

# Differential Research on the Coupled and Coordinated Development of Digital Economy and Green Economy in China

Xinyue Zhang

School of International Trade and Economics, Anhui University of Finance and Economics,  
Bengbu, Anhui, China

## Abstract

**In the "14th Five-Year Plan" digital economic development plan, the digital economy and green economy as two new economic forms are closely related, is an important focus of future economic development. However, the study found that in the process of economic development, the degree of coordination and efficiency of the digital economy and green economy is not consistent and there has been an imbalance, this topic in order to help China's efficient implementation of the transformation of the digital green economy, the establishment of a model for the digital green economy and its coupling degree of coordination of the study, through the coupling degree of coordination of the measurement, the study of China's digital economy and the green economy coupling the coordinated development of the differences between the digital economy and green economic coupling, thus promoting the balanced development of the digital green economy put forward effective strategy recommendations.**

## Keywords

**Digital Economy; Green Economy; Coupled Coordinated Development Model.**

## 1. Introduction

In the 2023 National People's Congress, the digital economy has once again become a hot topic, nowadays digital technology has been deeply penetrated into various fields, which promotes the process of globalization and intelligent development, and green environmental protection, as one of the focuses of the international community, is of great significance in the promotion of the practical realization of the concept of sustainable development, and the digital economy and the green economy are closely related to each other as two new types of economic forms, which are important focuses of economic development in the future. Digital economy and green economy are closely related as two new economic forms, which are important focus points for future economic development. Combined with China's national conditions, seeking the reasons for the differences in the efficiency of coordinated development between regions in China, exploring the path of coordinated development of the digital green economy in line with the national top-level strategy, helping the efficient implementation of China's green and low-carbon transformation strategy and digital transformation strategy, promoting the balanced development of the digital green economy, and realizing the goal of upgrading the economy and the industrial structure are of great practical significance, and it is necessary to carry out in-depth research on this.

Previously, the academic community on the digital economy and the green economy has launched a multi-dimensional research, through the analysis of existing literature, this paper mainly from the following two aspects of the comb:

First, in the digital economy measurement and green economy measurement. In terms of green economy measurement, a unified measurement standard has not yet been formed, Li Su and Yin Haitao (2020) refer to the United Nations Environment Programme in the article to assess

the inclusive green growth indicators on the further improvement, combined with China's national conditions, the construction of the green economy development indicators, the article measured the green economy development index of different provinces in China, the results of the calculation concluded that in recent years, the overall level of China is improving, but the level of growth between different The growth level is different between regions[1]; Meng Wangsheng and Shao Fangqin (2021) in the article take the green total factor productivity and energy and environmental efficiency index as the measurement index, and adopt the method of non-radial directional distance function model to measure and analyse the relevant indexes of different provinces in China, and summarize the characteristics of the change of China's green economic growth efficiency from 2003 to 2016 In terms of the measurement of the digital economy[2]; Xiang Hui (2022) in his paper conducted a horizontal comparative analysis and vertical comparison of 30 provinces (cities and districts) in China from five specific aspects-digital infrastructure, digital industrialization, industrial digitisation, ICT development and sustained development[3]; Yan Changchun and Liao Jun (2023) peeled off the concept of digital economy from that of platform economy, the platform economy as the core form of the digital economy, and constructs an indicator system to measure the economic value of the platform economy[4].

Secondly, in the coupled coordination analysis. Wang Yanjuan (2022) selected Henan Province to conduct a study on the synergistic development of digital economy and green economy, and put forward constructive suggestions for the development of digital green economy in Henan Province[5]; Jiang jinghe (2021), from the perspectives of technological and economic innovations and environmental externalities, put forward the idea that the high-quality integration and development of digital economy and green economy should be achieved from the perspectives of institutional design, innovation paradigm in green transformation, and data governance capacity[6]. However, the research on the interaction between the two in most articles is only based on the qualitative perspective, and the research on the quantitative perspective is relatively lacking.

