

# Research on Measurement and Path of High-quality Development of Carbon Finance under New Development Concept

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**Abstract:** High-quality development and environmental and ecological issues are the core issues of current economic and social development in China. While pursuing high-quality economic development, the increasingly severe reality of environmental and ecological problems cannot be ignored. Under this background, the development of carbon finance is of great significance to China. Based on the background of the new development concept, this paper constructs a high-quality development measurement index system of carbon finance with five dimensions and 20 secondary indicators, and uses the entropy method to determine the weight and comprehensive level index to further analyze the high-quality development level of carbon finance in Yunnan, Guizhou, Sichuan and southwest Chongqing from 2016 to 2021. The research shows that Chongqing has a high overall score from 2016 to 2021, and the development quality of carbon finance is high, showing a steady upward trend. The development level of high-quality carbon finance in Guizhou is low, and there is a lack of coordinated development among the provinces. Based on the calculated results and analysis, the paper puts forward corresponding countermeasures and suggestions for the high-quality development of carbon finance in the four southwest provinces.

**Keywords:** New development concept, Carbon finance, High-quality development, Entropy method.

## 1. Introduction

### 1.1. Research Background and Significance

President Xi Jinping set out goals of great significance in the general debate of the United Nations General Assembly on September 22, 2020. He stated that China will strive to achieve peak CO<sub>2</sub> emissions by 2030 and a carbon neutrality target by 2060. To achieve this goal, China needs to accelerate the development of a carbon financial market, with a focus on carbon emissions trading, to promote green and low-carbon development and reduce carbon emissions intensity. In the report of the 19th Party Congress, the concept of "high-quality development" was proposed for the first time, and it called for the establishment of a sound economic system of green, low-carbon and circular development.

(1) It is helpful to enhance the international competitiveness of China's financial institutions. Carbon finance has become an emerging financial field and has formed a multi-level financial market. Environmental financial products have also gradually become a popular investment and hedging instrument in the world. Although China already has some basic carbon financial products, there is still a certain gap in development and competitiveness. Through the development of carbon finance, China financial institutions can change this disadvantage and enhance their position and competitiveness in the international financial market.

(3) It is helpful to improve the high-quality development level of regional carbon finance. This study measures the high-quality development level of carbon finance based on the background of new development concept, combined with the strategic planning of carbon finance and high-quality development status. On this basis, we will complete the research on the influencing factors and level measurement of high-quality development of carbon finance under the new

development concept, and promote the high-quality development process of the four provinces in southwest China. It is helpful to improve the layout of high-quality development of carbon finance economy. Even from the perspective of global economic coordinates, it also constitutes an effective variable that affects China's economic strength and competitiveness.

### 1.2. Research Trends at Home and Abroad

High-quality development is a relatively new concept, which has been widely studied by scholars in China. According to Yang Weimin (2018)<sup>[1]</sup>, high-quality development refers to development that meets people's expectations for a better life. Innovation is the primary driving force to promote development, coordination is its intrinsic characteristic, green is the commonly adopted form, openness is the only way, and sharing is the fundamental goal. In terms of high-quality development of carbon finance, Cao Mengshi and others (2021)<sup>[2]</sup> believe that carbon finance means that financial activities and behaviors must be carried out around the "double carbon" target. This is a requirement that the financial industry must respond to and a task with certain passivity. Lu Minfeng (2021)<sup>[3]</sup> believes that carbon finance is an important manifestation of high-quality financial development, and its essence is to further reduce the social responsibility of financial institutions. Carbon finance has put forward specific requirements for the financial sector itself, that is, the financial sector should also pursue green revenue and reduce heavy asset investment. At the same time, financial institutions should take the lead to lead a low-carbon economy and contribute to the construction of a conservation-oriented society.

For the construction of high-quality development evaluation index system, Yin Xingmin (2018)<sup>[4]</sup> pointed out that high-quality development index system can be

constructed from five dimensions: total factor productivity, financial system efficiency, human resource quality, scientific and technological innovation ability and market resource allocation mechanism. Ma Ru et al. (2019)<sup>[5]</sup> demonstrated the construction of an evaluation index system for the high-quality development of the regional economy in China from five dimensions: high-quality supply, high-quality demand, economic operation, development efficiency and opening to the outside world, and calculated it using the equal weight allocation method. On the choice of instruments to measure the high-quality development of carbon finance, Fan Dan et al. (2017)<sup>[6]</sup> tested the effect of China's carbon trading rights policy by using double difference method. The study found that the emission reduction effect of different pilot provinces was significantly different, and there was still room for improvement in emission reduction flexibility and economic dividend of non-pilot provinces. Chen Zhiying and others (2020)<sup>[7]</sup> found that the development level of carbon finance in China has generally increased year by year, but the dynamic evolution is not stable enough, and the development level of carbon finance in various regions is unbalanced. According to the research of Zheng Qunzhe (2022)<sup>[8]</sup>, he used the time series multi-index model to measure the development level of carbon finance in China, and established a panel data model to analyze the impact of different factors on the development level of carbon finance in China. The research results show that the overall development of carbon finance in China presents a positive upward trend.

