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Digital Infrastructure and Rural Revitalization: Based on the Context of New Infrastructure in Education

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Abstract: Digital infrastructure is the foundation for the efficient operation of the countryside in the digital era, which has injected new momentum into rural revitalization by enhancing the supply capacity of rural network infrastructure, increasing the transformation and upgrading of rural infrastructure, and facilitating the intelligent upgrading of agricultural production methods and the modernization of agriculture, among other things. There are three main findings: first, rural revitalization is steadily advancing but facing challenges, and although the average level of its index is currently in the lower middle range, the overall trend is steadily rising, and various economic indicators need to be considered comprehensively. Second, digital infrastructure has significantly contributed to rural revitalization by strengthening rural network infrastructure, such as 5G networks and the Internet of Things (IoT), and encouraging the growth of e-commerce in rural areas, smart culture and tourism, and other digital new businesses, thus activating a new engine for rural industries. Thirdly, the new education infrastructure, which is based on digital infrastructure, has also shown to play a significant role in promoting rural revitalization.

Keywords: digital infrastructure, rural revitalization, new infrastructure for education.

1. Introduction

By promoting rural revitalization, it can promote the modernization of agriculture and rural areas, promote the comprehensive development of rural economy, society, culture, and other aspects, and lay a solid foundation for the comprehensive construction of a modern socialist country. Despite the widespread use of digital tools and technologies in the promotion of rural revival, several inadequacies persist. It will be discovered that, when seen in the context of modern educational infrastructure, the use of digital infrastructure in the field of education is not deep and wide enough, nor is the development of digital abilities sufficiently refined. Thus, to support the overall advancement of rural revitalization, more study on the integration and development of digital infrastructure and education infrastructure is required.

The Chinese government originally proposed the idea of "new infrastructure construction" in December 2018. This idea is centered on cutting-edge technologies including 5G, artificial intelligence, and industrial internet. When compared to the new educational infrastructure, the state of digital infrastructure development in rural revitalization is still lacking, which prevents villages from fully utilizing modern information technology to raise educational standards, makes it

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challenging to draw in and develop professionals, limits the flow of information between rural education and outside resources, and impedes the digital transformation of villages.

In conclusion, China's policy for rural rejuvenation has advanced into a new phase of rapid acceleration with the growth and popularization of digital infrastructure. This research aims to investigate the ways in which the new educational infrastructure influences rural regeneration, taking into account the degree of digital empowerment as a starting point and the building of the digital context. The following two points are examples of potential advances this study could make in comparison to previous literature: first, the term digital infrastructure was introduced relatively late, and although its positive impact and marginal contribution have attracted academic attention, there are still shortcomings in current research on how to measure how to advance rural revitalization strategies in a more rigorous way. Secondly, this research offers a comprehensive examination of the distinct process underlying the contribution of new educational infrastructure to rural revival by presenting it as a moderating variable. In order to radically alter the conventional educational model, the new educational infrastructure makes use of cutting-edge technologies like big data, cloud computing, and artificial intelligence in addition to modernizing physical buildings.

2. Literature Review, Theoretical Analysis and Research Hypotheses

2.1. Literature Review

From the perspective of academic research, rural revitalization is a complex and systematic project, which is regarded as a multi-dimensional and multi-level socioeconomic change process, the effectiveness of which is affected by the interweaving of various factors. For instance, a healthy ecological environment is a necessary material foundation for rural revitalization, and enhancing the ecological environment in the region is a crucial step in putting the strategy into practice. Additionally, the abundance of natural resources in rural areas is now a major factor in the revitalization of rural areas[1]. The abundance of natural resources found in rural areas is now one of the main forces behind rural revival. Building a strong cultural foundation is necessary for the implementation of the rural revitalization strategy, and a strong rural culture influences the promotion of the rural revitalization strategy overall in addition to aiding in the growth of rural cultural industries, the development of cultural services, and the enhancement of spiritual outlooks[2] .New opportunities for rural revitalization will also be brought about by creating a single national market, recognizing the free flow of factors between urban and rural areas, eliminating market segmentation, putting in place an integrated market system for urban-rural integration, and encouraging the development of a new pattern of specialized labor division and socialized production between urban and rural areas[3]. Realizing urban-rural integration in mountainous areas and sustainable rural development is greatly dependent on tourism urbanization, which is a key means of enabling resource-rich underdeveloped areas to escape poverty, become wealthy, and experience rural revival[4].