In the collection and collation of related literature, it is found that scholars have not yet formed a digital economy measurement and evaluation system based on a qualitative perspective, and the analysis of the interaction mechanism between the green economy and the digital economy needs to be studied. Therefore, in the context of the current theoretical research, this project puts forward relevant assumptions, establishes an efficiency evaluation system, empirically analyses the differences between the integrated development of digital economy and green economy from the quantitative level, draws conclusions and puts forward relevant recommendations.

## 2. Theoretical Analyses

### 2.1. Mechanism Hypothesis

From the article "Digital Economy, Technological Innovation and Urban Green Economy Efficiency" (Zhu Jiexi, 2023)[7], it can be seen that the digital economy has the essential characteristics of rapidity, permeability, virtuality and sustainability, etc. The digital economy is able to effectively crack the problems of overconsumption of resources, imbalance between supply and demand of innovation elements, and fragmentation of the industrial chain, etc., and promote the optimisation of the consumption structure of the energy structure and the change of management through efficient use of the main energy source, so as to Promote the development of the green economy, at the same time, the green economy as a development concept, will lead the digital economy in the direction of a good ecological environment, through the combination of digitalization and green production and life ascension, to promote the sustainable development of the economy and society But in the development of recent years

and the research of various scholars on the digital economy and the green economy, it can be clearly seen that with the Internet as a medium, the digital economy development momentum is fierce, but the green economy as a derivative of sustainable development, its development space is still to be explored, and the internal efficiency of the two economies is not coordinated. Based on this, the mechanism hypothesis of this topic is proposed - there are differences in the internal economic efficiency of the digital economy and green economy subsystems between regions.

## 2.2. Digital Economy and Green Economy Coupling Model Establishment

### 2.2.1. Data Sources

By combing and summarizing the relevant literature, in order to better illustrate the relationship between the digital economy and the green economy, this topic will explore the synergistic relationship between the digital economy and the green economy through the establishment of the Modified Coupling Model (Modified Coupling Model), quantify the coupling and coordination relationship between the digital economy and the green economy development level of mutual influence and constraints, and study the benign effect of the two. The effect of the interaction between the two is studied.

In order to ensure the validity of the results, the research data come from the relevant statistical yearbooks from 2010 to 2020, and in order to eliminate the quantitative and directional differences between the indicators to achieve comparability, the original data of each indicator is standardized by the polarity standardization, and then the entropy weight method is selected to determine the weights of each indicator on the basis of the principle of objectivity and the problem of the amount of calculation.

### 2.2.2. Evaluation Index System Construction

**Table 1.** Evaluation indicator system

System	Primary indicator	Secondary indicator	Unit
Digital Economics	Digital Industry Development	Revenue of IT service industry	billion yuan
		Total Telecommunications Business	billion yuan
	Digital transactions	Percentage of companies with e-commerce transactions	%
		E-commerce sales	billion yuan
		Software business revenue	billion yuan
Green Economy	Green Industry	Contribution of tertiary industry to GDP	%
		Total Coal Consumption million tonnes	million tonnes
	Green Ecology	Green space per capita	Square metres per person
		Forest Coverage Rate	%
		Green coverage rate of built-up area	%

In today's increasingly developing digital economy and green economy, each direction of economic development has its own focus, in order to better measure the relevant economic

indicators, combined with the current situation of China's digital economy and green economy development, we can understand that: the Internet as a carrier of the digital industry has an important significance for the development of the digital economy, therefore, this paper will select the development of the digital industry and the digital transaction as a measure of the level of digitalization of China's economic development. In addition, for the green economy, its green industry development and green ecology are both the products of the green economy and the pillars of the green economy, therefore, this topic selects green production and green ecology as the first level of indicators to measure the level of development of China's green economy, to sum up, each of the two first level of indicators and their corresponding second level of indicators, the establishment of the indicator evaluation system as shown in Table 1.