Foreign countries also have some research on the high-quality development of carbon finance under the new concept. Different manifestations of high-quality development and different emphases of the index system. For example, the sustainability index compiled by Eurostat Bolcárová & Kolota (2015)<sup>[9]</sup> reviews the sustainability of economic development mainly in terms of happiness, gender equality, economic growth, reducing inequality and decent work. Some scholars also use a single indicator to characterize the quality of economic development. Adedokun(2017)<sup>[10]</sup> measures the quality of Africa's economic development in terms of GDP growth rates. The research of Mi and Qu(2020)<sup>[11]</sup> has established an evaluation system, including economic vitality, innovative development, green and low-carbon and shared openness, which is used to measure the quality of economic development of the six central provinces during the period 2014-2018. This research provides valuable suggestions for the central region to establish a modern economic system and realize coordinated and high-quality development. Wang and Lu(2020)<sup>[12]</sup> focused on the economic and social aspects, constructed the logical framework of "1+2+3+4+5+6", and incorporated it into the evaluation index system of economic development quality of sub-provincial cities in China.

Through studying and combing the domestic and foreign literature on high-quality development, it is found that whether the connotation of high-quality development is interpreted or the specific measurement of high-quality development in a certain field, the shadow of the new development concept will appear directly or indirectly. It can be seen that most scholars accept the new concept of development and its extension as the guiding ideology of high-quality development and the criteria for judging whether or not to achieve it. Based on the previous research results, this study constructs a new index system to measure the high-quality development level of carbon finance under the new development concept. The research uses entropy method to

determine the weight of each index, and calculates the carbon finance development index of four provinces in the southwest region. Finally, the research analyzes the factors that affect the high-quality development level of carbon finance.

## 2. Current Situation and Problems of Carbon Finance

### 2.1. Development Status of Carbon Finance

Carbon finance refers to financing and investment activities for carbon emission reduction and low-carbon technologies through mechanisms such as carbon pricing and carbon trading. In the past few decades, the carbon finance field has made remarkable development and gradually became a hot area in the global financial market.

The global carbon market is gradually maturing. Some countries and regions have established carbon markets or carbon pricing mechanisms, such as the European Union Emission Trading System (EU ETS), the regional carbon market in the United States and the carbon market pilot project in China. These carbon markets provide the basis for carbon finance and promote carbon emission reduction and low-carbon investment. More and more investors and financial institutions began to pay attention to carbon finance and participate in it. Some mainstream financial institutions have incorporated carbon risk assessment and carbon asset management into their investment decisions. In addition, some special carbon asset funds and carbon financial institutions have also emerged, providing more funds and expertise for the development of the carbon market. There are also many innovative products and tools in the carbon finance field. For example, carbon emissions trading, carbon derivatives, carbon asset investment funds, etc. These products and tools provide more choices and flexibility to meet the different needs of investors and enterprises. Corporate and social attention to carbon emission reduction and sustainable development is also increasing. Enterprises are increasingly aware of the importance of carbon risks and opportunities, and actively promote carbon emission reduction and investment in low-carbon technologies. This increase in social and corporate responsibility supports the high-quality development of carbon finance.

### 2.2. The Development of Carbon Finance

Despite the rapid development of carbon finance, there are still many problems. The main manifestations are:

(1) The price in the carbon market fluctuates greatly with high uncertainty. This may affect investors' assessment and decision-making on carbon assets. Market fluctuations may be caused by various factors, such as policy adjustments, changes in energy prices, economic fluctuations, etc. The lack of a stable carbon market environment may hinder the high-quality development of carbon finance.

