# III. The Impact of Digital Economic Infrastructure Construction on the Development Level of Digital Economy in Countries Along the Belt and Road Initiative

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The global shift towards the digital economy necessitates accelerated development of digital infrastructure. Since the inception of the "Belt and Road" initiative, China and partner nations have significantly advanced economic cooperation. Mainly, with the introduction of the "Digital Silk Road" concept in 2017, nations along the initiative have actively pursued digital infrastructure projects. Through analysing domestic and international research, this article conducts an empirical analysis and assesses the impact of digital economic infrastructure on participating countries' digital economies. It is concluded that the level of digital economic infrastructure construction, such as mobile network coverage, fixed broadband penetration and complete Internet servers, can promote the development of the digital economy in these countries.

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## 1 Introduction

The concept of the digital economy emerged in the 1990s. In 1995, the OECD discussed its potential trends, highlighting the shift from traditional to information processing driven by the Internet revolution. American scholar Tapscott (1996) further explored this impact in his book The Digital Economy: Promise and Peril in the Age of Networked Intelligence. In 1998, the U.S. Department of Commerce released the report The Emerging Digital Economy, outlining the transition from industrial to digital economies and emphasising key characteristics such as the Internet as infrastructure and e-commerce as an engine of growth (United States, Department of Commerce, 1998).

With the introduction of the concept of the digital economy, the international community has gradually formed a strategic consensus to develop the digital economy vigorously. Not only has the United States proposed a digital economic agenda strategy, but the European Union has also proposed a European digital agenda. It has successively introduced strategic plans such as Digital France, Digital Britain, and Digital Germany. Against this background, China has also actively implemented its big data development strategy, comprehensively promoted the construction of network power, promoted the construction of a digital China and smart society, advocated the digital economy and the sharing economy, and accelerated the construction of digital China (Nie & Zhang, 2022; Tian, 2017).

Internationally, the digital economy's importance has grown significantly. At the G20 Summit, China introduced the "China's 'Internet +' Digital Economy Index" with several departments. In 2017, the 19th National Congress of the Communist Party of China highlighted the "digital economy" for the first time, stressing integration with the Internet, big data, and artificial intelligence. President Xi Jinping reiterated this integration at the 2018 G20 Summit in Buenos Aires. In 2019, the central government prioritised R&D in big data and AI, aiming to bolster the digital economy. China's 14th Five-Year Plan for Digital Economy Development in 2022 signalled a new growth phase. On October 18, 2023, at the "Belt and Road" International Cooperation Summit Forum, China and 13 countries released the "Belt and Road" Digital Economy International Cooperation Beijing Initiative to deepen collaboration (Pan & Wan, 2020; Wang, 2017).

In the era of the digital economy, the "Belt and Road" initiative sees fresh opportunities. Technologies like mobile Internet and cloud computing have invigorated this initiative. China and Argentina's 2017 cooperation initiative aimed to foster technological, finance, and trade innovation, facilitating cross-border collaboration in e-commerce, smart transportation, and IoT. The Chinese government actively promotes the "Data Silk Road," forging partnerships with other nations for digital economy development (Fang, 2019; Geng, 2019; Liu et al., 2020).

Studying the impact of digital economy infrastructure on "Belt and Road" countries is academically significant and offers policy value. It provides policymakers with vital insights for guiding infrastructure investment decisions within the initiative. Existing literature underscores the crucial link between digital infrastructure and digital economy development. Effective infrastructure facilitates technology adoption and drives digital economy growth. Through case analyses and experience summaries, governments can receive tailored guidance for formulating policies and investments in digital infrastructure to advance digital economy development.

Secondly, studying the impact of digital economic infrastructure construction on the development level of the digital economy in countries along the "Belt and Road" will help reveal the mechanism of digital infrastructure on economic growth and innovation capabilities. Academic research can use data analysis and empirical research to deeply explore the degree and path of the impact of digital infrastructure on various fields of the digital economy, thereby providing a theoretical basis and practical experience for improving the development level of the digital economy. In addition, by comparing the policy initiatives and effects of different countries in digital infrastructure construction, we can provide a reference for other countries and promote healthy competition and cooperation in developing the global digital economy.