### 2.2.3. Model Setting

Through the study of the coupling model in the Study on the Measurement and Evaluation of the Coupling and Coordination of Digital Economy and Urban-Rural Integration and Development published by Yao Yuchun scholars in March 2023[8], this topic establishes the coupling and coordination model in order to reveal the difference in the efficiency of the coordination effect of the digital green economy and the difference in the economic efficiency within the sub-systems, and to construct the index system for measuring the level of integration and development of the digital economy and the green economy. Referring to the study of Zheng Xiaoyun (2021)[9], the coupling model is established using panel data as follows:

$$\text{If: } U_1 > U_2: C = \sqrt{[1 - (U_1 - U_2)] \times \frac{U_2}{U_1}} \quad (1)$$

$$\text{If: } U_1 < U_2: C = \sqrt{[1 - (U_2 - U_1)] \times \frac{U_1}{U_2}} \quad (2)$$

Since the coupling degree cannot show the effect of benign interaction between digital economy and green economy, the coupling coordination degree model is introduced in order to study its coordination level:

$$D = \sqrt{C \times T} \quad (3)$$

Among them:

$$T = \alpha U_1 + \beta U_2 \quad (4)$$

In the model,  $U_1$  and  $U_2$  represent the development level of digital economy and green economy development index respectively;  $C$  is the coupling degree of the two subsystems, and the range of values is generally defined as 0 to 1. The larger the value of the coupling degree  $C$  is, the stronger the interactions are; in particular, when  $U_1 = U_2$ ,  $C$  is 1.  $D$  represents the degree of coordination of the coupling of digital economy and green economy, and  $T$  is the development level of the green economy and the digital economy, and the development index, and the  $\alpha$  and  $\beta$  are pending coefficients in equation (4), which usually take the value of 0.5 for the two subsystems. development index,  $\alpha$  and  $\beta$  in Eq. (4) are coefficients to be determined, and usually take the value of 0.5 for two subsystems.

### 3. Analysis of the Coupling Coordination Degree of China's Digital Economy and Green Economy Development

Through the establishment of the coupling coordination model, the coupling degree and the coupling coordination degree measure the strength and weakness of the interaction effect between different systems and their coordination school, to analyse the relevant development level of China's digital economy and green economy, and to explore the law of development of China's digital economy and green economy.

**Table 2.** Criteria for classifying coupling

C	0	[0.0-0.3]	[0.3-0.5]	[0.5-0.8]	[0.8-1.0]
Category	Disorderly development	Low level coupling	Antagonistic period	Break-in period	High level coupling

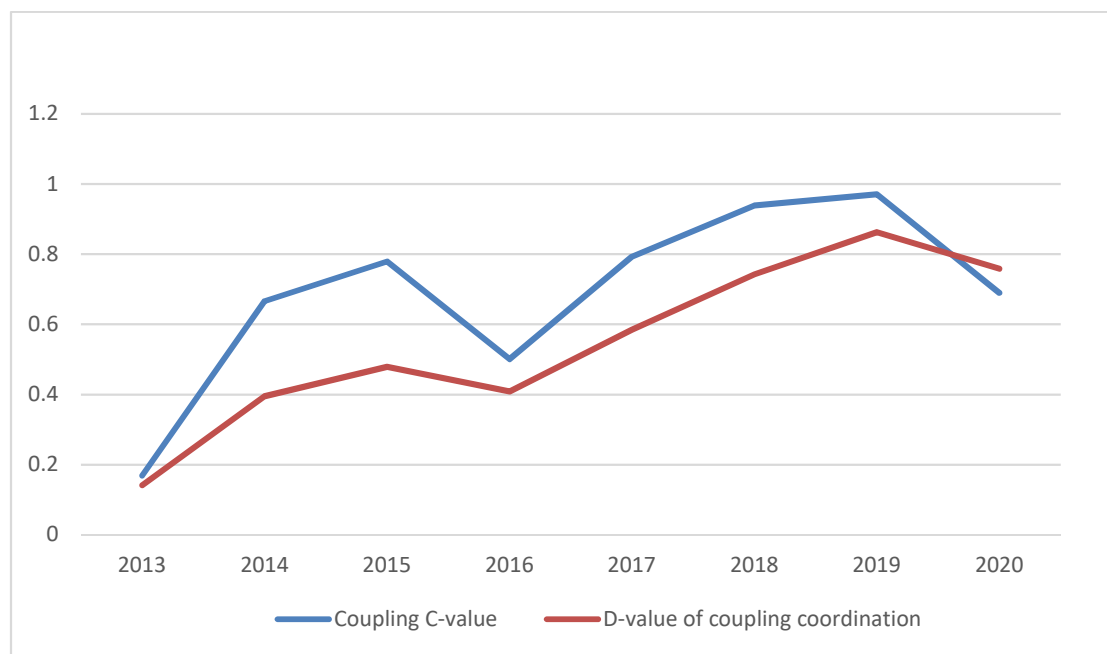
**Table 3.** Criteria for classifying the degree of coupling coordination

