

"Internet + Government Service" and Regional Innovation Environment: Impact Estimation and Mechanism Analysis

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ABSTRACT

The regional innovation environment is an important supporting environment for regional innovation, and "Internet + government services" are of great significance to improve government efficiency, optimize the market environment, and stimulate innovation vitality. This paper embeds regional innovation environment variables into the research of "Internet + government services", explores the optimization effect and influence mechanism of government behavior on the innovation environment with the support of digital technology, and uses the panel data of 251 prefecture-level cities from 2018 to 2021 to verify the innovation environment in each region. The results show that: (1) "Internet + government service" has a significant optimization effect on the regional innovation environment, and from the perspective of sub-indicators, the optimization effect of service supply capacity and service intelligence ability is stronger than that of service response ability. (2) "Internet + government services" can promote the optimization of regional innovation environment by improving government efficiency and inhibiting rent-seeking activities.

KEYWORDS

Internet + Government Service; Regional innovation environment; Government efficiency; Rent-seeking activities

1 Introduction

A new round of scientific and technological revolution and industrial transformation is in full swing, and innovation has become a new driving force for economic development. The reports of the 19th and 20th National Congress of the Communist Party of China both pointed out that "innovation is the primary driving force for development" and emphasized the implementation of "innovation-driven development strategy". At present, there are still shortcomings in China, such as weak scientific and technological innovation capabilities, insufficient diversity of innovation subjects, imperfect basic systems to support innovation, and low utilization of scientific and technological resources, one of the reasons for these problems is the failure to create a good innovation environment^[1]. As an important supporting environment for regional innovation, the regional innovation environment directly affects the supply of resources in terms of human resources, infrastructure, and financial support for innovation activities in the region^[2], which in turn affects the efficiency and innovation ability of regional innovation. Therefore, the continuous promotion of the "innovation-driven development strategy" is inseparable from the optimization of the regional innovation environment.

The regional innovation environment has the attributes of public goods, and the government

should play a major role in its optimization. With the continuous development of digital technology, the channels for government services have gradually moved from offline to online, and "Internet + government services" have become an important way of government services. The emergence of "Internet + government services" is not only the government's use of digital technology to empower government services, but also the optimization and reengineering of government affairs concepts, service processes, organizational structures, supervision and evaluation, performance evaluation, etc.^[3], which has profoundly affected the behavior patterns of governments and market entities. The existing literature also shows that "Internet + government services" can improve government efficiency^[4] and reduce institutional transaction costs^[5]. So what is the mechanism of "Internet + government services" on the optimization of regional innovation environment?

At present, the research on the regional innovation environment mainly includes two aspects: first, the research on the connotation and constituent elements of the regional innovation environment. The second is the evaluation and analysis of the regional innovation environment.

The earliest research on the connotation and constituent elements of regional innovation environment is the concept of regional innovation environment proposed by the European Research Group on Innovation Environment^[6], that is, regional innovation environment is an informal and complex social relationship established by the main actors in a certain region through mutual synergy and collective learning. Freeman^[7] defined the innovation environment as an institutional arrangement from the perspective of ecosystem. Cooke et al.^[8] argue that the learning environment, cultural environment, and financial environment are important factors in the innovation environment. Some scholars take the regional innovation environment as an independent variable, and believe that the improvement of the regional innovation environment can increase the possibility of enterprises to engage in R&D continuously^[9], improve innovation capabilities^[10], improve industrial innovation efficiency^[11], and promote the agglomeration of scientific and technological talents^[12].

The research on the construction of the evaluation index system of innovation environment mainly focuses on the inter-provincial level^[13-17], and only a few scholars measure it from the city level of a certain province or region^[18-21]. From the perspective of evaluation methods, factor analysis^[15, 18, 20] and weighted comprehensive evaluation methods^[17, 22, 23] are mostly used.

The above research provides ideas for "Internet + government services" and regional innovation, but there are still the following two shortcomings: first, most of the literature on the innovation environment is limited to the study of the inter-provincial and regional innovation environment, and some studies at the city level are also limited to a single province and region. Second, most of the existing literature regards regional innovation environment and online government affairs as two independent research goals, and does not consider the integrity and interaction between the two in the context of digital government.