Finally, studying the impact of digital economic infrastructure construction on the development level of the digital economy in countries along the Belt and Road Initiative will help promote the global digitalisation process and the realisation of sustainable development goals. The development of digital economic infrastructure is important not only for economic growth and innovation capabilities but also for promoting social inclusion and sustainable development. By strengthening international cooperation and jointly promoting digital infrastructure construction

and digital economic development, we can achieve the sharing of digital development results and promote the prosperity and sustainable development of the global digital economy.

Therefore, an in-depth study of the impact of digital economy infrastructure construction on the development level of the digital economy in countries along the "Belt and Road" initiative has not only important academic significance but also has important policy implications and strategic significance for promoting the development of the digital economy and promoting the global Economic growth, and sustainable development has important practical significance.

The research content layout is presented in Figure 1.

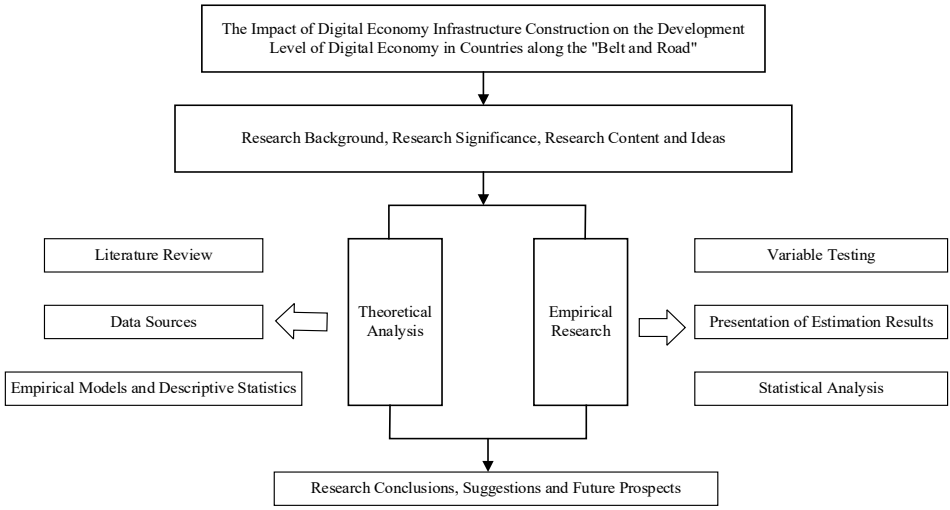


**Figure 1: Research content layout**

## 2 Literature review

### 2.1 Digital economy

The concept of "digital economy" was first proposed by Tapscott in the book The Digital Economy: Promise and Peril in the Age of Networked Intelligence, where he described all aspects of it in detail. One of the most classic descriptions in the

book defines the digital economy as an economy that "uses bits rather than atoms" (Tapscott, 1996). With the rapid development of digital technology, the scope of the digital economy has expanded. Industries such as optical fiber, software publishing, software copying, programming services, equipment management, cables, and artificial satellite communications have all become part of the digital economy. The U.S. definition of the digital economy focuses on viewing it as the sum of measurable e-commerce and information technology industries (Terence et al., 2023). The digital economy represents a new development paradigm following the agricultural and industrial economies, where data has become a crucial means of production.

At present, the academic community primarily explores the theoretical connotation, promoting factors, and measurement systems of the digital economy. Therefore, the following literature review is divided into three perspectives.

**(1) Theoretical Connotation of the Digital Economy**

According to the Statistical Classification of Digital Economy and its Core Industries (2021) released by the National Bureau of Statistics of China in May 2021, the digital economy is defined as "a series of economic activities that utilise data resources." Information and communication technology (ICT) is a key factor of production in modern times, where information networks serve as an important carrier, and the effective use of ICT acts as a driving force for efficiency improvement and economic structure optimisation. The digital economy is an economic form that primarily uses digital technology for production, closely integrating capital, labour, and infrastructure construction (Li, 2017). Infrastructure construction significantly impacts local industrial structures, fostering technological progress through the "spillover effect," which enhances technological development in local enterprises (Wang et al., 2014).