The digitization of basic public services, including employment, social security, and medical care in rural areas, has accelerated due to the integration and development of digital infrastructure and information technology. This has also reduced the barriers to information transmission between urban and rural areas, shortened the distances between them in space and time, improved urban-rural connectivity, and created previously unheard-of opportunities for the realization of urban-rural basic public service equalization[5] .

The new infrastructure system for education is driven by informatization and new development concepts, with a focus on digital resources, smart campuses, information networks, platform systems, creative applications, and reliable security to meet the demands of high-quality educational development[6].Existing literature mostly focuses unilaterally on how digital technology and infrastructure can empower rural revitalization, thus, within the framework of new infrastructure in

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education, this article focuses on how digital infrastructure might support the growth of rural revitalization.

2.2. Theoretical Analysis And Research Hypotheses

The new infrastructure of education, as the cornerstone of modern education, provides solid infrastructural support for the cultivation of new-quality productive forces, and new types of workers not only master solid professional skills, but also have the ability to continuously learn and innovate. In this process, efforts are made to cultivate skilled personnel, and the new workers are no longer just providers of labor, but also the main body of innovation and value creation[7]. These new, tech-savvy talent will fully utilize the new abilities, procedures, and kinetic energy they have gained, enhancing agricultural productivity, encouraging the optimization of the rural industrial structure, and providing a powerful boost to rural revitalization.

Furthermore, the new education infrastructure is appropriate for promoting and utilizing digital education resources given the nation's concentration on new infrastructure. In order to assist create a high-quality educational system, the main goal of the new infrastructure of digital education resources is to promote the development of the national public service system of digital education resources using new information technology[8]. It fosters a learning society, promotes educational resource access, and ensures seamless knowledge transfer from urban to rural areas via new educational tools, optimized resource systems, and efficient utilization. The cultural upgrade in rural regions underpins this strategy with a robust cultural foundation.

To this end, the promotion of the industrial structure upgrade must rely heavily on the underlying infrastructure investment, as the marginal benefit of traditional infrastructure investment has slowed down. Instead, the application of digital technology as the primary feature of the new infrastructure investment will serve as a major source of inspiration for China's industrial structure upgrade[9]. The new infrastructure investment will become an important power source for the upgrading of China's industrial structure. The ongoing development of new educational infrastructure is fostering a deeper cross-fertilization of education with cutting-edge technology, which offers robust support for innovative educational approaches and efficient resource allocation. This deep integration has not only given rise to the emergence of new products, new modes and new business forms, but also greatly enriched the connotation and extension of the education industry and promoted the comprehensive upgrading of the industrial chain. Based on the above analysis, this paper puts forward the following theoretical assumptions:

Hypothesis 1: Digital infrastructure has a significant contribution to rural revitalization.

Hypho1A: Digital infrastructure can inject new development momentum into rural revitalization by promoting the upgrading of industrial structure.

Hypho1B: Digital infrastructure can promote rural revitalization by upgrading rural culture through the popularization of digital educational resources.

Hypho1C: Digital infrastructure can have a catalytic effect on rural revitalization by fostering new quality productivity and skilled manpower.

Hypothesis 2: New infrastructure for education significantly enhances the moderating effect of digital infrastructure in promoting rural revitalization.

3. Mechanism Analysis and Modeling

3.1. Model Setup

This paper created the following time fixed effects model to evaluate the relevant theoretical research hypotheses, building on the analysis of the preceding paper's analysis of the influence of digital infrastructure on supporting rural revitalization strategy within the framework of new educational

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infrastructure:

$$Rural_{it} = \beta_0 + \beta_1 Dig_{it} + \beta_k \sum Control_{it} + \lambda_t + \epsilon_{it}$$

3.2. Variable Selection

i stands for a city at the prefecture level; Year is indicated by t; the explanatory variable Rural is the primary explanatory variable that indicates the degree of regional rural rejuvenation. Dig is a measure of the state of the regional digital infrastructure, and it is based on the digital infrastructure index of each city at the prefecture level. K is the number of control variables, and control indicates a set of control variables.

In order to control the influence of other variables, the control variables of population size (Pop), urban economic development level (Eco), degree of openness to the outside world (Open), degree of government intervention (Govt), and environmental quality (Env) are selected. And take the logarithm of the above variables in the test.

3.3. Data Sources

This paper states that the research utilizes a sample consisting of panel data spanning from 2011 to 2021 for 287 prefecture-level cities in China. The sources of these data encompass diverse publications such as the China Statistical Yearbook, China Rural Statistical Yearbook, publications related to Digital Economy Technology and Economy Research, along with regional statistical yearbooks and government work reports from the respective areas.