(2) The carbon pricing mechanism is imperfect and the information is asymmetric. The carbon pricing standards and methods adopted by different countries and regions are different, and there is no globally unified carbon pricing mechanism. This results in the limited connectivity and liquidity of the carbon market, limiting the high-quality development of carbon finance. Investors and financial institutions often have difficulty in obtaining reliable and accurate carbon data and information, which affects their assessment and decision-making of carbon assets. The lack of uniform information disclosure standards and reliable data

sources makes it difficult for market participants to accurately understand the true value and risks of carbon assets.

(3) Carbon finance requires long-term investment and support, and there are financial risks and carbon risks. Some investors and financial institutions may focus more on short-term profits and lack long-term support for carbon reduction and low-carbon technologies. This may limit the high-quality development of carbon finance. Financial risk includes market risk, credit risk and operational risk, which may affect the participation of investors and financial institutions and investment decisions. At the same time, carbon risk involves fluctuations in the value of carbon assets and the risk of achieving carbon emission reduction targets, which may affect the stability and sustainable development of the carbon financial market.

In order to solve these problems, a series of measures should be taken. These include improving the carbon pricing mechanism and improving the stability of the market; Promoting information disclosure and transparency and providing reliable carbon data; Strengthen long-term investment and support, and promote the sustainable development of carbon finance, etc. Therefore, this study constructs a high-quality development index system of carbon finance, measures and analyzes the influencing factors of high-quality development of carbon finance, and looks for excellent indicators and inferior indicators of high-quality development of carbon finance. These efforts will help promote the development direction of carbon finance towards higher quality.

### **3. Construction of High-quality Development Index System for Carbon Finance**

#### **3.1. Principles for Constructing High-quality Development Indicators of Carbon Finance**

(1) the principle of accuracy. The construction of measurement index system must ensure the accuracy of data, clarify the relevant concepts and connotation of high-quality development of carbon finance, accurately grasp the real basis for the development of carbon finance, objectively, scientifically and accurately measure the high-quality development level of carbon finance, and accurately analyze the influencing factors in the development.

(2) the principle of integrity. The measurement indicators of high-quality development level of carbon finance cover a wide range of areas. Therefore, the construction of high-quality development indicators of carbon finance must take into account its integrity, ensure that the indicators are representative on the basis of ensuring the availability of data, and construct indicators of relevant measures from different perspectives.

#### **3.2. Construction of High-quality Development Index System for Carbon Finance**

In order to comprehensively analyze the influencing factors and measurement results of high-quality development of carbon finance, on the basis of ensuring the authenticity,

accuracy and availability of research data, relevant evaluation indicators are screened, supplemented and adjusted according to the relevant research of existing scholars and with reference to their research results. Finally, under the background of new development concept, a high-quality development index system of carbon finance is constructed, which includes five first-level indicators, namely, innovative development, coordinated development, green development, open development and shared development.

In the innovative development of the first-level indicators, it is divided into four secondary indicators, namely, the proportion of scientific research funds, the growth rate of patent licenses, the proportion of education expenditures in fiscal expenditures, and the growth rate of technology market turnover. In the coordinated development of the first-level indicators, it is divided into four secondary indicators, namely, per capita GDP growth rate, government support, the proportion of tertiary industry added value in GDP, and GDP growth rate. In the green development of the first-level indicators, It is divided into four secondary indicators, namely, waste particulate matter emission, PM2.5 concentration, green coverage rate of built-up areas and comprehensive utilization rate of general industrial solid waste. In the open development of primary indicators, it is divided into four secondary indicators, namely, the ratio of added value of financial industry, the growth rate of financial institutions, the growth rate of foreign-invested industrial enterprises and the ratio of total import and export to GDP. In the shared development of primary indicators, it is divided into four secondary indicators, namely, the per capita public library collection, the growth rate of public motor vehicle operation, the growth rate of Internet broadband access users and the growth rate of mobile phone penetration rate. The above secondary indicators are all positive indicators except for the primary indicator, i.e. the emission of waste particulate matter in green development and the concentration of PM2.5, which are negative indicators.

#### **3.3. Table 1 High-quality Development Indicator System of Carbon Finance**

The research data in this paper are mainly derived from China Statistical Yearbook, Yunnan Statistical Yearbook, Guizhou Statistical Yearbook, Sichuan Statistical Yearbook, Chongqing Statistical Yearbook, Yunnan, Guizhou, Sichuan and Chongqing Ecological Environment Statistical Bulletin for each year from 2016 to 2021.

In this study, the high-quality development index system of carbon finance is constructed, the weight is determined by entropy method, and the comprehensive score of high-quality development of carbon finance in Yunnan, Guizhou, Sichuan and Chongqing from 2016 to 2021 is calculated.