Based on this theoretical framework, the digital economy includes core software and hardware, network platforms, and industrial digitisation. Network platforms promote core technological advancements while simultaneously driving industrial digitisation, ultimately enhancing efficiency and supporting the development of the real economy. Many scholars have further expanded on the connotation of the digital economy by analysing its effects. For instance, the digital economy plays a critical role in reducing search, copying, transportation, tracking, and verification

costs, ultimately contributing to economic growth and productivity improvements (Goldfarb & Tucker, 2019). The core of the digital economy revolves around the development of ICT and its impact, with digital communications influencing international trade in both digital and non-digital goods (Freund & Weinhold, 2004).

**(2) Promoting Factors of the Digital Economy**

Domestic and foreign scholars have conducted multi-dimensional analyses of the factors that drive the development of the digital economy, summarising them into three main categories: dependence on digital lifestyles, the construction of digital economic infrastructure, and the development of digital financial policies.

First, in terms of digital lifestyles, the rapid growth of China's digital economy is largely attributed to the widespread adoption of digital applications in daily life. The convenience and improved quality of life of digitalisation have significantly increased people's interaction with digital technologies. According to CNNCI (2022), the number of internet users in China reached 1.051 billion, with an internet penetration rate of 74.4%, highlighting China's status as the world's largest digital society, where digital applications have permeated all aspects of life. Online shopping, in particular, has become a defining characteristic of China's digital economy.

Second, Terence Tai Leung Chong argues that China's digital economy has flourished due to its strong foundation in digital infrastructure (Terence et al., 2023). Furthermore, scholars such as Chen emphasise that developing a country's digital economy is closely tied to expanding and enhancing national infrastructure, particularly information infrastructure that bridges urban and rural areas (Chen & Kang, 2018). As a global leader in infrastructure development, China has made remarkable progress in digital infrastructure. By the end of 2021, the number of data centre servers in China had reached 5.2 million, with an annual growth rate exceeding 30%. In 2021, China's cloud service market reached 322.9 billion yuan, and communication infrastructure development continued to accelerate. China's high-quality and large-scale digital infrastructure has provided a solid foundation for the digital economy.

Finally, according to the McKinsey Global Payments Report (2022), China is now a global leader in digital financial services. This achievement is closely linked to the country's financial policies, which have played a crucial role in fostering growth in this sector. Hasan et al. (2022) argue that the promise of high-interest returns has motivated private investors, microfinance companies, and financing guarantee companies to enter the peer-to-peer (P2P) industry since 2013, establishing China as a dominant force in digital financial services.

### (3) Measurement System for the Development Level of the Digital Economy

Regarding systematically measuring the digital economy's development level, Chinese and international institutions have introduced various digital economy-related indices (see Table 1). Additionally, numerous scholars have provided theoretical insights and explanations regarding measurement methodologies. Xu et al. (2018) conducted a comparative analysis of 12 international and domestic digital economy-related index systems, evaluating their advantages, limitations, and reference values. Their study highlights the importance of index framework design and survey data collection mechanisms as key elements for reference.

**Table 1: List of China and Worldwide Digital Economy Related Indicator Systems**

| | Index Name | Issuing Authority | Relevancy | Release Time | Source from |
|---|---|---|---|---|---|
| China | Digital Economy Index | China Academy of Information and Communications Technology | High | 2017 | White Paper on the Development of China's Digital Economy (2017) |
| | Global Digital Economy Competitiveness Index | Shanghai Academy of Social Sciences | High | 2017 | Global Digital Economy Competitiveness Development Report (2017) |
| | "Internet +" Digital Economy Index | Tencent Group | High | 2017 | China "Internet +" Digital Economy Index 2017 |

| | Index Name | Issuing Authority | Relevancy | Release Time | Source from |
|---|---|---|---|---|---|
| | China City Digital Economy Index | New H3C Group | Relatively High | 2017 | China City Digital Economy Index White Paper (2017) |
| Worldwide | Digital Economy and Society Index (DESI) | European Union | High | 2014 | DESI 2017: Digital Economy and Society Index |
| | Evaluation & Suggestions on the Digital Economy | U.S. Department of Commerce Digital Economy Advisory Council | High | 2016 | Measuring the Digital Economy-BEA |
| | Network Readiness (NRI) | World Economic Forum | Relatively High | 2004 | The Global Information Technology Report2016 |
| | ICT Development Index (IDI) | ITU | Relatively High | 1995 | Measuring the Information Society Report2017 |

Thomas L. Mesenbourg (2001) notes that definitions of the digital economy are intentionally broad to create an inclusive framework for planning statistical measures. This flexibility allows researchers and policymakers to continuously adapt and incorporate emerging trends in the digital economy.