Based on the shortcomings of the above research, this paper discusses the optimization effect and mechanism of "Internet + government service" on the regional innovation environment in the context of the digital economy. Its innovations include the following two aspects: first, the data of 251 prefecture-level cities in China are used to compare and analyze the regional innovation environment, sort out the influencing factors of the innovation environment from the practical level, and verify the positive effect of "Internet + government services" on optimizing the regional innovation environment, so as to provide a realistic basis for the formulation of policies for the optimization of the innovation environment; Second, the mechanism of "Internet + government services" to optimize the regional innovation environment is clarified from the two aspects of efficiency and rent-seeking, that is, "Internet + government services" optimizes the regional innovation environment through two paths: improving government efficiency and inhibiting rent-seeking activities.

2 Mechanism analysis and research hypothesis

"Internet + government services" is conducive to the optimization of regional innovation environment, and the specific path is to promote the optimization of regional innovation environment by improving government efficiency and inhibiting rent-seeking activities.

2.1 The impact of "Internet + government services" on the regional innovation environment

On the one hand, compared with traditional offline government affairs, "Internet + government services" use digital technology to simplify the work process, integrate the government resources of various government departments, improve the efficiency of administrative approval and supervision, improve the transparency of preferential policies for enterprises, reduce the ineffective rules, rules and procedures in government science and technology public services, improve the efficiency of service supply, make the economic activities of market entities more convenient and efficient^[24], and enterprises more easily obtain innovative resources such as capital, technology, talents, and infrastructure^[25]. The market environment is more fair and orderly, so as to achieve the purpose of optimizing the regional innovation environment.

On the other hand, "Internet + government services" provide a convenient communication channel for innovative subjects, which helps them to reflect their opinions and needs in a timely manner, and according to the "opinion-policy" connection theory, the formulation of policies will be affected by the public's opinion preference and the scale of opinions^[26]. Therefore, hypothesis 1 is proposed:

H1: The higher the service level of "Internet + government services", the better the innovation environment in the region.

2.2 Internet + Government Services" Mechanism Analysis of Regional Innovation Environment

2.2.1 Mechanism for improving government efficiency

As a specific form of information communication technology, the wide application of "Internet + government service" in the field of government service has greatly improved government efficiency^[27], which is manifested in the following three points: First, "Internet + government services" to achieve "one network", the integration of all kinds of government service resources, break the data barriers between departments, for the same project involving multiple approval departments of the materials required for the same project do not need to be submitted repeatedly, change the "mass errands" to "data errands", effectively resolve the "difficult, slow, complicated" and other problems, so that the efficiency of the government can be improved. Second, the government information resources provided by "Internet + government services" are used to monitor government efficiency, and the quality and efficiency of government affairs are tracked and managed and statistically analyzed by tracking the business handling process and time of government staff, as well as the consultation, complaints, and evaluation information of enterprises and the public, so as to promote the improvement of administrative efficiency and service quality^[28]. Third, "Internet + government services" realize the simplification and standardization of government service processes, compress and delete some unnecessary processes, save the time of enterprises and the public, and improve government efficiency. Based on this, hypothesis 2 is proposed:

H2: "Internet + government services" can improve the regional innovation environment by

improving the efficiency of regional governments.

2.2.2 Inhibitory effects of rent-seeking activities

As an unproductive social activity, corrupt rent-seeking consumes a lot of social resources, hinders the fair competition of market players, and has a significant inhibitory effect on enterprise innovation^[29]. According to principal-agent theory, the root cause of rent-seeking activities lies in the incompatibility of incentives and information asymmetry between government officials as agents and the public as principals. The key to curbing rent-seeking activities is to improve information asymmetry, reduce the discretion of government officials, and strengthen the public's oversight and accountability to the government^[30]. The construction of "Internet + government services" can effectively inhibit rent-seeking activities in the following three aspects: first, the government discloses various government affairs information through "Internet + government services", which improves the transparency of government behavior, reduces the information asymmetry between the government and the public, and makes power run under the sun^[31]; The second is to standardize and determinize the work process and provide non-discriminatory standardized services, which can effectively control and reduce the discretion of government workers and avoid black-box operations and relational transactions^[32]; Third, the development of "Internet + government services" has broadened the channels for public feedback^[33]. Therefore, hypothesis 3 is proposed:

H3: "Internet + government services" can improve the regional innovation environment by curbing rent-seeking activities.