First of all, the specific indicators in the high-quality development index system of carbon finance represent different meanings and have dimensional differences. Therefore, in measuring the high-quality development index of carbon finance, the value of the indicators needs to be dimensionless. In this study, the range standardization method is adopted, and the processing formula is:

**Table 1.** High-quality Development Indicator System of Carbon Finance

system	Level 1 indicators	Secondary indicators	Indicator attribute
High-quality development index system of carbon finance	Innovative development	Proportion of research funding	straight
		Patent licensing growth	straight
		Proportion of Education Expenditure to Fiscal Expenditure	straight
		Technology Market Turnover Growth	straight
	coordinated development	Growth rate of GDP per capita	straight
		Government support	straight
		Tertiary industry added value as a proportion of GDP	straight
		GDP growth rate	straight
	Green development	Waste particulate matter emissions	minus
		PM2.5 concentration	minus
		Green coverage rate of built-up areas	straight
		Comprehensive utilization rate of general industrial solid waste	straight
	open development	Financial industry value added ratio	straight
		Growth rate of financial institutions	straight
		Growth rate of foreign-invested industrial enterprises	straight
		Total imports and exports as a proportion of GDP	straight
	shared development	Per capita public library collections	straight
		Growth in operation of public buses and trams	straight
Growth rate of internet broadband access users		straight	
Mobile phone penetration rate increases		straight	

Step 1, constructing an original matrix  $X=(x_{ij})_{m \times n}$ :

$$\dots\dots\dots X = \begin{pmatrix} x_{11} & \dots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \dots & x_{mn} \end{pmatrix} \dots\dots\dots(1)$$

The second step is to dimensionless the positive and negative indicators respectively;

$$\dots\dots U_{ij} = \frac{x_{ij} - x_{min}}{x_{max} - x_{min}} \dots\dots(2)$$

$$\dots\dots\dots U_{ij} = \frac{x_{max} - x_{ij}}{x_{max} - x_{min}} \dots\dots\dots(3)$$

Thirdly, calculating the proportion of the I-th sample value under the j-th index to the index;

$$\dots\dots\dots S_{ij} = \frac{U_{ij}}{\sum_{i=1}^n U_{ij}} \dots\dots\dots(4)$$

In the fourth step, calculate the entropy value  $H_j$  of the j-th indicator;

$$\dots\dots\dots H_j = - \frac{1}{\ln n \sum_{i=1}^n S_{ij} \ln S_{ij}} \dots\dots\dots(5)$$

Fifthly, calculating the information utility value  $A_j$  of the index j;

$$\dots\dots\dots A_j = 1 - H_j \dots\dots\dots(6)$$

Step 6, calculating the weight  $W_j$  of the high-quality development index of carbon finance;

$$\dots\dots\dots W_j = \frac{A_j}{\sum_{j=1}^n A_j} \dots\dots\dots(7)$$

Step 7, according to the index weight, calculating the comprehensive score of the high-quality development index system of carbon finance by the weighted sum of the comprehensive index method;

$$\dots\dots\dots Y = \sum_{j=1}^n W_j U_{ij} \dots\dots\dots(8)$$

The high-quality development index Y of carbon finance derived from formula (8) is between 0 and 1. The higher the value of Y is, the higher the high-quality development level of carbon finance is, and the lower it is otherwise.

## 4. Analysis on the Application of High-quality Development Model of Carbon Finance

### 4.1. Determining Indicator Weight

As shown in Table 2, the first-level indicators have the highest weight of shared development indicators, followed by open development, innovative development and green development, and coordinated development has the lowest weight. On the whole, shared development and open development are most important to the high-quality development of carbon finance, and innovative development has also played a certain role. In the secondary indicators, the proportion of research funding exceeds 10%, the per capita public library collection is also close to 10%, and the weight of the growth rate of public bus and tram operation ranks third, indicating that these indicators have a great impact on the high-quality development of carbon finance. The growth rate of foreign-invested industrial enterprises, the growth rate of technology market turnover and the proportion of tertiary industry added value in GDP ranked the last three, indicating that these three indicators have little impact on the high-quality development of carbon finance.