## 2.2 Research on constructing digital economic infrastructure in China and countries along the "Belt and Road"

First, before deeply understanding the construction of digital economic infrastructure in China and countries along the Belt and Road, it is necessary to examine relevant research on the definition of digital economic infrastructure. The foundation must first be established if one wants to build a house. General Secretary Xi Jinping has emphasised the importance of building solid digital infrastructure as the cornerstone of development in the information age. In February 2014, President

Xi Jinping emphasised "the need to have good information infrastructure and form a strong information economy at the first meeting of China's Central Leading Group on Cyber Security and Informatization."

Many scholars define digital economic infrastructure as both a factor of production and its application. For example, Junmo Kim (2006) defines digital infrastructure as the digital equipment manufacturing industry, which facilitates data collection, transmission, and production execution through sensors, networks, and other basic hardware, enabling data storage, analysis, and application in the digital industry. Pan and Wan (2020) offer a broader definition, identifying ten major infrastructure areas, including intelligent digital infrastructure, digital technological innovation infrastructure, modern energy, modern transportation, and national security and governance infrastructure. Additionally, Nong (2022) integrates multiple scholarly perspectives, categorising digital economic infrastructure into hard infrastructure, represented by traditional communications, cloud computing, the Internet of Things, and blockchain technology, and soft digital economic infrastructure, aimed at ensuring network security.

Regarding research on digital economic infrastructure, Grimes (2003) points out that Internet infrastructure is necessary for developing the digital economy. Roxburgh (2011) further highlights that digital economic infrastructure plays a critical role in transforming and upgrading basic industries, with a particularly significant impact on small and medium-sized enterprises.

Regarding the importance of digital economic infrastructure in economic activities, existing literature generally agrees that digital economic infrastructure has strong spillover effects on economic growth and contributes to economic transformation and high-quality development. Early scholars focused on exploring the relationship between Internet infrastructure and economic growth, confirming through empirical research that telecommunications infrastructure significantly promotes national economic growth and plays a crucial role in economic transformation. Wang (2017) argues that achieving information interconnection between China and ASEAN is a key aspect of international cooperation under initiatives such as the 21st Century Maritime Silk Road. Network construction and deepening interconnectivity have also become important components of the Belt and Road initiative (Fang, 2019). The construction of information network infrastructure and sharing public

information resources provide crucial information support for the Belt and Road initiative (Geng, 2019).

Finally, in terms of the role of digital economic infrastructure in trade promotion, empirical studies indicate that investments in communications, transportation, and technological infrastructure in Belt and Road countries significantly enhance national trade competitiveness (Xin & Li, 2020).

## 2.3 Summary

To sum up, existing research primarily focuses on in-depth discussions and analyses of the digital economy's theoretical connotation, promotion factors, and measurement systems. Most studies agree that the digital economy relies on information and communication technology (ICT) as its core element, with modern information networks serving as the carriers that effectively utilise ICT to enhance efficiency and optimise economic structures. Additionally, reliance on digital lifestyles, digital economic infrastructure development, and the robust expansion of digital financial policies constitute the multi-dimensional factors driving a country's digital economy. At the same time, many scholars emphasise that digital economic infrastructure plays a critical role across multiple sectors and contributes to economic transformation and high-quality development.

However, much existing research primarily concentrates on the theoretical framework, development planning, statistical measurement, and economic implications of digital economic infrastructure construction. From a micro perspective on infrastructure, limited literature comprehensively considers and empirically analyses digital economic infrastructure in a detailed and structured manner. Additionally, due to the "intentionally broad" definition of digital economic development (Mesenbourg, 2001), most empirical studies remain at a macro and general level, incorporating broad digital economy indicators such as ICT frontier metrics and digital economic infrastructure, including internet server connectivity indicators, into empirical research. This inclusion aligns with the evolving needs of the digital economy and contemporary development trends.