D	[0.0-0.4]	[0.4-0.5]	[0.5-0.8]	[0.8-1]	1
Category	Low-level	Primary	Intermediate	High-level	Quality

Dong Yi (2023) and other scholars in the coupling coordination model for the coupled and coordinated development of urban human-water systems for the degree of coupling and coupling coordination of the degree of ranking[10], with reference to the degree of coupling and coordination of the degree of index range, the degree of coupling and coordination of the degree of ranking criteria as shown in Table 2, Table 3. According to the coupling coordination model, the calculation results of the coupling coordination degree of China's digital economy and green economy from 2010 to 2020 are shown in Table 4.

**Table 4.** Calculation results of coupling coordination degree

vintage	C	T	D	coupling	Degree of coupling coordination
2020	0.690	0.834	0.758	Break-in	Intermediate
2019	0.971	0.768	0.863	High level	Advanced
2018	0.939	0.588	0.743	High level	Intermediate
2017	0.793	0.432	0.585	Break-in	Intermediate
2016	0.501	0.334	0.409	Break-in	Low-level
2015	0.779	0.295	0.479	Break-in	Low-level
2014	0.666	0.234	0.395	Break-in	Low-level
2013	0.169	0.118	0.141	Low level	Low-level



**Figure 1.** Trends in coupling and coordination

The results of the measurement can be seen that the coupling degree of the national green economy development and digital economy development tends to rise on the whole, and the development trend of the coupling degree and the coupling coordination degree is consistent, and the coupling effect from 2013 to 2015 and from 2016 to 2019 has increased rapidly, and has gradually developed to a high degree of coupling, with a high degree of interdependence, which indicates that the digital economy development and the green economy in these two time periods are mutually mutual influence and high integration, and both 2018 and 2019 are at a high level of coupling, and the degree of coupling coordination in 2019 has reached advanced coupling, but throughout the study period, the two were at the lowest level of coupling in the development process in 2016, indicating that the gap between the four systems of the digital economy and the green economy was large in 2016, and there were developmental differences within the system, and that, from the point of view of the degree of coupling coordination, since 2017 the digital economy and the green economy have entered the intermediate level of coordination, but in 2020, due to the impact of the general background of the epidemic, the Internet-mediated digital economy has been subjected to greater constraints, and has declined from high coupling to a period of friction, and the degree of coupling coordination has simultaneously declined from advanced coordination to intermediate coordination again.