4. Empirical Analysis

4.1. descriptive Analysis

From the results of the descriptive analysis of the sample as a whole, most rural areas still have some room for improvement in rural revitalization. As for the independent variables, the mean value of the digital infrastructure index is generally low in the sample rural areas, which may limit the promotion of informatization and intelligence in rural revitalization. Similarly, with regards to the control variables, notable differences are observed in population size, economic advancement, and the extent of international openness across various regions.

Table 1: Results of descriptive analysis of rural revitalization

	(1)	(2)	(3)	(4)	(5)
VARIABLES	N	mean	sd	min	max
Rural	3157.000	0.335	0.114	0.0622	0.799
Lndig	3102.000	-3.512	0.542	-5.859	-0.352
Lnpop	3156.000	1.765	0.128	1.089	2.096
Lneco	3156.000	2.373	0.0533	2.172	2.569
Lnopen	3156.000	-2.673	1.475	-12.81	0.913
Lngovt	3156.000	-1.687	0.445	-3.126	0.854
Lnenv	3154.000	4.982	1.694	0.000	10.300

4.2. Benchmark Regression And Moderating Effects Test

Based on the comprehensive regression analysis of the sample, considering time-fixed effects, a

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notable and positive relationship emerges between the advancement of digital infrastructure and rural revitalization. Specifically, for every 1 percentage point rise in the digital infrastructure index, the rural revitalization index experiences an improvement of 0.01 multiplied by 0.0433 units, a statistically significant increase at the 1% level. This preliminary finding underscores the substantial promotional impact that enhanced digital infrastructure has on rural revitalization efforts.

Column (2) of Table 2 adds different control variables on the basis of time fixed effects, and there is still a significant positive correlation between the level of digital infrastructure and rural revitalization, i.e., for every 1 percentage point increase in the digital infrastructure index, the rural revitalization index improves by 0.01*0.0197 units, which is significantly positive at the 1% level, and there is no essential change in the regression results.

Table 3 delves into the interactive dynamics between digital infrastructure and education infrastructure levels by incorporating a cross-multiplier term (lndig*lnedu) to assess their combined influence on rural revitalization. Also remains statistically significant at the 1% level, further confirming a notable and positive correlation between these factors. Upon including the control variables in column (2), the model continues to demonstrate statistical significance, as evidenced by a regression coefficient of 0.0214% that is significantly positive at the 1% level. This indicates that the original relationship remains robust even after accounting for these additional variables.

Table 2: Rural revitalization benchmark regression results

	(1) Rural	(2) Rural	(3) Rural	(4) Rural
Lndig	0.0433***	0.0197***	0.0440***	0.0223***
	(11.1398)	(3.5457)	(11.1852)	(4.0334)
Controls	YES	YES	YES	YES
Lnedu			0.0149***	-0.0279***
			(6.0300)	(-5.9903)
Lndig*Lnedu			0.0310***	0.0214***
			(6.9596)	(4.7700)
_cons	0.4540***	1.0519***	0.3622***	1.4775***
	(28.0923)	(4.9550)	(17.2438)	(6.7827)
N	3102	3099	3102	3099
adj. R^2	0.097	0.201	0.125	0.217

t statistics in parentheses
* $p < 0.1$,** $p < 0.05$,*** $p < 0.01$

4.3. robustness Check

To reinforce the conclusions drawn from Table 2, this paper undertakes a series of robustness tests. Firstly, adding more control variables; secondly, replacing explanatory variables; and thirdly, replacing explanatory variables. All three situations are significantly positive, as expected.

Table 3: Rural revitalization robustness test results

	(1) Rural	(2) Rural	(3) Rural	(4) Rural	(5) Rural	(6) Labor
Lndig	0.0433***	0.0440***	0.0197***	0.0128**		108.4094**
	(11.1398)	(11.1852)	(3.5457)	(2.0598)		(2.2508)

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Table 3: (continued).