# 3 Data sources, empirical models and descriptive statistics

## 3.1 Data Sources

Taking the countries along the "Belt and Road" as the research object, based on the reliability and availability of the above indicator data, countries with serious missing indicator data were deleted, and finally, the data of 38 countries along the "Belt and Road" including China from 2000 to 2022 were selected (see Table 2). The relevant data covers six major regions, and important areas along the "Belt and Road" are not missed. China's statistics do not include Hong Kong, Macao and Taiwan. The data mainly comes from the World Development Indicators, World Bank database, etc. (see Tables 2, 3&4).

**Table 2: Sample of countries along the Belt and Road**

| Regions and Areas | Main Countries |
|---|---|
| East Asia and ASEAN | China, Mongolia, Indonesia, Malaysia, Thailand, Vietnam, Brunei, Philippines, Singapore |
| Central Asia | Kazakhstan, Kyrgyzstan |
| South Asia | Sri Lanka, Nepal, Pakistan, Bangladesh |
| CIS | Ukraine, Georgia, Russia, Azerbaijan, Moldova, Armenia |
| West Asia | Bahrain, Israel, Saudi Arabia, Cyprus, Jordan, Egypt, Iran |

**Table 3: Comprehensive indicator system for digital economy infrastructure construction**

| First Level Indicator | Secondary Indicators | Indicator Description | Source from |
|---|---|---|---|
| Digital Economy Infrastructure Construction | Mobile Network Coverage | Mobile Network Subscriptions Per 100 People | World Bank Database |
| | Landline penetration rate | Mobile Phone Subscriptions Per 100 People | World Bank Database |
| | Fixed broadband penetration | Fixed broadband subscriptions per 100 people | World Bank Database |
| | Secure Internet Servers (per million people) | Number of secure Internet servers per million people | World Bank Database |
| | Mobile cellular subscriptions | Mobile cellular subscriptions per 100 people | World Bank Database |

**Table 4: Comprehensive Indicator System for Digital Economy Development Level**

| First level Indicator | Secondary Indicators | Indicator Description | Source from |
|---|---|---|---|
| Digital Economy Development Level | ICT Service Export | Earnings by the country from the provision of ICT-related services | WDI |
| | Information and Communication Services Export | Export volume of Information and Communication Services | WDI |
| | Number of ICT-related Papers Published | Number of Scientific Papers Published Related to Information and Communications Technology | WDI |
| | R&D Expenditure as a Share of GDP | National Expenditure on R&D Activities as a Share of GDP | WDI |
| | ICT Cutting-edge Technology Readiness | Measure the Country's Technological Reserves and Readiness in the Field of Information and Communications Technology | WDI |
| | Availability of Latest Technology | Ability and Ease of Access to the Latest Information and Communications Technologies | WDI |

## 3.2 Empirical models and descriptive statistics

When measuring the development level of the digital economy, this study analyses the digital economy from six indicators: ICT service exports, information and communication service exports, the number of ICT-related paper publications, the proportion of R&D expenditures in GDP, ICT cutting-edge technology readiness and the availability of the latest technology. The impact of infrastructure on the development level of digital economy in countries along the "Belt and Road". Based on the panel data of six major regions from 2000 to 2022, this study uses the least squares method to conduct further empirical analysis. The specific model is as follows.

$$Yi=\beta 0+\beta 1X1+\beta 2X2+\ldots+\beta nXn+\varepsilon \quad (1)$$

Yi (i=1,2,…,n) is the explained variable, that is, the relevant indicators of the development level of the digital economy; x1, x2,..,xn are the explanatory variables, that is, the relevant indicators of the digital economy infrastructure construction; β1, β2,..,n, is the coefficient of the OLS model, indicating the impact of the independent variable on the dependent variable, and ε is the error term.

To eliminate the influence of outlying values, this study first winsorises all continuous variables, eliminating samples below the 1% quantile and above the 99% quantile. At the same time, variables with larger values (number of ICT-related paper publications, secure Internet servers, mobile cellular subscriptions) are subjected to natural logarithm processing, and the descriptive statistics are as follows (see Table 5).