3 Study design

3.1 Research samples and data sources

In this paper, sample data of prefecture-level cities in China from 2018 to 2021 are selected. The explanatory variable "Internet + government service" data comes from the "Report on the Development of Internet Service Capacity of Local Governments in China" released by the University of Electronic Science and Technology of China; The data of government efficiency, the intermediary variable, are from the Research Report on Local Government Efficiency in China published by Jiangxi Normal University. The intermediary variable rent-seeking activity is calculated from the data of listed companies; The data for the remaining variables are from the China Urban Statistical Yearbook.

3.2 Variable definitions

3.2.1 Explanatory variables

In the literature review above, scholars have different views on the connotation and constituent elements of the regional innovation environment due to different research perspectives, but they generally include the key elements of infrastructure, human resources, markets, finance and institutions. Therefore, drawing on the research of Jiang Haining et al.^[20], this paper divides the regional innovation environment into five dimensions: infrastructure elements, human resource elements, market factors, financial factors, and institutional elements.

3.2.2 Core explanatory variables

This paper uses the Internet government service capability index in the Internet service

capability report to measure the level of "Internet + government service". The index comprehensively evaluates the capabilities of service supply, service response, and service intelligence, and comprehensively reflects the Internet government service capabilities of local and municipal governments. Among them, the service supply capacity mainly evaluates the completeness of online services provided by the government, the standardization of online service processes, and the integration and linkage of various government resources. The service responsiveness mainly evaluates the convenience and smoothness of the public to submit their demands to the government through the Internet and the government's responsiveness to the public's service demands and interactive demands. The service intelligence capability mainly evaluates the intelligent interaction (such as intelligent search, AI Q&A, etc.) and personalized service capabilities of the government's digital government platform.

3.2.3 Control variables

According to previous studies, the following four control variables were selected: per capita GDP, population density, the proportion of government fiscal revenue in GDP, and the proportion of foreign investment in GDP. The variables used for baseline regression are shown in Table 1.

Table 1 Variables

Variable type	Variable	interpretation
Explanatory variables	cxhj	Regional innovation environment
Core explanatory variables	x	The level of "Internet + government services"
Sub-indicators of core explanatory variables	fwgj	Service delivery capacity
	fwxy	Service responsiveness capacity
	fwzh	Service intelligence capacity
Control variables	x1	GDP per capita
	x2	population density
	x3	Government revenue as a percentage of GDP
	x4	Foreign investment as a percentage of GDP

3.3 Model design

In order to verify the optimization effect of "Internet + government services" on the regional innovation environment, the following basic regression model is constructed:

$$cxhj_{ij} = a_0 + a_1x_{ij} + a_2control_{it} + \gamma_i + \varepsilon_{it} \quad (1)$$

i stands for city, j stands for year, γ_i is the unobservable individual fixed effect of city i , ε is a residual.

4 Analysis of empirical results

4.1 Assessment of the regional innovation environment

This paper measures the regional innovation environment indicators of 251 prefecture-level cities for four consecutive years, and the data show that the mean, minimum and maximum values of the regional innovation environment index show an upward trend every year, indicating that the regional innovation environment of each city is continuously optimized, but the overall index level is still not high. The annual increase of the standard deviation indicates that the gap in the regional

innovation environment in different cities is widening. This paper also focuses on the measurement of the Yangtze River Delta urban agglomeration, the Pearl River Delta urban agglomeration and the urban agglomeration of the three northeastern provinces, and finds that the mean value of the economically developed Yangtze River Delta and the Pearl River Delta urban agglomeration is higher than the national average, and its standard deviation is also higher than that of the whole country, indicating that the regional innovation environment of the cities in the Yangtze River Delta and the Pearl River Delta urban agglomeration is relatively large, but it is generally in the forefront of China.

