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Research on Green Ecological Innovation Index of Chinese Commercial Banks

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Abstract: The development of green finance by commercial banks is a key way to achieve the goal of "carbon peak and carbon neutrality" in China. This paper uses entropy method to collect data from the social responsibility report and annual report of commercial banks, establishes the green ecological innovation index of commercial banks, and evaluates the development of green finance of commercial banks in recent years, and finds that the development of green finance of Chinese commercial banks is on the rise; In terms of organizational innovation, the management policies and full-time institutions of commercial banks have been continuously improved, but many banks still need to pay attention to the construction of management systems related to green finance. In terms of product innovation, the score of ecological innovation of commercial banks' products continues to rise significantly, and the green financial products of commercial banks continue to be abundant, but the products in the field of carbon finance are relatively simple. In terms of cultural innovation, banks still need to strengthen special training on green finance and deepen the concept of green development.

Keywords: green finance, commercial banks, entropy method

1. Introduction

In recent years, the warming of the global climate system has accelerated, and the earth is facing extreme climate threats. In 2016, "green finance" was included in the agenda of the G20 Summit for the first time and received wide support and response. The 2020 Central Economic Work Conference proposed the goal of "reaching the peak of carbon and carbon neutrality". The Fifth Plenary Session of the 19th Central Committee proposed to promote supply-side structural reform and high-quality economic development, take green as the guidance, vigorously develop green finance, support financial institutions to set up green financial departments or green branches, and guide the real economy to establish green new development concepts. The 20th report emphasized green development and incorporated the "dual carbon" goal into the 14th Five-Year Plan, highlighting China's determination to improve the environment and address climate change.

As an important part of China's financial system, commercial banks have been actively responding to the call of the state to implement green financial development policies. The green finance business of commercial banks is developing rapidly. By the end of 2022, the balance of green credit in China was 22.03 trillion yuan, an increase of 38.5% year-on-year, 5.5 percentage points higher than that at

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the end of the previous year, with a rapid growth rate; The stock of green bonds reached 3 trillion yuan, and the scale of issuance continued to expand.

With the rise of green finance, there are more and more related researches, but most of them are in the stage of qualitative analysis. This paper will build the green finance development index system of commercial banks, and conduct quantitative analysis on the development of green finance through specific indicators to make up for the current situation of insufficient quantitative analysis and research. On the one hand, the application of indicators to evaluate, understand its development characteristics, better for commercial banks to develop development strategies and innovative business. On the other hand, it provides reference for relevant departments to formulate green financial policies scientifically and improve green financial system.

2. Literature Review

Green finance originated from "environmental finance", which was proposed by White [1]. Cowan believes that green finance is an interdisciplinary subject involving green economy and finance, and the study of green finance plays an important role in promoting the development of green economy [2]. Labatt believes that green finance is a kind of financial product that can improve the environment created by banks to avoid risks caused by environmental problems [3]. Xueping Xiong believes that green finance means that financial institutions should consider environmental risks and other important factors in their daily operations, which is the future trend of the financial industry [4]. Yongda Yu and Peiyuan Guo believe that the connotation of green finance not only refers to the investment of funds into green industries, but also the potential environmental impact should be taken into account when making investment, and the sustainable development strategy should be reflected through the operation of financial business [5]. The G20 Green Finance Study Group proposed the concept of green finance: a financial ecosystem that generates positive environmental benefits to support sustainable development and channels social capital into green development.

As for the economic effects of green finance, foreign scholar Graedel believes that finance plays an important role in environmental protection [6]. Ambec and Lanoie believe that engaging in green finance is conducive to reducing long-term costs, enhancing corporate social responsibility, making it easier for enterprises to be recognized by consumers in the financial market, and thus improving economic benefits [7]. Jiankui He et al. expounded the necessity of implementing green finance in China from three aspects: natural ecology, economic development and financial institutions themselves [8]. China's ecological environment is facing serious threats, and economic development should not only pay attention to GDP but also to people's quality of life, while the development of financial institutions also depends on sustainable economic development. The Green Finance Research Group of Industrial and Commercial Bank of China believes that the development of green finance by commercial banks is the general trend of The Times, and it is urgent for China to achieve economic transformation and upgrading and green development [9]. According to the above findings, domestic and foreign scholars believe that the development of green finance will bring benefits to the economy and environment.