**Table 5: Descriptive Statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| **Y1** | 793 | 9.615 | 10.156 | .326 | 48.867 |
| **Y2** | 823 | 35.124 | 15.871 | 7.043 | 77.644 |
| **Y3** | 481 | 7.291 | 1.902 | 2.833 | 12.145 |
| **Y4** | 614 | .794 | .807 | .048 | 4.255 |
| **Y5** | 532 | .506 | .226 | .079 | .947 |
| **Y6** | 420 | 4.793 | .74 | 3.215 | 6.354 |
| **X1** | 866 | 41.555 | 29.976 | .24 | 97.862 |
| **X2** | 889 | 18.598 | 12.407 | .548 | 51.866 |
| **X3** | 814 | 10.647 | 10.523 | .002 | 37.36 |
| **X4** | 429 | 5.387 | 2.781 | -.308 | 11.33 |
| **X5** | 892 | 4.135 | 1.228 | -.929 | 5.167 |

From the descriptive statistics results, on the one hand, in terms of the explained variables, first of all, Y1 shows significant dispersion, with an average value of 9.615 but a standard deviation as high as 10.156, which reflects the dispersion of this indicator in the entire data set. Greater volatility. Secondly, the mean value of Y2 is approximately 35.124, and the standard deviation is 15.871, which shows that although these countries have huge potential and development opportunities in the field of the digital economy, the actual situation shows an obvious imbalance. Furthermore, in terms of Y3, the mean is 7.291, and the standard deviation is 1.902, implying lower publication volume volatility among regions or countries. In addition, the mean value of Y4 is about 0.794, and the standard deviation is 0.807, which shows obvious differences in the degree of investment in innovation among the sample countries. Coincidentally, the standard deviation of Y5 is 0.226, which

further reflects the obvious imbalance in ICT technology preparation among regions, with values ranging from 0.079 to 0.947. Finally, the mean value of the latest technology accessibility is about 4.793, with a standard deviation of 0.74, which shows significant differences in access to the latest technology across regions, possibly due to the relative lag in economic development of some countries along the Belt and Road. It faces greater challenges in acquiring the latest technology, a weak foundation for scientific and technological innovation, a shortage of technical talents and other reasons.

On the other hand, in terms of explanatory variables, X1 has a mean of about 41.555% and a standard deviation of 29.976%. Regarding X2, there are significant differences in the coverage and popularity of these indicators in countries and regions along the Belt and Road. The average values of X4 and X5 are approximately 5.387 and 4.135, and the standard deviations are also large, which reflects the significant volatility of these two variables in different regions.

This study proposes:

Null hypothesis H0: *The explanatory variables related to the construction of digital economy infrastructure have no significant impact on the explained variables related to the development level of digital economy in the countries along the "Belt and Road".*

Hypothesis H1: *Explanatory variables related to digital economy infrastructure construction have a significant promoting effect on explanatory variables related to the development level of digital economy in countries along the "Belt and Road".*

## 4 Empirical analysis

### 4.1 Variable test

After testing, the variance inflation factors between the respective variables are all less than 10, indicating no multicollinearity problem in our empirical analysis. This result gives us more confidence in the model we built because it shows that the independent variables we used are not highly correlated and will not affect the stability and accuracy of the model. Multicollinearity can lead to inaccurate or

unreliable model coefficient estimates, but we can continue the analysis with confidence in this case.

In addition, we chose to use robust standard errors to build the OLS linear regression model to solve the possible heteroskedasticity problem. Heteroscedasticity may lead to low standard errors in the model, affecting the accuracy of parameter estimates and the reliability of confidence intervals. By using robust standard errors, we can better cope with the existence of this heteroskedasticity and ensure the accuracy and credibility of the model estimation results. As a result, we can conclude with greater certainty and have greater confidence in the trustworthiness of our findings.

## 4.2 Estimation results and statistical analysis

### Joint significance test

From the test results in Table 6, it can be seen that the F statistics of each group of models are large. The corresponding p values are less than 0.01, indicating that at the 1% significance level, the null hypothesis H0 should be rejected: All independent variables have no significant impact on the dependent variable, indicating that at least one independent variable has a significant impact on the dependent variable. The goodness of fit r2 and the corrected goodness of fit adj_r2 of the model with Y4 as the dependent variable are both large, indicating that the changes in the independent variables explain the changes in the dependent variables to a greater extent, and the model has good fit. Both r2 and adj_r2 are small, indicating that changes in independent variables generally explain changes in dependent variables well.

