

Impact of Digital Economy on Environment: Yangtze River Delta Case Study

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Abstract

With the rapid development of the digital economy, its impact on the ecological environment has attracted increasing attention. This paper takes the Yangtze River Delta region as an example to explore the impact of the digital economy on the ecological environment and its pathways. Through theoretical analysis and case studies, this paper reveals the positive role of the digital economy in promoting green development, improving resource utilization efficiency, and optimizing environmental governance, while also pointing out its potential environmental risks. The article finally proposes policy suggestions for promoting the harmonious coexistence of the digital economy and the ecological environment.

Keywords

Digital economy, Ecological environment, Yangtze River Delta, Impact pathways, Green development.

1. Introduction

The digital economy, as an emerging economic form, is profoundly changing the global economic landscape. The Yangtze River Delta region, as an important engine of China's economic development, ranks among the leading regions in the country in terms of digital economy development. However, the impact of the digital economy on the ecological environment cannot be ignored while it brings economic growth. This paper aims to analyze the impact of the digital economy on the ecological environment in the Yangtze River Delta region and its pathways, providing a theoretical basis for promoting regional sustainable development.

2. Overview of the Relationship between the Digital Economy and the Ecological Environment

2.1. Connotation and Characteristics of the Digital Economy

The digital economy, as the name suggests, is a new economic form that takes digital knowledge and information as key production factors, digital technology innovation as the core driving force, and deeply integrates digital technology with the real economy to continuously improve the digital and intelligent level of traditional industries, accelerate the reconstruction of economic development and government governance models. In the digital economy, data becomes the fifth major production factor, along with land, labor, capital, and entrepreneurship. Data has the characteristics of non-rivalry, non-excludability, and replicability, and its value increases with the increase in usage. The core driving force is digital technology, especially emerging technologies such as big data, cloud computing, artificial intelligence, and blockchain. These technologies continuously break through the boundaries of traditional industries, giving birth to new industries, new formats, and new models. The digital economy is not a virtual

economy independent of the real economy. By digitally transforming and upgrading traditional industries, it achieves optimization and upgrading of the economic structure. The digital economy permeates all areas of the economy and society, not only changing the operation models of traditional industries but also creating entirely new industrial formats. For example, e-commerce, online education, and remote medical care are all typical examples of the penetration of the digital economy. Due to the attributes of data being replicable, shareable, infinitely growing, and supplyable, the digital economy can realize value multiplication through the multiple utilization and value-added development of data. Digital technology has greatly improved economic efficiency and reduced transaction costs. For example, through big data analysis, enterprises can more accurately understand consumer demand and achieve personalized production and services. The network platform in the digital economy has the characteristics of self-organization, self-optimization, and self-development. The platform automatically matches supply and demand through algorithms and rules, realizing the optimal allocation of resources. The digital economy breaks the boundaries of regions, industries, and departments, realizing the global allocation of resources. At the same time, open data interfaces and standards enable different systems and platforms to interconnect and jointly build an open digital economy ecosystem.

2.2. Importance of the Ecological Environment

The importance of the ecological environment lies in its role as the foundation for human survival and development, providing the necessary resources and conditions for the sustainable development of the economy and society. First, the ecological environment directly affects people's basic living needs, such as food, water, and air, which are all essential elements for human survival. At the same time, the maintenance of biodiversity depends on a healthy ecological environment, and biodiversity is the key to the stability of ecosystems and the sustainable development of human society. From an economic perspective, the ecological environment provides rich natural resources, such as minerals, forests, and fishery resources, all of which are important material bases for promoting economic development. In addition, the ecological environment also provides a variety of irreplaceable ecological services, such as climate regulation, water source conservation, and soil conservation, which are crucial for the stability and sustainable development of the economy.