## 4. Conclusion and Recommendations

### 4.1. Conclusion

China's overall digital economy and green economy development level shows a rising trend year by year, the degree of coupling and coordination are tending to stabilise, experienced a low level of coordination gradually to the high level of coordination, the high level of coupling proves that the digital economy and the green economy have a significant effect on each other, but the overall seems to be that if you want to promote the digital economy and the green economy of the depth of the development of a high level of fluctuations in the level of coupling still needs to be improved. In the research results, only one year reached the level of high-level coordination of coupling coordination, which is a certain obstacle to the promotion of high-quality digital green economy integration and development, but the overall trend of China's digital economy and the green economy in the development of a good trend, therefore, the use



of good coupling coordination to promote the level of coordination of the development of the digital green economy in order to promote the realization of the development of the digital green economy.

#### 4.2. Suggestions for Countermeasures

The integration of digital economy and green economy is a necessary path to promote sustainable development and economic transformation and upgrading. My suggestions are as follows: first, strengthen scientific and technological innovation, promote the application of digital and intelligent technologies to green industries, make digital industries green, promote energy cleanliness, reduce carbon emissions, and achieve the goals of efficient use of resources, energy saving and pollution reduction. Second, establish a digital platform to digitise the green industry and promote the sharing and opening of environmental data. The government can formulate more effective environmental protection measures through big data analysis; and enterprises can optimise operations such as supply chain management through data analysis. Fourth, encourage financial institutions to provide special funds to support renewable energy projects, and provide them with convenient and fast service processes as well as all-round risk prevention. Finally, laws and regulations should be enacted to encourage the use of digital innovations in environmental governance, and Internet companies should be encouraged to take full advantage of online information transfer to help observe pollutant emissions and make this important information available to a wider range of participants.

In short, to promote the deep integration of the digital economy and green economy, it is necessary to form a positive interactive relationship between various fields and plan and layout with a long-term development strategy to promote its effective, rapid and steady progress.

#### Acknowledgments

This research is funded by 2023 Anhui University of Finance and Economics Undergraduate Research Innovation Fund Project (No.: XSKY23108).

#### References

- [1] Li Su and Yin Haitao: Measurement and spatial and temporal characterization of the green economy development index of China's provinces - based on the perspective of inclusive green growth, *Ecological Economy*, Vol. 36 (2020) No. 9, p.44-53.
- [2] Meng Wangsheng, Shao Fangqin: Measuring the efficiency of green economic growth in Chinese provinces and regions, *Statistics and Decision Making*, Vol. 16 (2020) No. 36, p.105-109.
- [3] Xianghui: Study on the Measurement of the Development Level of China's Digital Economy and Regional Differentiation(Ph.D., Hebei University of Economics and Trade,China2023).
- [4] Yan Changchun, Liao Jun: Construction and measurement of evaluation index system of China's platform economy development level; Construction and measurement of evaluation index system of China's platform economy development level; *Statistics and Decision Making*, Vol. 39 (2023) No.11, p.5-10.
- [5] Wang Yanjuan: Research on the synergistic development of digital economy and green low-carbon industry in Henan Province under the background of "dual-carbon" strategy, *Business Exhibition Economy*, Vol. 16 (2022), p.122-124.
- [6] Jinho Jiang: Sustainable digital era: high-quality integration of digital economy and green economy, *Business Economics*, Vol. 40 (2021) No. 07, p.23-30+161.
- [7] Jiexi Zhu: Digital economy, technological innovation and urban green economic efficiency: an empirical analysis based on spatial econometric modelling and mediation effects, *Exploration of Economic Issues*, Vol. 02 (2023), p.65-80.

- [8] Yao Yuchun: A study on the measurement and evaluation of the coupling and coordination of digital economy and urban-rural integrated development, Journal of Lanzhou University (Social Science Edition), Vol. 51 (2023) No.01, p.54-67.
- [9] Zheng Xiaoyun: Research on the synergistic development of green economy and digital economy--an empirical analysis based on a modified coupling model; Price Theory and Practice, Vol. 08 (2021), p.164-167+187.
- [10] Information on:<https://kns.cnki.net/kcms/detail/32.1356.TV.20230302.1727.012.html>.