However, the average and standard values of the three economically underdeveloped provinces in Northeast China are smaller than those of the whole country, indicating that the region's innovation environment index ranking is relatively backward, but the gap between cities is small. The same conclusion can be reached from an analysis of the East, Central and Western regions.

The mean and standard deviation of the economically developed eastern region are larger than those of the whole country, while the mean and standard deviation of the economically underdeveloped western region are smaller than that of the whole country, and the growth of the regional innovation environment index is faster in the economically developed regions.

4.2 Correlation analysis

The descriptive statistical results of the explanatory variables, core explanatory variables and control variables in this paper are shown in Table 2, and the data show that there is a significant gap between the regional innovation environment and the level of "Internet + government services" among prefecture-level cities.

Table 2 Descriptive statistics of basic regression variables

Year	Sample size	Mean	Standard deviation	Minimum	Maximum
cxhj	1004	11.59	7.692	4.076	59.65
x	1004	71.50	8.8	40.04	90.45
fwgj	1004	29.00	3.707	15.32	38.74
fwxy	1004	29.08	5.227	11.88	39.62
fwzh	1004	13.42	2.546	4.190	18.78
x1	1004	6.577	3.437	1.266	21.81
x2	1004	465.9	362.2	6.018	3 144
x3	1004	7.294	2.207	2.343	16.86
x4	1004	1.379	1.533	0.000 423	8.877

4.3 Analysis of the impact of "Internet + government services" on the regional innovation environment

It can be seen from Table 3 that the regression coefficients of the level of "Internet + government service" and its three sub-indicators are significantly positive, indicating that "Internet + government service" has a significant positive impact on the regional innovation environment, thus verifying hypothesis H1. Among the three sub-indicators, the regression coefficient of service supply capacity and service intelligence ability to the regional innovation environment is much greater than that of service response ability, indicating that compared with the degree of interaction between the government and market entities, the completeness, standardization and intelligence of online government services, which are more intuitive to improve the user experience, have a

greater effect on the optimization of the regional innovation environment.

Table 3 Benchmark regression results

	(1)	(2)	(3)	(4)
	cxhj	cxhj	cxhj	cxhj
x	0.042*** (8.495)			
fwgj		0.086*** (7.847)		
fwxy			0.036*** (4.618)	
fwzh				0.069*** (4.148)
controls	yes	yes	yes	yes
cons	-0.636 (-0.373)	-0.952 (-0.512)	0.575 (0.300)	0.153 (0.080)
N	1004	1004	1004	1004
F	38.49	33.17	29.07	22.12
r2	0.287	0.283	0.240	0.235

The t-statistic is in parentheses, *p<0.1, ** p<0.05, ***p<0.01

4.4 Robustness test

In this paper, the following two methods are used to test the robustness. (1) The entropy method re-calculates the regional innovation environment index, and because the weight design of the above article contains a certain degree of subjectivity, the entropy method is used to determine the weight according to the data itself to calculate the regional innovation environment index. (2) Propensity score matching method. The propensity score matching method (PSM) was used to find the control group, and the one-to-one nearest neighbor matching method was used to match the samples. None of the above methods changed the regression results (Table 4).

Table 4 Robustness test results

	The entropy method measures the regional innovation environment				PSM grouping			
	cxhj	cxhj	cxhj	cxhj	cxhj	cxhj	cxhj	cxhj
x	0.029*** (5.975)				0.037*** (5.776)			
fwgj		0.060*** (5.341)				0.091*** (4.048)		
fwxy			0.024*** (3.477)				0.058*** (5.254)	
fwzh				0.052*** (3.376)				0.052*** (2.177)
cons	-1.252 (-0.719)	-1.474 (-0.792)	-0.406 (-0.215)	-0.738 (-0.394)	-1.378 (-0.845)	-3.302 (-1.567)	-1.425 (-0.646)	-2.401 (-0.714)
controls	yes	yes	yes	yes	yes	yes	yes	yes
N	1004	1004	1004	1004	477	491	498	501
F	20.55	17.84	17.07	14.60	23.75	18.867	18.320	9.267
r2	0.256	0.254	0.229	0.228	0.237	0.278	0.180	0.195

4.5 Intermediary mechanism test

In the mechanism analysis above, two intermediary paths of government efficiency and rent-seeking activities are described. That is, "Internet + government services" can not only improve government efficiency, but also inhibit rent-seeking activities, and then optimize the regional innovation environment. First, this paper uses the government efficiency index in the government efficiency report to measure the intermediary variable of government efficiency according to Tang et al.^[34]. Drawing on the practice of Ma et al.^[35], this paper uses excess management expenses to measure rent-seeking activity variables.