2.3. Interaction between the Digital Economy and the Ecological Environment

The digital economy, through the integration of advanced technologies, has brought about many positive changes to the ecological environment. First, in terms of resource optimization and allocation, the digital economy, with the help of modern information technologies such as big data and cloud computing, has achieved precise prediction and efficient allocation of resource demand, significantly reducing the phenomenon of resource waste. Second, in terms of energy conservation and emission reduction, the application of digital technology has promoted the intelligence and automation of the production process, effectively reducing energy consumption and emission levels. In addition, the integration of digital technology has also strengthened environmental monitoring and governance. The use of technologies such as the Internet of Things and remote sensing enables the real-time monitoring of environmental conditions, providing solid data support for environmental governance. However, the development of the digital economy also brings some potential environmental risks. For example, the issue of electronic waste has become increasingly prominent with the rapid development of the digital economy, and how to properly handle these electronic waste has become an urgent environmental problem to be solved. At the same time, the operation of digital infrastructure such as data centers and cloud computing platforms requires a large amount of energy, which also puts certain pressure on the ecological environment. The ecological environment also has an irreversible impact on the development of the digital

economy. A good ecological environment provides a sustainable development foundation for the digital economy, while the existence of environmental problems forces the digital economy to pay attention to the principles of green and sustainable development in the process of development. This counteractive mechanism prompts the digital economy to continuously seek balance and harmony with the ecological environment in the interaction with the ecological environment. In summary, the interactive relationship between the digital economy and the ecological environment is diverse and dynamic. The two promote social progress and development together in the process of mutual influence and mutual restraint. This interactive relationship requires that while developing the digital economy, we must attach great importance to the protection and governance of the ecological environment, ensuring that the two can achieve positive interaction and win-win results.

3. Status Quo of the Digital Economy and Ecological Environment in the Yangtze River Delta Region

3.1. Overview of Digital Economic Development in the Yangtze River Delta Region

The Yangtze River Delta region, as an important engine of China's economic development, presents a prosperous development trend in terms of the digital economy. Relying on its superior geographical location, strong economic foundation, and rich scientific and technological resources, the region actively deploys the digital economy and promotes the transformation and upgrading of the regional economy. At the policy level, governments at all levels in the Yangtze River Delta region attach great importance to the development of the digital economy and have introduced a series of support policies, providing strong guarantees for the rapid growth of the digital economy. These policies cover various aspects such as infrastructure construction, scientific and technological innovation, and industrial integration, forming a good policy environment. In terms of infrastructure construction, the Yangtze River Delta region vigorously promotes the construction of new infrastructure such as 5G networks, data centers, and cloud computing platforms, improving the carrying capacity of the regional digital economy. At the same time, the region also actively promotes cross-regional information sharing and interconnection, laying the foundation for the collaborative development of the digital economy. In terms of industrial layout, the Yangtze River Delta region has formed digital economy industrial clusters represented by e-commerce, cloud computing, big data, artificial intelligence, etc. These industrial clusters are not only large in scale but also strong in innovation, leading the development trend of the digital economy in China and even the world. In addition, the Yangtze River Delta region also focuses on the deep integration of digital technology and traditional industries, promoting the digital and intelligent transformation of fields such as manufacturing and services. Through the extensive application of digital technology, the overall competitiveness of the industrial chain is improved, and high-quality economic development is achieved.

3.2. Status Quo of the Ecological Environment in the Yangtze River Delta Region

The Yangtze River Delta region, as one of the most active regions of economic development in China, has a relatively complex ecological environment. With the rapid advancement of industrialization and urbanization, the region faces certain environmental pressures. Air pollution, water pollution, and soil pollution exist to a certain extent, especially in some industrial concentration areas and densely populated cities. However, in recent years, with the enhancement of environmental awareness and the strengthening of governance measures, the Yangtze River Delta region has achieved certain results in improving the ecological

environment. Local governments actively promote green development, strengthen pollution control, and improve the quality of the ecological environment. For example, by implementing strict emission standards, promoting clean energy, and strengthening ecological restoration, the air quality, water quality, and greening coverage in some regions have improved. Overall, the Yangtze River Delta region is in a balance between ecological environment protection and economic and social development, and it still needs to continue its efforts in the future to achieve harmonious coexistence between economic development and the ecological environment.