Lnedu		0.0149***				-2.9e+02***
		(6.0300)				(-7.2221)
Lndig*Lnedu		0.0310***				165.8490***
		(6.9596)				(4.2496)
Controls			YES	YES	YES	YES
Controls1				YES		
Lnnet					0.0367***	
					(7.0462)	
_cons	0.4540***	0.3622***	1.0519***	1.0053***	0.7855***	1.6e+04***
	(28.0923)	(17.2438)	(4.9550)	(4.5919)	(3.8877)	(8.6620)
N	3102	3102	3099	3098	3099	3099
adj. R^2	0.097	0.125	0.201	0.204	0.210	0.192

t statistics in parentheses
* $p < 0.1$,** $p < 0.05$,*** $p < 0.01$

5. Further analysis

5.1. Mechanism testing

The preceding paper provided preliminary evidence suggesting that digital infrastructure development, when paired with advancements in educational infrastructure, can effectively bolster rural revitalization. However, delving deeper into the intricate mechanisms by which digital infrastructure influences rural revitalization represents a vital and crucial next step in understanding its full potential. This paper analyzes how the three main mechanisms of industrial structure (Indus), the number of rural cultural stations (Cult), and the attention of talents (Talent) affect rural revitalization, and tests and analyzes the influence mechanism accordingly through stepwise regression.

5.1.1. Upgrading effect of industrial structure

This paragraph discusses the utilization of a specific ratio, namely the sum of the output values from secondary and tertiary industries divided by the regional GDP, as a metric to assess industrial structure. Table 4, column 2, presents the outcomes of an analysis investigating the mechanism by which industrial structure upgrading influences a given phenomenon. Notably, the statistical significance of the regression coefficient for Lndig at the 1% level suggests a mediating effect is present.

5.1.2. Rural Culture Level Enhancement Effect

In this paper, the number of rural cultural stations is used to measure the level of rural culture, and column (3) of Table 4 shows the results of the impact mechanism test based on the level of rural culture. The empirical results show that for every 1 percentage point increase in the digital infrastructure index, the level of rural culture increases by 0.01*0.7645 units, which is significant at the 5% level, which shows that the channel that digital infrastructure promotes rural revitalization by

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increasing the level of rural culture is established, and thus hypothesis 1B in hypothesis 1 proposed in this paper is verified.

5.1.3. Skilled personnel enhancement effect

For the measurement of technology-based talents, this paper refers to the work report of the government of prefecture-level cities to count the word frequency of 28 keywords about basic research and scientific and technological talents, statistics and subsequent measurement. From the results, the coefficient of digital infrastructure level also passes the test at 1% significance level after adding the measurement of technology-based talents, and it can be concluded that the path of digital infrastructure to promote rural revitalization through fostering technology-based talents is established, and the 1C hypothesis in Hypothesis 1 proposed in the previous paper is verified.

Table 4: Results of rural revitalization mediating effects

	(1) Rural	(2) Indus	(3) Cult	(4) Talent
Lndig	0.0197***	0.0106***	0.7645**	251.2278***
	(3.5457)	(3.9029)	(2.0587)	(3.8918)
Controls	YES	YES	YES	YES
Lnedu			-2.0505***	
			(-6.5608)	
Lndig*Lnedu			1.1908***	
			(3.9574)	
_cons	1.0519***	-0.3114***	114.7837***	5.0e+03**
	(4.9550)	(-3.0169)	(7.8623)	(2.0808)
N	3099	3099	3099	2934
adj. R^2	0.201	0.588	0.190	0.154

t statistics in parentheses
* $p < 0.1$,** $p < 0.05$,*** $p < 0.01$

5.2. Heterogeneity analysis

In this paper, we choose to conduct the heterogeneity analysis based on regional characteristics, and divide the Rural results into East, Central and West for regression analysis. As can be seen from the regression results in Table 5, the coefficient of the east in column (1) is significantly positive at the 1% level, while the results in columns (2) and (3) are not significant, indicating that the effect of digital infrastructure for rural revitalization emerges to be greater in cities in the eastern region.

Table 5: Results of rural revitalization heterogeneity analysis

	(1) Eastern rural	(2) Central rural	(3) West rural
Lndig	0.0431***	0.0134	-0.0204
	(8.2266)	(1.4861)	(-1.4215)
Controls	YES	YES	YES
_cons	-0.4409**	2.8256***	1.4293**

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Table 5: (continued).