On the study of green finance system, Thompson et al. pointed out that the establishment of diversified environmental assessment strategies and impact assessment systems can promote the development of green finance [10]. The Green Finance Research Group of Industrial and Commercial Bank of China believes that building a green financial system is a necessary condition to support the green economy, and China has initially established a green financial supervision system [9]. Xin Hong analyzed the coupling coordination relationship between carbon trading and green finance in each pilot by constructing a comprehensive evaluation index system of carbon trading and green finance and using the coupling coordination degree model [11]. Most of the green finance systems

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are only qualitative analysis from the theory, this paper will build a green finance index system, the development of green finance for quantitative analysis.

3. Construction of Green Ecological Innovation Index

3.1. Ecological Innovation Index

In the process of solving the ecological and environmental problems widely concerned by the world, the theory of ecological innovation provides a new perspective and method for the research in the economic field, mainly embodied in corporate social responsibility. Schumpeter put forward the theory of innovation, believing that innovation is an economic concept and the internal force of economic development [12]. Only when new technological inventions are applied to economic activities can they be called "innovation". Claude Fussler and Peter James put forward the concept of ecological innovation, arguing that ecological innovation is a new product or process that is conducive to reducing environmental problems and bringing commercial value to enterprises and consumers [13].

3.2. Index Selection and Quantification

This paper constructs the green ecological innovation index from the aspects of organization, product and culture to evaluate the green finance business of commercial banks. The first level evaluation index was named green ecological innovation Index. The secondary evaluation index is divided into organizational ecological innovation index, product ecological innovation index and cultural ecological innovation index. Based on the available and quantifiable information in the annual reports and social responsibility reports published on the official websites of 14 commercial banks from 2015 to 2020, empirical analysis was carried out. The 14 banks selected are Industrial and Commercial Bank of China, China Construction Bank, Bank of Communications of China, Agricultural Bank of China, Bank of China, China Merchants Bank, Pudong Development Bank, Minsheng Bank, Ping An Bank, CITIC Bank, Industrial Bank, Bank of Ningbo, Hua Xia Bank and Postal Savings Bank.

3.2.1. Organizational Ecological Innovation

Organizational innovation refers to an innovation that allocates resources to human, financial, material and other factors to improve the efficiency of factors, including the innovation of property rights system, the innovation of employment system, and the innovation of management mechanism. This paper selects two three-level indicators, management policy and green sector, to measure.

Management policy reflect whether commercial banks respond to the call of the state and tilt funds in the green direction, including the one-vote veto system, green channel, and green credit classification system.

The green sector reflects the strength of its element resources allocation in the field of green finance, including green business department/committee, green branch/sub-branch, green franchise.

3.2.2. Product Ecological Innovation

Product ecological innovation refers to the innovation of resource-saving and environment-friendly new products in the process of enterprise development. This paper selects three three-level indicators: the proportion of green credit, the proportion of green bonds and the number of other green financial instruments for evaluation.

The proportion of green credit and the proportion of green bonds are measured by the ratio of green credit balance to total loans and advanced capital and the ratio of green bond issuance scale to total debt, respectively.

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Other green financial instruments reflect the product innovation of commercial banks, including green stock/bond index, green lease, green fund, green trust, and carbon financial products.

3.2.3. Cultural Ecological Innovation

Cultural ecological innovation refers to the innovation of enterprise business philosophy and corporate culture. An enterprise is a personified enterprise whose business is completed by people, and everyone has his own values, which will be reflected in the daily production and operation of an enterprise. A good corporate culture also plays an extremely important role in the efficient development of an enterprise. This paper measures whether the corporate culture of commercial banks takes ecological protection and green development as their business concept through two three-level indicators: whether to conduct special training on green finance for employees and business philosophy.

Special training on green finance Statistics The bank has conducted relevant training for its employees and assigned a value of 1, otherwise 0.

The business philosophy includes nine elements: sustainable development, green operation, green innovation, green economy, green service, green transportation, green industry, resource conservation and environmental friendliness.