**Table 2. Weight Table of High Quality Development Indicators of Carbon Finance**

system	Level 1 indicators	weight	Secondary indicators	weight
High-quality development index system of carbon finance	Innovative development	0.2062	Proportion of research funding	0.1026
			Patent licensing growth	0.0288
			Proportion of Education Expenditure to Fiscal Expenditure	0.0542
			Technology Market Turnover Growth	0.0205
	coordinated development	0.1386	Growth rate of GDP per capita	0.0434
			Government support	0.0423
			Tertiary industry added value as a proportion of GDP	0.0197
			GDP growth rate	0.0332
	Green development	0.1656	Waste particulate matter emissions	0.0408
			PM2.5 concentration	0.0271
			Green coverage rate of built-up areas	0.0325
			Comprehensive utilization rate of general industrial solid waste	0.0653
	open development	0.2315	Financial industry value added ratio	0.0609
			Growth rate of financial institutions	0.0710
			Growth rate of foreign-invested industrial enterprises	0.0255
			Total imports and exports as a proportion of GDP	0.0742
	shared development	0.2581	Per capita public library collections	0.0949
			Growth in operation of public buses and trams	0.0747
			Growth rate of internet broadband access users	0.0533
			Mobile phone penetration rate increases	0.0352

## 4.2. Carbon Finance High Quality Development Index

According to the formula (8), the evaluation parameter values and comprehensive measurement scores of high-quality development of carbon finance in Yunnan, Guizhou, Sichuan and Chongqing from 2016 to 2021 are calculated as shown in the table, with Chongqing (0.5290) having the highest comprehensive score in 2021, Yunnan (0.5259) in

2021, and Sichuan (0.5171) in 2021. The last three places are Yunnan (0.4151) in 2019, Guizhou (0.3984) in 2020 and Guizhou (0.3850) in 2019. Chongqing's high-quality development of carbon finance in 2016-2021 ranked in the top ten, and Guizhou's high-quality development of carbon finance in 2016-2021 ranked in the bottom ten. The above data show that in six years, the overall development level of carbon finance in 2021 was higher, Chongqing's development level was the highest, and Guizhou's was the lowest.

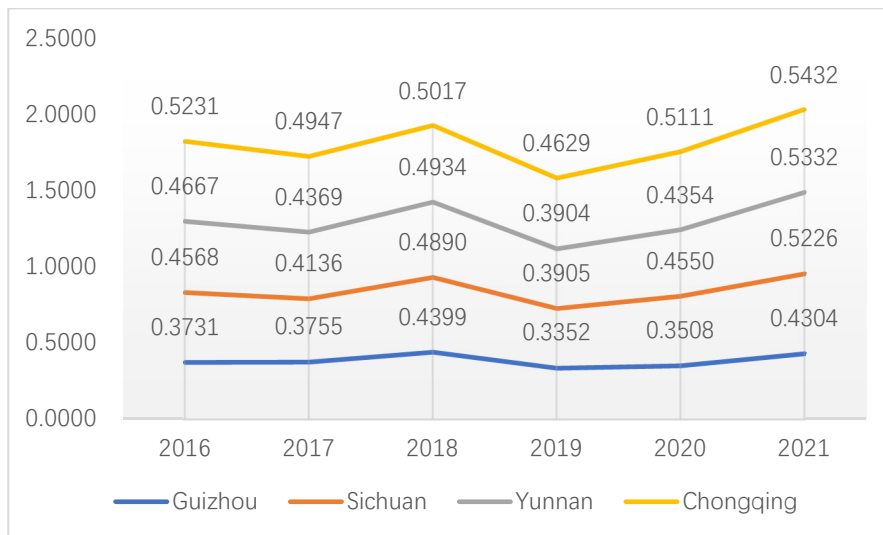
**Table 3. Evaluation Parameters and Comprehensive Measures for High-quality Development of Carbon Finance in Four Provinces**

	D+	D-	Comprehensive score	sort
Yunnan (2016)	0.6059	0.5481	0.4750	10
Guizhou (2016)	0.7217	0.5167	0.4172	20
Sichuan (2016)	0.6165	0.5418	0.4677	13
Chongqing (2016)	0.5671	0.6062	0.5167	four
Yunnan (2017)	0.6415	0.5340	0.4543	15
Guizhou (2017)	0.7182	0.5165	0.4183	19
Sichuan (2017)	0.6345	0.4793	0.4303	18
Chongqing (2017)	0.5869	0.5777	0.4960	seven
Yunnan (2018)	0.5887	0.5772	0.4951	eight
Guizhou (2018)	0.6640	0.5662	0.4602	14
Sichuan (2018)	0.5669	0.5470	0.4910	nine
Chongqing (2018)	0.5851	0.5878	0.5011	six
Yunnan (2019)	0.6645	0.4715	0.4151	22
Guizhou (2019)	0.7362	0.4608	0.3850	24
Sichuan (2019)	0.6656	0.4733	0.4156	21
Chongqing (2019)	0.6251	0.5624	0.4736	11
Yunnan (2020)	0.6341	0.5221	0.4516	17
Guizhou (2020)	0.7292	0.4830	0.3984	23
Sichuan (2020)	0.6343	0.5588	0.4684	12
Chongqing (2020)	0.6238	0.6412	0.5069	five
Yunnan (2021)	0.5362	0.5947	0.5259	2
Guizhou (2021)	0.6616	0.5462	0.4522	16
Sichuan (2021)	0.5528	0.5921	0.5171	three
Chongqing (2021)	0.5745	0.6452	0.5290	one