	(-2.0773)	(8.5302)	(2.5488)
N	1243	1188	668
adj. R^2	0.351	0.129	0.065

t statistics in parentheses
$^{*}p < 0.1, ^{**}p < 0.05, ^{***}p < 0.01$

6. Conclusions and recommendations

The research findings of this paper:(1) Rural revitalization is in the process of active promotion, although the average level of its index is in the middle of the lower range, but has been the steadily rising trend, its development is multifaceted and multidimensional, and it is necessary to take into account the various economic indicators and take targeted measures. (2) An enhancement in the level of digital infrastructure is found to significantly boost the progress of rural revitalization. Specifically, a 1 percentage point increase in digital infrastructure level corresponds to a statistically significant 0.01*0.0433% unit increase in the rural revitalization index, indicating a robust positive relationship. (3) In the context of modern educational infrastructure, the development of digital infrastructure can elevate the quality of rural education, fostering the growth of high-caliber talent in rural areas. This, in turn, fosters economic and social development in rural communities, ultimately facilitating the achievement of rural revitalization objectives. Consequently, this paper offers the following policy recommendations:

First, expanding the coverage of digital education infrastructure and upgrading the digitalization of rural education. Taking the new development concept as a prerequisite, the infrastructure plays an important supporting role in economic development. Not only should we actively provide rural schools with advanced hardware teaching equipment, but we should also introduce AI, VR and other advanced means to create "smart classrooms", "smart campuses", "virtual laboratories", etc., so as breaking the shackles of time and space in rural education. Breaking the time and space shackles of rural education. More importantly, it is necessary to improve the resources, applications and other software teaching equipment, optimize the teaching resource base, develop high-quality teaching software and platforms, and promote the deep integration of information technology and education and teaching.

Second, strengthening the digital skills training of rural teachers and enhancing the digital literacy of students and residents, so as to improve the ability of the new education infrastructure to serve rural revitalization. On the one hand, this is a key part of improving the quality of rural education, and a necessary step to promote the deep integration of information technology and rural education and teaching. On the other hand, by mastering the necessary information technology skills and improving their ability to solve problems and innovate and create with digital tools, they can in turn inject a steady stream of intellectual support and talent vitality into rural revitalization, so that digital technology can better serve rural revitalization.

Third, optimizing regulation in the field of rural education and establishing a sound regulatory mechanism and evaluation system for new education infrastructure to ensure that policies and measures are effectively implemented. On the one hand, it is necessary to improve the top-level design of the new education infrastructure, combine the actual situation of each village, formulate a scientific and reasonable development plan for the new education infrastructure, and clarify the focus and time point of the construction, so as to ensure that the policies and measures are promoted in an orderly manner. On the other hand, leveraging a sophisticated evaluation framework powered by big data, cloud computing, and other cutting-edge IT tools, we aim to achieve supervisory intelligence

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and precision, enhancing oversight's effectiveness and precision. This will enable swift adjustments and optimizations to policy implementation strategies.

References

[1] *MA Liyang,WEN Xiaojuan,JING Fuhui,LUO Qiyou,LIU Yang. Study on spatial and temporal evolution of coordinated development of rural revitalization and ecological environment system in border ethnic areas[J]. China Agricultural Resources and Zoning:1-13.*

[2] *Li Jun, Zhang Yanqi. (2024) The Historical Origin and Practical Value of Rural Excellent Traditional Culture in Constructing the Cultural Foundation for Rural Revitalization[J]. China Rural Observation, (03):2-17.*

[3] *WANG Caiyan,LIU Xiuyan. (2024) Transportation Infrastructure Construction, Domestic Market Integration and Rural Revitalization-A Study Based on Market Access Perspective[J]. Journal of Shanxi University of Finance and Economics,46(05):16-27.*

[4] *Ma Mengyao,Tang Jianxiong. (2024) Study on the nonlinear impact of tourism urbanization on rural revitalization in mountainous areas--Taking Wuling Mountain Area as an example[J]. Progress in Geographical Sciences,43(05):950-965.*

[5] *ZHANG Jie, KONG Xinmin. How digital infrastructure affects the equalization of basic public services in urban and rural areas: Evidence from a quasi-natural experiment on "Broadband China"[J]. Journal of Management:1-16.*

[6] *Zeng Wengge,Gao Ying. (2023) Dilemma and optimization path of collaborative construction of new educational infrastructure under the perspective of holistic governance[J]. Journal of National College of Education Administration,(06):19-26.*

[7] *Luo Jianghua,Wang Lin. (2023) The Logic, Challenges and Practical Roadmap of Digital Transformation of Education Empowered by New Infrastructure[J]. China Electronic Education,(03):37-45.*

[8] *Kang Rong. (2024) Construction Strategy of Golden Teaching Materials for New Infrastructure of Vocational Education under the Perspective of New Quality Productivity[J]. Journal of Beijing Vocational College of Finance and Trade,40(03):38-42.*

[9] *LONG Hai-Ming,LIU Zi-Xin,CHENG Mo-Yi. Research on the spatial effect of new infrastructure investment affecting industrial structure upgrading[J]. Systems Engineering Theory and Practice:1-23.*