Table 1: Construction of Green Ecological Innovation Index.

Primary index	Secondary index	Three-level index	Content	Direction
Green Ecological Innovation Index	Organizational Ecological innovation Index	Management policy	One-vote veto system, Green channel, Green credit classification system	forward
		Green sector	Green business department/committee, Green Branch/Sub-branch, Green franchise	forward
	Product Ecological Innovation Index	Proportion of green credit	Green credit balance/total loans and capital advances	forward
		Proportion of green bonds	Green bond issuance size/total liabilities	forward
		Other green financial instruments	Green stock/bong index, green trust, green lease, carbon financial products, green fund	forward
	Cultural Ecological Innovation Index	Whether green finance training	Yes/No	forward
		Business Philosophy	Sustainable Development, Green Operation, Green Innovation, Green Economy, Green Service, Green Transportation, Green Industry, Resource Saving, Environmentally Friendly	forward

Data source: Data collected from annual reports and social responsibility reports of banks.

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3.3. Determination of Indicator Weights

The methods of comprehensive evaluation to determine the weight of indicators can be divided into subjective and objective categories. Subjective weight determination method is mainly carried out by experts, and objective evaluation method is adopted in this paper. The objective evaluation methods include stepwise equal weight method, factor analysis method, entropy method and so on. The stepwise equal weight method assigns equal weight to the indicators of the same level. Factor analysis will lose some indicators, and the indicators contained in the common factors of different data are uncertain, which may lead to a lack of logic. The entropy method assigns weights to indicators according to the variation degree of data. The greater the dispersion degree of indicators, the greater the weight given, and the index information will not be lost at the same time. This method is applied in this paper to avoid the influence caused by subjective factors, and gives less weight to indicators with similar data of most commercial banks and more weight to indicators with large data dispersion, so as to facilitate the comparison between banks. Specific operational steps:

1. Standardization of indicators. As the indicators in this paper are all positive indicators, the positive indicator processing formula is applied. In order to make the data of different years comparable, 2015 was used as the base period for calculation.

Standardized formula for positive indicators:

$$X_{ij} = \frac{x_{ij} - x_{i0}^{min}}{x_{i0}^{max} - x_{i0}^{min}} \tag{1}$$

where.x_{ij} denotes the raw data of the i indicator for the j bank in a given year, andx_{i0}^{min} denotes the minimum value of the raw data of the i indicator in 2015, and x_{i0}^{max} denotes the maximum value of the raw data of the i indicator in 2015.

2. Apply the entropy value method to assign weights and calculate the weights of the three-level indicators. The entropy value of the tertiary indicator is calculated first:

$$e_i = -\frac{1}{\ln m}\sum_{j=1}^{m} P_{ij} \ln P_{ij} \tag{2}$$

$$P_{ij} = \frac{x_{ij}}{\sum_{j=1}^{m} x_{ij}} \tag{3}$$

where.e_i is the entropy value of the i indicator in a given year; m is the number of sample banks m=14;P_{ij} is the weight of the i indicator of the j bank in a given year to the sum of the i indicators of the 14 banks in the current year.

Coefficient of variation of the i indicator for the current year:

$$d_i = 1 - e_i \tag{4}$$

Weight of indicator i for the current year.

$$w_i = \frac{d_i}{\sum_{i=1}^{n} d_i} \tag{5}$$

where n is the number of indicators.

3. Calculate the score. Use the average weight of the corresponding indicator$\overline{w_i}$ and the normalized dataX_{ij} product for each indicator score, the formula for calculating the score of the ith indicator for the jth bank in a given year:

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$$y_{ij} = \overline{w_i} \cdot X_{ij} \quad (6)$$

Composite score of the j bank:

$$Y_j = \sum_{i=1}^{n} y_{ij} \quad (7)$$

The results after empowerment through the above steps are as follows:

Table 2: Assignment of Weights.