**Table 6: OLS Linear Regression Model Estimation Results**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 |
| X1 | -0.177*** | 0.127* | -0.00321 | 0.00211 | 0.00377*** | 0.00809*** |
| | (-5.68) | (1.91) | (-0.47) | (0.75) | (10.60) | (3.11) |
| | | | | | | |
| X2 | 0.103 | 0.268*** | -0.0332*** | 0.0145** | 0.00237*** | -0.00296 |
| | (1.57) | (3.62) | (-2.91) | (2.29) | (3.13) | (-0.83) |
| | | | | | | |

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Y1 | Y2 | Y3 | Y4 | Y5 | Y6 |
| X3 | 0.0905 | -0.0552 | 0.0614** | 0.0388*** | 0.00227** | 0.0317*** |
| | (1.22) | (-0.36) | (2.48) | (5.04) | (2.00) | (3.83) |
| | | | | | | |
| X4 | 1.712*** | 1.257** | 0.0895 | -0.0226 | 0.0283*** | -0.00690 |
| | (5.77) | (2.51) | (1.21) | (-0.97) | (9.23) | (-0.29) |
| | | | | | | |
| X5 | -14.45*** | -10.27** | -0.863 | -0.310** | 0.00266 | -0.128 |
| | (-5.47) | (-2.45) | (-1.65) | (-2.02) | (0.11) | (-0.76) |
| | | | | | | |
| _cons | 76.80*** | 65.92*** | 10.72*** | 1.437** | 0.0709 | 4.721*** |
| | (6.29) | (3.57) | (4.47) | (2.12) | (0.68) | (6.53) |
| *N* | 386 | 394 | 399 | 313 | 410 | 302 |
| F | 21.23 | 21.85 | 8.408 | 27.88 | 392.3 | 44.04 |
| p | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| r2 | 0.189 | 0.181 | 0.0818 | 0.315 | 0.792 | 0.361 |
| r2_a | 0.178 | 0.171 | 0.0701 | 0.304 | 0.790 | 0.350 |

Note: t statistics in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01

**Regression coefficient t-test**

Y1: Increasing mobile network coverage by 1 unit significantly decreases ICT service exports by 0.177 units. A 1% increase in secure Internet servers (X4) boosts ICT service exports by 1.712 units, while a similar increase in mobile cellular subscriptions significantly reduces 14.45 units.

Y2: Mobile network coverage (x1) positively impacts information and communication service exports (Y2) by 0.127 units. A 1% increase in fixed telephone penetration (x2) raises Y2 by 0.268 units. The number of secure Internet servers (X4) positively influences Y2, while mobile cellular subscriptions (X5) have a significant negative impact.

Y3: Increasing fixed phone penetration (x2) by 1% decreases ICT-related paper publications by 3.32% at a 1% significance level. Conversely, a 1% increase in fixed broadband penetration (x3) significantly increases ICT-related paper publications by 6.14% at a 5% significance level.

Y4: Increasing fixed phone penetration (x2) by 1% correlates with a 0.0145% increase in the proportion of R&D expenditure in GDP at a 5% significance level. Similarly, a 1% increase in fixed broadband penetration leads to a 0.0388% increase in the proportion of R&D expenditure in GDP at a 1% significance level.

Y5: Mobile network coverage (x1), fixed phone penetration (x2), and secure Internet servers (x4) significantly impact ICT frontier technology readiness at a 1% significance level. Additionally, a 1% increase in fixed broadband penetration significantly increases Y5 at a 5% significance level.

Y6: Both mobile network coverage (x1) and fixed broadband penetration (x3) positively influence the availability of the latest technology at a 1% significance level. Specifically, a 1% increase in mobile network coverage increases availability by 0.00809 units, while a similar increase in fixed broadband penetration increases availability by 0.0317 units.