Then, the following model is built for validation:

$$M_{ij} = a_0 + a_1 x_{ij} + a_2 \text{control}_{it} + \gamma_i + \varepsilon_{it} \quad (2)$$

$$\text{cxhj}_{ij} = a_0 + a_1 x_{ij} + a_2 M_{ij} + a_3 \text{control}_{it} + \gamma_i + \varepsilon_{it} \quad (3)$$

Among them, the M_{ij} are two mediating variables, and the other variables are consistent with the previous ones. The regression results are shown in Table 5. The first three columns in the table show that the impact of "Internet + government service" on government efficiency is significantly positive at the level of 10%, and the impact of government efficiency on the regional innovation environment is significantly positive at the level of 10%, indicating that "Internet + government service" can optimize the regional innovation environment through the improvement of government efficiency, thus verifying hypothesis H2. The last three columns in the table show that the impact coefficient of "Internet + government service" on rent-seeking activities is negative at the significant level of 1%, and the impact coefficient of rent-seeking activities on the regional innovation environment is also negative at the significant level of 5%, so "Internet + government service" can optimize the regional innovation environment by inhibiting rent-seeking activities. Suppose H3 is validated.

Table 5 Mechanism test

	Government efficiency intermediary mechanism			Rent-seeking intermediary mechanisms		
	(1)	(2)	(3)	(4)	(5)	(6)
	cxhj	zfxl	cxhj	cxhj	xzhd	cxhj
x	0.084*** (5.469)	0.003* (1.681)	0.080*** (5.613)	0.048*** (7.650)	-0.176*** (-2.855)	0.047*** (7.464)
zfxl			1.190* (1.842)			
xzhd						-0.004** (-2.053)
controls	yes	yes	yes	yes	yes	yes
cons	0.204 (0.067)	1.252*** (2.221)	-1.285 (-0.400)	-0.372 (-0.188)	113.452*** (7.881)	0.131 (0.065)
N	1,004	1,004	1,004	726	726	726
F	28.27	3.632	25.22	30.728	6.723	33.87
r2	0.409	0.082	0.427	0.315	0.066	0.317

5 Conclusions and policy recommendations

Based on the theory of "opinion-policy connection" and the principal-agent theory, this paper analyzes the mechanism of "Internet + government service" to optimize the regional innovation environment, and uses the panel data of 251 prefecture-level cities to empirically test the regional innovation environment of each city, and verifies the positive effect of "Internet + government service" on the regional innovation environment. The results show that: (1) The regional innovation

environment in all cities in China is constantly optimized, but the overall level is not high. At the same time, the gap between regions and regions in the innovation environment is also widening, and the innovation environment index in economically developed regions is growing faster. (2) The development of "Internet + government services" is conducive to the optimization of the regional innovation environment, and from the perspective of sub-indicators, the optimization effect of service supply capacity and service intelligence capability is stronger than that of service response ability. (3) The paper verifies that "Internet + government service" optimizes the regional innovation environment by improving government efficiency and reducing rent-seeking costs.

Based on the above conclusions, this paper proposes an overall digital government development plan and puts forward policy suggestions. (1) Accelerate the construction of information infrastructure in various places, and gradually build a national integrated "Internet + government service" platform, so as to realize the integration of data resources and information sharing among government departments at all levels. (2) Make full use of the media role of the government affairs platform, strengthen the interaction between government entities and market entities, understand public opinions in a timely manner. (3) Do a good job in the disclosure of government service information, further improve government efficiency, and enhance the transparency of government behavior; Efforts will be made to strengthen the integration of online and offline services, and continue to innovate government service methods.

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