassroots digital governance can significantly enhance urban commercial vitality. Possible explanations are: First, grassroots digital governance can improve the efficiency of urban commercial information dissemination. In traditional models, community commercial information is mainly disseminated through paper flyers and shop signs, whereas grassroots digital governance builds a community commercial information platform, greatly increasing the speed and coverage of commercial information dissemination, attracting more residents to consume, thereby enhancing urban commercial vitality. Second, grassroots digital governance helps optimize commercial resource allocation. By analyzing community residents' consumption habits and needs using big data technology, grassroots digital governance allows sharing data such as types, frequency, and amounts of goods consumed with businesses, facilitating better inventory management, optimizing community commercial layouts, and guiding different types of commercial entities to cluster, ultimately forming a commercial agglomeration effect and boosting overall community commercial vitality. Third, grassroots digital governance can improve residents' consumption experience. The digital environment fostered by grassroots digital governance provides conditions for community commercial innovation; some community supermarkets can offer online ordering with offline delivery or pickup services, meeting residents' diverse needs and injecting new vitality into community commerce.

Table 1: Grassroots Digital Governance Measurement Items

Dimension Metrics	Observation Metrics	Measurement Items
Field Construction	Field Creation	This community has established an efficient digital governance organizational operation system
		This community uses digital technology to create a favorable environment for community participation
	Platform Building	This community has established a comprehensive cloud service platform
		This community interacts with residents online via WeChat, Weibo, or dedicated apps
Resource Integration	Element Integration	This community collects and organizes various types of element information within the region based on digital technology
		This community emphasizes using digital technology to improve efficiency and effectiveness in handling affairs
	Precise Supply	This community uses database data to accurately identify residents' needs and provide personalized services
		This community's database integrates data from different departments
Concept Restructuring	Interaction Willingness	This community is committed to encouraging residents to actively use the digital government affairs platform
		This community is committed to enhancing communication among residents and promoting the flow of various types of information
	Participation Awareness	This community focuses on using digital technology to stimulate residents' enthusiasm for participating in community co-governance
		This community emphasizes cultivating residents' sense of ownership and community identity
Information Services	Information Transmission	This community has made the information platform an important tool for transmitting administrative information
		This community continuously enhances the service capabilities of its information platform
	Information Security	This community places high importance on the standardized and secure use of data
		This community ensures the security of data sharing through systems and information technology means

Table 2: Results of the benchmark regression analysis

Variable	(1)	(2)	(3)	(4)	(5)
Basic-level digital governance	0.462*** (4.583)	0.452*** (4.802)	0.441*** (4.703)	0.368*** (4.305)	0.338*** (3. 571)
Economic development level		0.577** (2.172)	0.602** (2.195)	0.389*** (4.246)	0.428*** (4.295)
Resident consumption capacity			0.248*** (10.972)	0.373*** (4.336)	0.182* (1.662)
Urban-rural integrated development				0.308* (1.967)	0.431*** (3.796)
Regional connectivity					0.132*** (1.372)
Constant term	0.885*** (0.986)	0.936*** (2.009)	1.358*** (3.505)	1.358*** (2.305)	1.455*** (2.986)
City fixed	Yes	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes	Yes
R^2	0.762	0.795	0.808	0.814	0.856

Note: *** indicates 1%, ** indicates 5%, * indicates 10%; values in parentheses are t-values, same below.

To more intuitively reflect the impact of grassroots digital governance on urban commercial vitality, this paper uses two methods for estimation: fixed effects model and GMM model. Figure 1 shows that as the level of grassroots digital governance improves, urban commercial vitality has experienced a significant upward process, once again indicating that grassroots digital governance is one of the important reasons for enhancing urban commercial vitality.