## 4.3. Measurement and analysis of high-quality development of carbon finance

In order to deeply analyze the development trend of high-quality

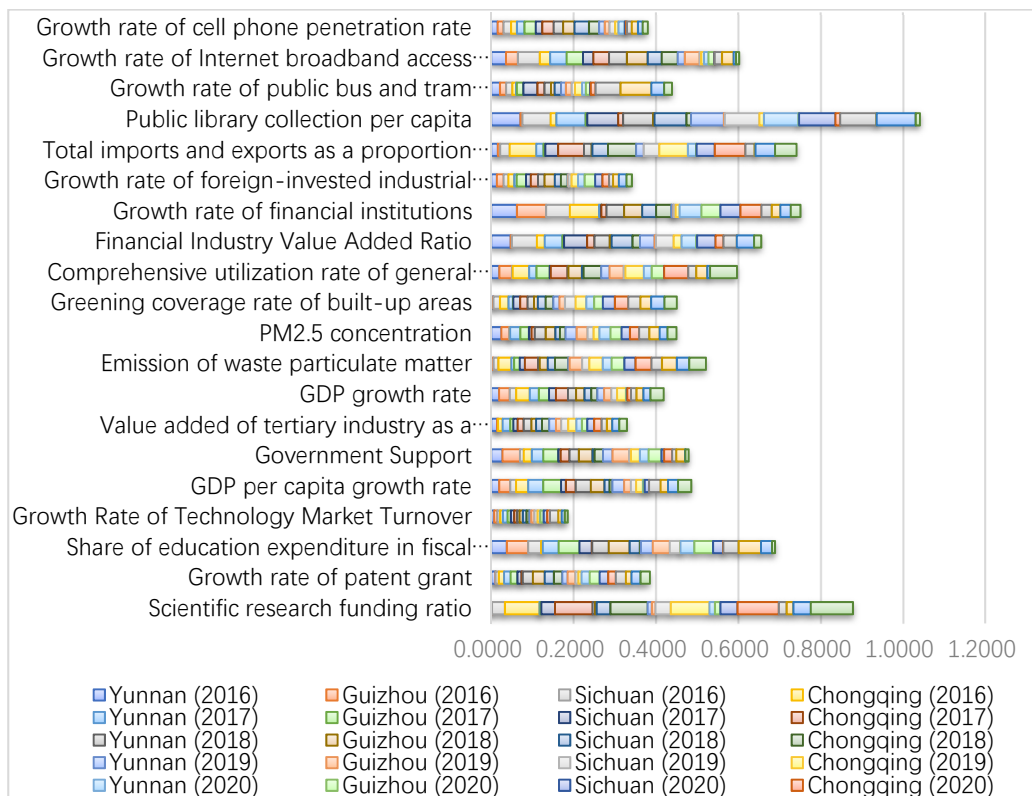
carbon finance in the four provinces, a comprehensive measurement trend chart is drawn.



**Figure 1.** Trend Chart of Comprehensive Measurement of High-quality Development of Carbon Finance in Four Provinces from 2016 to 2021

From the trend chart of comprehensive measurement of high-quality development of carbon finance in the four provinces from 2016 to 2021, it can be seen that there was a fluctuating upward trend in the four provinces from 2016 to 2018, but in 2019, under the impact of the epidemic, the overall development level of carbon finance showed a decline, and then the overall increase. Among them, Chongqing is the city with the highest level of high-quality development of carbon finance in the four provinces, followed by Yunnan, Sichuan and Guizhou. However, the fluctuation of high-quality development level of carbon finance in Yunnan is the largest, and the fluctuation range of high-quality development level of carbon finance in Guizhou is the smallest, indicating that the high-quality development level of carbon finance in Yunnan is developing rapidly.