## 5 Conclusion

**Main conclusions**

It can be seen from this that the impact of digital economic infrastructure construction on the development level of the digital economy in countries along the Belt and Road is complex and diverse. In the regression model with ICT service exports as the dependent variable, the significant positive impact of mobile network coverage suggests the key role of mobile networks in digital economic infrastructure, which is consistent with the discussion of the importance of digital infrastructure in the literature. However, in the model of information and communication services exports, the positive impact of mobile network coverage is observed with the positive impact of fixed-line telephone penetration, which may reflect the comprehensiveness of communication infrastructure in terms of information and communication services exports. Development plays a key role in expanding the market. In addition, for the model of the number of ICT-related paper publications, the negative impact of fixed phone penetration may reveal certain constraints of fixed communication infrastructure on digital economic innovation activities. The research results on the proportion of R&D expenditures in GDP highlight the close relationship between the improvement of digital infrastructure and technological innovation, which is related to the importance of technological investment and innovation capabilities in the development of the digital economy. Overall, the above model results provide in-depth insights into the development of the digital economy in countries along the Belt and Road and provide an important academic basis and decision-making reference for relevant policy formulation.

**Suggestions for digital infrastructure construction**

(1) Strengthening digital infrastructure coverage and quality improvement

Digital infrastructure plays a key role in the modern economy. However, some developing countries face challenges in constructing digital infrastructure due to limitations in capital, technology, and talent. Therefore, China can assist these countries in building modern digital infrastructure and achieve seamless connections between network facilities and information technology by providing financial support, technical assistance, and personnel training. At the same time, special funds and assistance projects will be established to provide low-interest funds to these countries along the route, accelerate the popularisation and implementation of digital infrastructure, and help develop their digital economy. In addition, given the positive impact of mobile network coverage on ICT service exports and information communication service exports, the government should increase investment in digital infrastructure construction, especially in strengthening the coverage of mobile communication networks and improving network quality. This includes strengthening infrastructure construction in remote areas and developing countries to ensure the inclusiveness and sustainability of digital economic development.

(2) Promoting the upgrade and innovation of communications infrastructure

Strengthen the digital technology innovation capabilities of countries along the "Belt and Road" and promote the balanced development of the digital economy in countries along the "Belt and Road". To solve the gap in the development level of the digital economy, countries along the "Belt and Road" can promote in-depth cooperation between relevant academic circles, research institutions and enterprises and countries along the route and make full use of research and innovation opportunities in areas of common interest and the initiative of a community with a shared future for mankind. In addition, countries along the "Belt and Road" can also carry out joint training projects for digital technology talents to promote technological innovation exchanges and provide intellectual support for developing the digital economy. In particular, fixed communications infrastructure remains an important component of the development of the digital economy. The government should encourage and support the upgrading and innovation of fixed

communications infrastructure to improve its role and efficiency in digital economic innovation and development.

(3) Increasing investment in scientific research and development

Since the proportion of R&D expenditure in GDP is closely related to the improvement of digital infrastructure and technological innovation, the government should increase investment in technological R&D. This includes increasing government financial support for scientific research institutions and enterprises, encouraging enterprises to increase independent innovation, and promoting the development of digital technology and innovation.

Establish a transnational cooperation mechanism: Facing the huge investment needs and complex challenges in the construction of digital economic infrastructure, countries along the Belt and Road should strengthen the establishment and deepening of transnational cooperation mechanisms to promote the interconnection and shared development of digital infrastructure jointly. This includes strengthening the construction of international cooperation platforms, promoting information sharing and technology exchanges, and jointly responding to challenges and risks in the development of the digital economy.

**Research prospects**

In future research, in addition to exploring the impact of digital economic infrastructure construction on the development level of the digital economy in countries along the Belt and Road, we can also further explore the complex interactive relationships between different digital economic infrastructure elements. Specifically, research can be carried out from the following two aspects.

The synergy between infrastructure elements: Conduct a comprehensive analysis of digital economy infrastructure elements such as mobile network coverage, fixed phone penetration, number of secure Internet servers, etc., and explore the synergy between them. For example, will the increase in mobile network coverage have an impact on fixed phone penetration, or will the increase in the number of secure Internet servers have an impact on mobile network coverage?

The relationship between technological innovation and digital economic infrastructure construction: Study the role of technological innovation in promoting digital economic infrastructure construction and explore the impact and application of emerging technologies, such as artificial intelligence, big data, cloud computing, etc., on digital economic infrastructure construction, as well as technology How innovation accelerates the updating and upgrading of digital economic infrastructure.

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