3.3 Robustness Test

This paper uses three common robustness test methods to discuss the robustness of the benchmark conclusions: First, the method of changing the sample pool is used. The initial sample pool includes some provincial capital cities, whose trade and commerce economies have natural advantages, which may lead to spurious regression problems, so provincial capital city samples such as Nanjing and Guangzhou are excluded during the robustness test. Table 3 Panel (1) presents the regression results after changing the sample pool; the impact coefficient of grassroots digital

governance is consistent with Table 2, indicating the robustness of the benchmark conclusions. Second, the method of shortening the examination period is used. According to the research experience of Yang Xiuyong et al. (2023), an overly long examination period may cause the estimation results to lose validity due to external factors such as policy shocks, so this paper adjusts the initial sample period from 2010-2023 to 2013-2020. Table 3 Panel (2) shows that the significance and magnitude of the coefficient of grassroots digital governance do not differ much from Table 2, indicating the robustness of the benchmark conclusions. Finally, the method of winsorization is used. Specifically, all continuous variables undergo 1% winsorization at both ends, followed by regression estimation. Table 3 Panel (3) presents the results after winsorization; the coefficient of grassroots digital governance is 0.365, indicating that for every 1-unit increase in grassroots digital governance, urban commercial vitality can increase by 0.365 units, which is basically consistent with the aforementioned results, showing that the winsorization method does not affect the robustness of the benchmark conclusions in Table 2.

Table 3: Robustness Test Results

Variable	(1) Replace Sample Library	(2) Shorten Evaluation Period	(3) Winsorization Method
Grassroots Digital Governance	0.262*** (10.503)	0.471*** (4.589)	0.365*** (4.306)
Constant Term	1.361*** (2.708)	1.362*** (2.286)	1.491*** (2.975)
Control Variable	Yes	Yes	Yes
City Fixed	Yes	Yes	Yes
Time Fixed	Yes	Yes	Yes
R^2	0.736	0.741	0.792

3.3 Impact Mechanism Test

The aforementioned research results answer the core question of whether grassroots digital governance can enhance urban commercial vitality. This section will focus on exploring the specific pathways through which grassroots digital governance boosts urban commercial vitality.

First, this paper argues that optimizing the business environment is an important pathway for grassroots digital governance to enhance urban commercial vitality. This is because: firstly, grassroots digital governance can use digital platforms to timely and accurately publish and update policy and regulatory information. This digital dissemination method allows businesses and investors to access policy and regulatory content more conveniently and quickly, reducing information asymmetry. Moreover, using big data analysis can push policies based on enterprise types and needs, enhancing the targeting and effectiveness of policies, enabling them to be implemented better, thereby optimizing the policy and regulatory environment within the business environment. Secondly, digital government service systems established during grassroots digital governance, such as online approval platforms and electronic license systems, can significantly reduce the time and cost for businesses to handle various administrative procedures, improving the flexibility and convenience of government services, effectively enhancing the government service environment. Lastly, in grassroots governance, digital technologies like IoT and big data provide powerful tools for market regulation, facilitating grassroots governance institutions to monitor market transaction data and promptly detect unfair competition behaviors. This precise market regulation can maintain a fair competitive market order, optimizing the market environment within the business environment. Furthermore, a favorable business environment, particularly the stability and inclusiveness of policies, can attract more commercial investments, bringing in new technologies, capital, and talent, thereby promoting urban commercial prosperity and enhancing commercial vitality.

Secondly, this paper also argues that enhancing entrepreneurial activity is another crucial pathway through which grassroots digital governance boosts urban commercial vitality. Theoretically, grassroots digital governance can provide an information and resource integration platform for entrepreneurship, thereby increasing urban entrepreneurial activity. In traditional settings, channels for entrepreneurs to obtain information and resources are limited. Grassroots digital governance establishes a digital entrepreneurship service platform that consolidates vast amounts of entrepreneurial information such as market trends, industry developments, and policy interpretations. This information aggregation reduces search costs for entrepreneurs, stimulates entrepreneurial intent, and thus enhances entrepreneurial activity. Additionally, grassroots digital governance leverages digital technology to digitize and automate administrative approval processes, reducing human error and time costs, significantly shortening the time required to establish a startup, improving entrepreneurial efficiency, and consequently boosting entrepreneurial activity. Notably, an increase in entrepreneurial activities means the continuous emergence of new business entities, enriching the urban commercial ecosystem, promoting urban commercial prosperity, and enhancing commercial vitality. Meanwhile, new startups entering the market inevitably bring novel ideas, technologies, and business models, intensifying market competition, fostering an innovative corporate atmosphere, and further enhancing urban commercial vitality.