4. Impact of the Digital Economy on the Ecological Environment in the Yangtze River Delta Region

4.1. Positive Impact

The positive impact of the digital economy on the ecological environment in the Yangtze River Delta region is mainly reflected in the following aspects: First, the digital economy promotes the optimization and upgrading of the industrial structure, reduces the proportion of traditional high-pollution and high-energy-consuming industries, and promotes the development of clean and low-carbon industries, thereby reducing overall pollution emissions. Second, the extensive application of digital technology has greatly improved the efficiency of resource utilization, reduced the consumption of resources such as land, labor, and capital, and avoided the waste of resources. Third, the development of the digital economy promotes the application of green technology, such as clean energy and energy-saving and emission-reduction technologies, thereby reducing the impact of economic development on the ecological environment.

4.2. Potential Risks

The rapid development of the digital economy has also led to a significant increase in energy consumption, further exacerbating the problem of carbon emissions and greenhouse gas emissions. In addition, the extensive use and rapid renewal of electronic devices have generated a large amount of electronic waste. If not properly handled, it will cause serious pollution to soil and water sources. The expansion of the digital economy has also driven the rapid development of related industrial chains, including some high-pollution links such as semiconductor manufacturing. These links may emit harmful substances during the production process, causing damage to the environment. At the same time, the development of the digital economy has accelerated the process of urbanization, and the land use changes and biodiversity reduction caused by urban expansion have gradually emerged. Therefore, how to effectively control the negative impact of the digital economy on the ecological environment while promoting it and achieve green and sustainable development has become an important challenge facing the Yangtze River Delta region and even the whole country.

5. Path Analysis of the Impact of the Digital Economy on the Ecological Environment in the Yangtze River Delta Region

5.1. Technical Path

The impact of the digital economy on the ecological environment in the Yangtze River Delta region is achieved through various technical paths, which interact with each other and together constitute a complex ecological impact network. First, the extensive application of digital technologies such as big data, cloud computing, and artificial intelligence has greatly improved production efficiency, but it has also led to a significant increase in energy consumption. Data centers, as the core infrastructure of the digital economy, require a large amount of electricity

to operate, which usually relies on traditional energy sources such as coal, leading to an increase in carbon emissions and putting pressure on regional air quality. Second, the promotion of intelligent manufacturing and industrial Internet has optimized the allocation of resources and reduced some material waste, but it may also exacerbate the expansion of certain high-pollution industries. For example, the rapid development of the semiconductor industry in the Yangtze River Delta region, the chemical substance emissions during its production process pose a threat to the water and soil environment. In addition, the development of the digital economy has also led to the emergence of new consumption models, such as the rapid development of e-commerce, which has brought about the rapid expansion of the logistics industry. The exhaust emissions and packaging waste generated during the logistics transportation process have posed new challenges to the ecological environment. Furthermore, the popularization of digital technology has also changed people's way of life, increased the demand for electronic devices, and accelerated the generation of electronic waste. If these wastes are not properly handled, they will cause serious pollution to the environment. Finally, the development of the digital economy also indirectly affects the ecological environment through its impact on the urban spatial structure. The construction of smart cities has promoted the upgrading of urban infrastructure, but it may also trigger urban expansion, leading to the destruction of natural habitats and the reduction of biodiversity.