As can be seen from the data accumulation charts of different indicators of the four provinces from 2016 to 2021, the per capita public library collection index has the greatest impact on the high-quality development level of carbon finance, followed by the proportion of scientific research funds, and the third is the growth rate of financial institutions. The higher the score, the provinces pay more attention to this development and will do it better. The high-quality development and adjustment of carbon finance in each province can draw lessons from the radar chart, clearly analyze the advantages and disadvantages of carbon finance development from its own perspective and make improvements to improve the high-quality development level of carbon finance and achieve the goal of sustainable development.



**Figure 2.** Data Stacking Diagram of Different Indicators in Four Provinces from 2016 to 2021

In order to deeply analyze the main change indicators that lead to the high-quality development of carbon finance in each province, this study has deeply studied the development changes of the first-

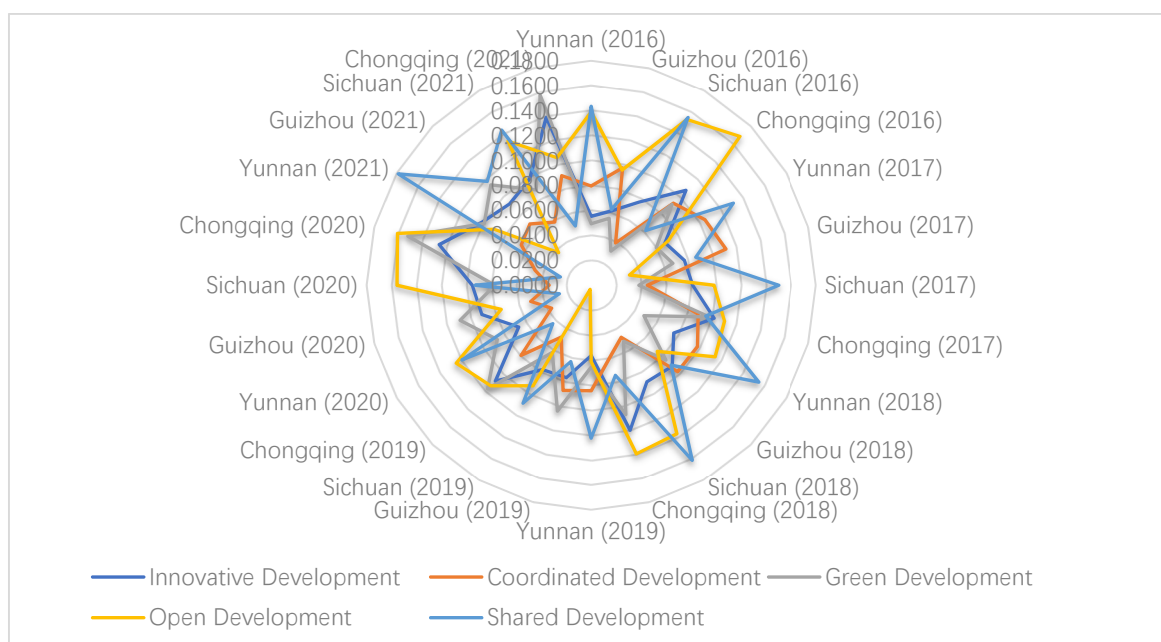
level indicators of high-quality development of carbon finance, as shown in the table.

**Table 4.** Comprehensive Measurement of High-quality Development Level 1 Indicators of Carbon Finance in Four Provinces from 2016 to 2021