Primary index	Secondary index	Three-level index	2015	2016	2017	2018	2019	2020	Average
Green Ecological Innovation Index	Organizational Ecological Innovation Index (0.259)	Management policy	0.200	0.092	0.031	0.023	0.031	0.014	0.062
		Green sector	0.206	0.291	0.293	0.207	0.217	0.149	0.197
	Product Ecological Innovation Index (0.602)	Proportion of green credit	0.043	0.072	0.114	0.117	0.176	0.153	0.094
		Proportion of green bonds	0.175	0.216	0.279	0.358	0.376	0.492	0.263
		Other green financial instruments	0.153	0.145	0.137	0.114	0.105	0.069	0.245
	Cultural Ecological Innovation Index (0.139)	Whether green finance training	0.200	0.155	0.126	0.130	0.070	0.074	0.112
		Business Philosophy	0.022	0.030	0.020	0.050	0.025	0.049	0.027

Data source: Data collected from annual reports and social responsibility reports of banks.

4. Evaluation of Green Ecological Development of Commercial Banks

4.1. Comprehensive Evaluation of Green Ecological Innovation Index

This paper comprehensively calculates the green ecological innovation index score of commercial banks from the three dimensions of organizational ecological innovation, product ecological innovation and cultural ecological innovation in 2015-2020 (Figure 1). From 2015 to 2020, the development of green finance of commercial banks showed an overall upward trend, and the growth rate was fast, especially in 2016, the fastest growth rate was 93%, followed by 2017, the growth rate was 43%. Growth was slowest in 2019, at 13%.

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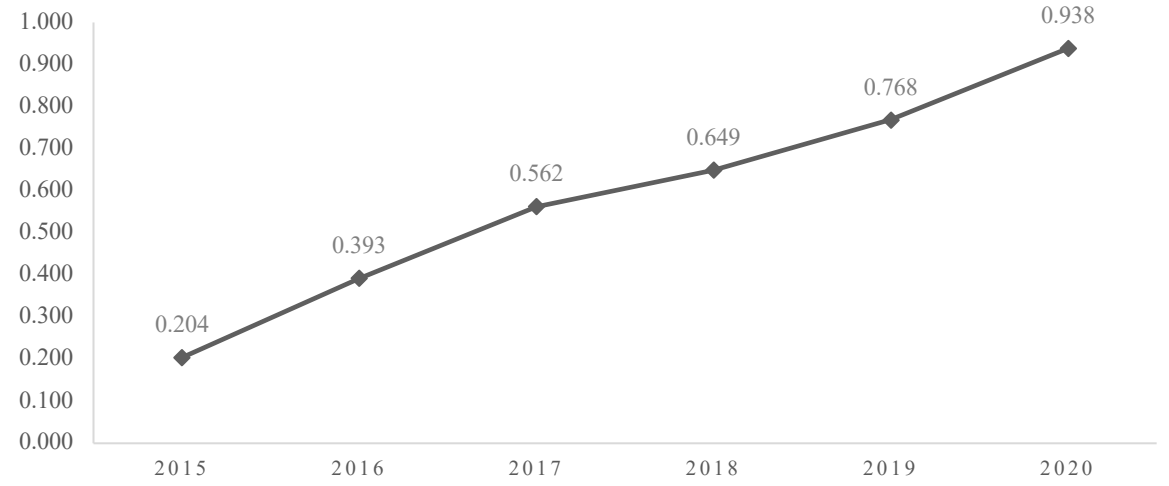

Figure 1: Trend chart of comprehensive score of green ecological innovation.

2016 is the first year of China's green finance, China's green financial products have also appeared many innovations, in early 2016 China opened the green bond market, green credit has developed rapidly, in addition to the launch of green industry funds, green stock index and other financial products. Internationally, "green finance" officially became a topic of the G20 Summit in 2016, prompting the green ecological innovation index of commercial banks to achieve a 93% growth in 2016. In 2017, China officially launched the carbon emission trading system, increased the new growth point of green finance, and further promoted the development of green finance business of commercial banks. In 2017, the green ecological innovation index reached a growth rate of 43%, indicating that the promulgation of national policies has a significant impact on the development of green finance of commercial banks.