5.2. Industrial Path

The impact of the digital economy on the ecological environment in the Yangtze River Delta region is reflected in a series of interrelated economic activities and ecological effects through the industrial path. With the deep integration of digital technology, the industrial structure of the Yangtze River Delta region has undergone significant changes. While traditional industries are digitally transformed, emerging industries such as cloud computing, big data, and artificial intelligence have rapidly emerged. These changes have improved economic efficiency while also having a complex impact on the ecological environment. First, the rapid development of the digital economy has promoted the agglomeration of high-tech industries, especially in high-tech manufacturing industries such as semiconductors and electronic information. These industries have high added value, but their production processes often accompany high energy consumption and pollutant emissions, such as greenhouse gases and harmful chemical substances, posing pressure on the regional air quality, water quality, and soil environment. Second, the digital economy has promoted the expansion of the service industry, especially the rapid growth of fields such as e-commerce, logistics, and digital finance. The prosperity of e-commerce has driven the rapid development of the logistics industry, increasing the carbon emissions of transportation vehicles and the generation of packaging waste. At the same time, the development of modern service industries such as digital finance has reduced the demand for physical transactions but increased the energy consumption of data centers, further exacerbating the environmental burden. In addition, the digital economy has also promoted the intelligent transformation of agriculture, and new models such as precision agriculture and intelligent breeding have improved the efficiency of agricultural production while also bringing about changes in the use of chemical substances such as fertilizers and pesticides, affecting the soil and water environment. Furthermore, the digital economy has also promoted the integration and collaboration between industries, forming a complex industrial chain network. This network effect improves the overall economic efficiency while also possibly leading to the diffusion and accumulation of environmental risks. For example, pollution problems in a certain link may be transmitted to other links through the industrial chain, forming a wider environmental impact. Finally, the development of the digital economy has also affected the regional industrial layout and spatial structure, promoting the process of urbanization and industrialization. In this process, land use changes, natural habitat destruction, and biodiversity

reduction have become increasingly prominent, posing long-term challenges to the ecological environment.

5.3. Governance Path

The analysis of the governance path of the digital economy on the ecological environment in the Yangtze River Delta region is a complex and multi-dimensional process that needs to comprehensively consider economic, social, and environmental factors. The following is an overall analysis of this governance path:

(1)Policy Guidance and Legal Construction: Formulate and improve laws and regulations related to the digital economy, clarify environmental responsibilities and regulatory requirements in the development of the digital economy. Introduce incentive policies to encourage enterprises to adopt green technologies and reduce the impact of the development of the digital economy on the environment.

(2)Technological Innovation and Green Transformation: Promote the green transformation of digital technology itself, such as developing low-carbon data centers and green cloud computing. Use digital technology to optimize traditional industries and achieve energy conservation and emission reduction in the production process, such as industrial Internet and intelligent manufacturing.

(3)Industrial Layout and Spatial Optimization: Rationally plan the layout of industries related to the digital economy and avoid excessive development in environmentally sensitive areas. Promote coordinated development between cities and regions, optimize the spatial structure, and reduce the negative impact of urbanization on the ecological environment.

(4)Environmental Monitoring and Risk Management: Use digital technology to strengthen environmental monitoring, realize real-time and accurate collection and analysis of environmental data. Establish an environmental risk warning and emergency system to prevent environmental risks in digital economic activities.

6. Conclusion and Suggestions

Strengthen Policy Guidance and Legal Construction: Formulate and improve laws and regulations related to the digital economy, clarify environmental responsibilities and regulatory requirements in the development of the digital economy, and introduce incentive policies to encourage enterprises to adopt green technologies and reduce the impact of the development of the digital economy on the environment.

(1)Promote Technological Innovation and Green Transformation: Promote the green transformation of digital technology itself, such as developing low-carbon data centers and green cloud computing. Use digital technology to optimize traditional industries and achieve energy conservation and emission reduction in the production process, such as industrial Internet and intelligent manufacturing.

(2)Optimize Industrial Layout and Spatial Structure: Rationally plan the layout of industries related to the digital economy and avoid excessive development in environmentally sensitive areas. Promote coordinated development between cities and regions, optimize the spatial structure, and reduce the negative impact of urbanization on the ecological environment.

(3)Strengthen Environmental Monitoring and Risk Management: Use digital technology to strengthen environmental monitoring, realize real-time and accurate collection and analysis of environmental data, and establish an environmental risk warning and emergency system to prevent environmental risks in digital economic activities.

(4)Promote Public Participation and Social Governance: Strengthen environmental awareness among the public, encourage public participation in environmental protection, and form a

pattern of environmental protection with the joint participation of the government, enterprises, and society.

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