	Innovative development	coordinated development	Green development	open development	shared development
Yunnan (2016)	0.0553	0.0796	0.0493	0.1390	0.1435
Guizhou (2016)	0.0617	0.0974	0.0555	0.0956	0.0629
Sichuan (2016)	0.0771	0.0392	0.0317	0.1536	0.1553
Chongqing (2016)	0.1075	0.0932	0.0917	0.1687	0.0620
Yunnan (2017)	0.0683	0.1052	0.0603	0.0715	0.1316
Guizhou (2017)	0.0773	0.1118	0.0678	0.0317	0.0868
Sichuan (2017)	0.0814	0.0450	0.0382	0.0986	0.1504
Chongqing (2017)	0.1020	0.0888	0.0981	0.1107	0.0951
Yunnan (2018)	0.0765	0.0984	0.0488	0.1147	0.1551
Guizhou (2018)	0.0918	0.0980	0.0847	0.0749	0.0905
Sichuan (2018)	0.0894	0.0482	0.0519	0.1374	0.1621
Chongqing (2018)	0.1203	0.0593	0.1074	0.1399	0.0748
Yunnan (2019)	0.0563	0.0846	0.0656	0.0613	0.1226
Guizhou (2019)	0.0767	0.0873	0.1044	0.0035	0.0634
Sichuan (2019)	0.0781	0.0480	0.0622	0.0931	0.1092
Chongqing (2019)	0.1087	0.0795	0.1174	0.1139	0.0435
Yunnan (2020)	0.0671	0.0366	0.0870	0.1249	0.1198
Guizhou (2020)	0.0907	0.0502	0.1088	0.0746	0.0264
Sichuan (2020)	0.0953	0.0337	0.0772	0.1556	0.0932
Chongqing (2020)	0.1261	0.0466	0.1522	0.1607	0.0256
Yunnan (2021)	0.1011	0.0647	0.0990	0.0898	0.1786
Guizhou (2021)	0.0923	0.0694	0.1137	0.0370	0.1178
Sichuan (2021)	0.0986	0.0586	0.0884	0.1335	0.1435
Chongqing (2021)	0.1393	0.0910	0.1579	0.1058	0.0492

In order to clearly analyze the comprehensive measures of innovation development, coordinated development, green development, open development and shared development of the four

provinces, this study shows the specific situation of the four provinces in the form of radar chart, as shown in the figure.



**Figure 3.** Radar chart of comprehensive measurement of level 1 indicators from 2016 to 2021

As can be seen from the figure, the ranking of the comprehensive measurement level of the first-level indicators is shared development > open development > innovative development > green development > coordinated development. The peak value of shared development is the highest, indicating that the comprehensive measurement level is the highest, followed by open development. The peak value is the coordinated development, indicating that the measurement level is the lowest, and also indicating that the impact on the high-quality development of carbon finance in the four provinces is the smallest. On the whole, the development among the first-level indicators is not balanced. Therefore, the research deeply analyzes the high-quality development of carbon finance in the four provinces. Aiming at the real situation that affects the high-quality development of carbon finance in the four provinces, the research can put forward targeted suggestions to truly promote the high-quality development of carbon finance.

## 5. Carbon Finance High-quality Development Path

### 5.1. Promote innovation of carbon financial products and support low-carbon transformation of enterprises

With the "double carbon" strategy and the promotion of new development concepts, the carbon financial market has great potential. The high-quality development of carbon finance needs to construct a transparent and efficient carbon finance market from all aspects of the market, so as to realize the optimal allocation of resources. By improving the financial market service system, promoting green innovation of enterprises, guiding financial institutions to participate in green investment and financing and building reasonable green financial products, we can promote high-quality development of carbon finance and achieve the goal of sustainable development. In the future, green financial products will achieve leapfrog growth, and the four provinces in the southwest will become the most competitive green financial development heights.

### 5.2. Give Full Play to Synergy and Promote Coordinated Financial Development

In order to promote the improvement and leap of high-quality development level of carbon finance, efforts should be made to promote the functional integration and construction of financial infrastructure, formulate economic and financial policies in line with local conditions to guide the investment of financial resources, so that they can better serve the areas with scarce resources. It can also focus on improving the top-level design, building a carbon finance development policy system, strengthening connectivity, strengthening scientific and technological support, strengthening carbon finance innovation, unifying carbon finance standards as soon as possible, increasing the diversity of carbon finance instruments, promoting the mainstreaming of ESG information disclosure, establishing and improving a regional coordination mechanism for carbon finance development as soon as possible, clarifying the regional positioning of the four provinces in the southwest, giving full play to synergies, fully grasping opportunities and advantages, and actively strengthening policy supervision cooperation with other regions.

### 5.3. Give full play to the advantages of financial institutions and increase government support

Financial institutions are the core subjects in developing carbon finance. However, the current development of carbon finance business of financial institutions is not balanced. In order to motivate financial institutions to actively participate in the innovation of carbon financial products, green information disclosure of

enterprises and the establishment of a perfect and unified rating system are crucial supporting factors. Local governments are guiding financial resources to tilt towards green development. In order to encourage financial institutions to participate in the innovation of carbon financial products, local governments can introduce management incentives and tax incentives from three aspects: introducing incentive policies, strengthening supervision and establishing a unified rating system. At the same time, financial institutions with underdeveloped carbon finance can be assessed and evaluated accordingly, and the enthusiasm of financial institutions can be further stimulated through corresponding rewards and punishment measures.

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