The green finance development of the 14 sample banks is unbalanced, and the development level of green finance of most banks is relatively backward. As the first commercial bank in China to join the Equator Principles, Industrial Bank has comprehensive green finance policies, abundant green financial tools and strong innovation. Its comprehensive score from 2015 to 2020 ranked first with an average score of 1.778. Second Hua Xia Bank score of 0.837, and Industrial Bank has a big gap. Among the five major state-owned banks, the Agricultural Bank of China is the most prominent. In 2017, the Agricultural Bank of China formulated a relatively comprehensive green finance policy system, and since then, the Agricultural Bank of China's green ecological innovation score has been among the best.

Table 3: Comprehensive Score of Green Ecological Innovation Index.

Bank	2015	Rank	2016	Rank	2017	Rank	2018	Rank	2019	Rank	2020	Rank	Average	Rank
Industrial Bank	1.406	1	1.695	1	1.805	1	2.061	1	1.889	1	1.810	1	1.778	1
Hua Xia Bank	0.020	13	0.628	3	0.779	3	0.844	4	1.201	2	1.551	2	0.837	2
Agricultural Bank of China	0.039	8	0.395	5	1.022	2	1.097	2	1.098	3	1.188	6	0.806	3
Construction Bank of China	0.188	6	0.193	8	0.676	5	0.933	3	0.943	5	1.272	3	0.701	4

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Table 3: (continued).

Pudong Development Bank	0.294	2	0.836	2	0.707	4	0.767	5	0.790	7	0.756	10	0.692	5
Industrial and Commercial Bank of China	0.214	5	0.302	7	0.547	7	0.549	8	0.806	6	1.244	4	0.610	6
China Post Bank	0.020	12	0.130	10	0.371	9	0.606	6	1.038	4	1.014	7	0.530	7
China CITIC Bank	0.255	4	0.569	4	0.620	6	0.566	7	0.582	10	0.566	11	0.527	8
Bank of China	0.020	11	0.119	11	0.282	11	0.368	11	0.730	8	1.212	5	0.455	9
Bank of Communications	0.037	9	0.149	9	0.416	8	0.506	9	0.647	9	0.880	8	0.439	10
Ping An Bank	0.274	3	0.335	6	0.342	10	0.407	10	0.515	11	0.496	12	0.395	11
China Merchants Bank	0.032	10	0.032	13	0.152	12	0.150	12	0.253	12	0.826	9	0.241	12
Minsheng Bank	0.045	7	0.097	12	0.144	13	0.148	13	0.249	13	0.249	13	0.155	13
Bank of Ningbo	0.009	14	0.015	14	0.010	14	0.084	14	0.015	14	0.072	14	0.034	14

Data source: Data collected from annual reports and social responsibility reports of banks.

4.2. Analysis of Organizational Ecological Innovation Index

The Organizational eco-innovation Index saw the largest growth in 2017, with a maximum growth rate of 130%, followed by a growth rate of 93% in 2016. With the proposal of national policies in 2016, banks actively implemented the relevant provisions of the "Green Credit Guidelines" of the Banking and Insurance Regulatory Commission. By 2019, most banks have established a relatively complete green financial management system, and the growth rate of organizational ecological innovation index in 2020 will be at least 18%. Among the 14 commercial banks, more than 10 have implemented the "one-vote veto system for environmental protection", and the "one-vote veto system" policy was implemented by half of the banks in 2016. In 2017, green finance institutions and specialized departments were set up in succession.