To validate the aforementioned impact pathways, this paper adopts a two-step approach: first, verifying the impact of grassroots digital governance on the business environment and entrepreneurial activity; second, verifying the impact of the business environment and entrepreneurial activity on urban commercial vitality. Table 4 presents the test results for the two mechanisms of the business environment and entrepreneurial activity. Panels (1) and (3) show that the coefficients of grassroots digital governance's impact on the business environment and entrepreneurial activity are both positive at the 1% significance level, indicating that grassroots digital governance can significantly optimize the business environment and enhance entrepreneurial activity. Furthermore, the coefficients for the business environment and entrepreneurial activity in Panels (2) and (4) are both positive at the 1% significance level, suggesting that both the business environment and entrepreneurial activity can boost urban commercial vitality. Combining the above analysis, it is clear that grassroots digital governance can enhance urban commercial vitality by optimizing the business environment and boosting entrepreneurial activity.

Table 4: Results of Mechanism Test

Variable	(1) Business environment	(2) Urban commercial vitality	(3) Entrepreneurial activity	(4) Urban commercial vitality
Grassroots digital governance	0.453*** (4.703)	0.131*** (1.538)	0.426*** (4.019)	0.636*** (2.205)
Business environment		0.033*** (5.496)		
Entrepreneurial activity				0.021*** (2.358)
Constant term	0.928*** (1.907)	0.938*** (1.908)	0.935*** (1.972)	0.936*** (1.896)
Control variable	Yes	Yes	Yes	Yes
City fixed	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes
R^2	0.752	0.732	0.803	0.728

4. Conclusions and Management Implications

Focusing on grassroots digital governance is one of the effective strategies to enhance urban commercial vitality. This paper matches panel data from prefecture-level cities in China with micro-survey data on grassroots digital governance to empirically study the impact mechanism of grassroots digital governance on enhancing urban commercial vitality. The conclusions indicate: First, grassroots digital governance can significantly enhance urban commercial vitality, and this conclusion remains robust after verification using methods such as changing the sample pool, shortening the evaluation period, and applying winsorization treatment for robustness checks. Second, mechanism analysis finds that the path through which grassroots digital governance enhances urban commercial vitality is by optimizing the business environment and increasing entrepreneurial activity, thereby boosting urban commercial vitality. Third, in addition to grassroots digital governance, the coefficients of control variables set in this paper, such as economic development level, residents' consumption capacity, urban-rural integration development, and regional connectivity, are all significantly positive in the baseline regression test, indicating that urban commercial vitality is not only related to grassroots digital governance but also requires efforts from multiple dimensions such as improving urban economic development quality, enhancing residents' consumption capacity, continuously advancing new urbanization, and strengthening regional connectivity.

The above findings provide the following management insights for stimulating urban business vitality: First, strengthen the promotion and popularization of digital technology in grass - roots governance and accelerate the improvement of grass - roots digital governance capabilities. Increase investment in the construction of network infrastructure in grass - roots areas. Through government subsidies or by encouraging enterprises to participate in equipment donations or provide preferential purchase channels, equip grass - roots governance units with necessary digital equipment. Build a digital governance platform integrating multiple functions such as government services, community management, and public safety to promote data sharing and business collaboration and improve governance efficiency. Second, attach importance to the value of the business environment and stimulate urban innovation and entrepreneurship vitality. Break local protectionism and market segmentation, establish a unified national market system, and provide a fair - competition market environment; create a positive innovation and entrepreneurship culture (Pan Yuqi, 2022), establish a support mechanism for innovation and entrepreneurship failures, and at the same time give financial rewards and policy support to winners to attract more people to pay attention to and practice innovation and entrepreneurship. Third, deeply promote new - type urbanization, enhance the consumption capacity of urban and rural residents, and promote the balanced improvement of digital governance capabilities at the urban and rural grass - roots levels. On the one hand, strengthen planning guidance and build characteristic towns based on the geographical and resource advantages of different towns; on the other hand, promote urban industrial upgrading, increase industrial added value, and thus increase the wage income of urban residents; develop characteristic agriculture, increase the added value of agricultural products, and broaden the income - increasing channels for rural residents.

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