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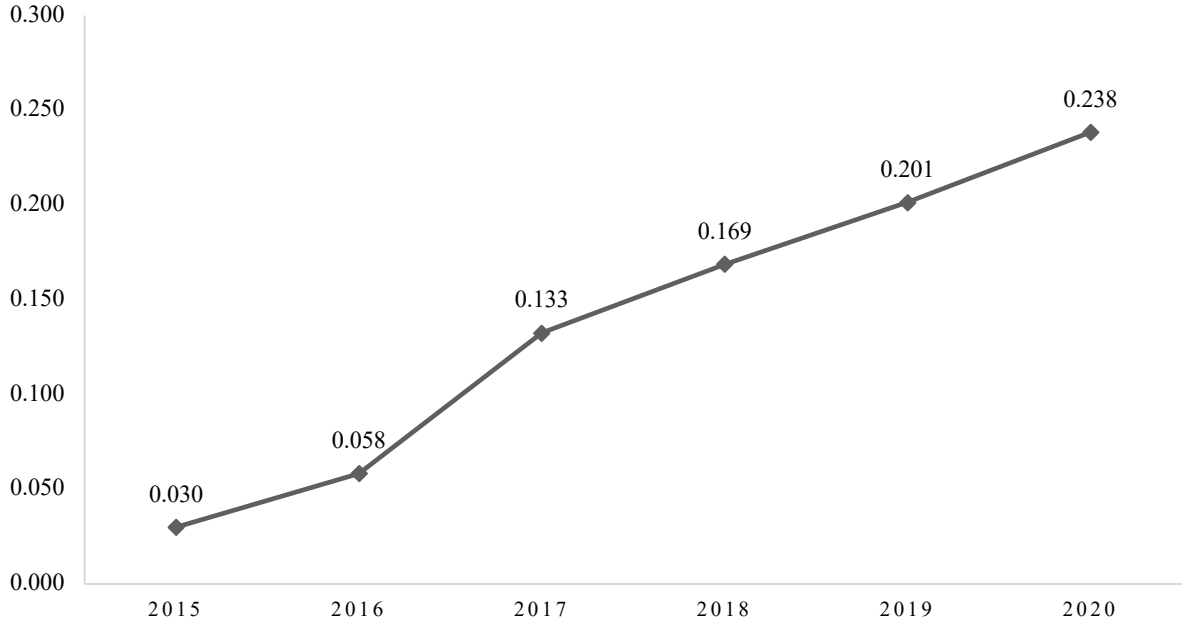

Figure 2: Trend chart of green organization innovation score.

Industrial Bank ranked first, established the first green branch, set up a green credit classification system. Among the big five state-owned banks, China Construction Bank performed best, ranking second overall and scoring just below Industrial Bank. China Construction Bank has implemented the "one-vote veto system" since 2006, established a green credit committee in 2015, provided green channels for green projects in 2017, established a green credit classification system, and established policies and full-time departments earlier. Among the 14 sample commercial banks, only Industrial Bank joined the Equator Principles to operate green finance business with international standards. In 2020, there are still 4 banks that have not set up green full-time departments and institutions. Bank of Ningbo has the lowest score and will only implement a one-vote veto in 2020.

Table 4: Scores of organizational ecological innovation.

Bank	2015	2016	2017	2018	2019	2020	Average	Rank
Industrial Bank	0.197	0.223	0.321	0.321	0.321	0.321	0.284	1
Construction Bank of China	0.161	0.161	0.284	0.284	0.284	0.383	0.260	2
China Post Bank	0.000	0.000	0.223	0.223	0.383	0.383	0.202	3
Bank of China	0.000	0.062	0.124	0.223	0.321	0.321	0.175	4
Hua Xia Bank	0.000	0.000	0.161	0.223	0.321	0.321	0.171	5
Industrial and Commercial Bank of China	0.062	0.124	0.124	0.124	0.124	0.321	0.146	6
Agricultural Bank of China	0.000	0.000	0.124	0.186	0.186	0.284	0.130	7
China Merchants Bank	0.000	0.000	0.124	0.124	0.223	0.284	0.126	8
Bank of Communications	0.000	0.000	0.062	0.223	0.223	0.223	0.122	9
Minsheng Bank	0.000	0.062	0.124	0.124	0.124	0.124	0.093	10
Pudong Development Bank	0.000	0.062	0.062	0.124	0.124	0.124	0.083	11
Ping An Bank	0.000	0.062	0.062	0.124	0.124	0.124	0.083	12
China CITIC Bank	0.000	0.062	0.062	0.062	0.062	0.062	0.052	13
Bank of Ningbo	0.000	0.000	0.000	0.000	0.000	0.062	0.010	14

Data source: Data collected from annual reports and social responsibility reports of banks.

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4.3. Analysis of Product Ecological Innovation Index

The trend of China's product ecological innovation index from 2015 to 2020 was stable, with the largest growth in 2016 and 2020. Before 2016, China mainly carried out green credit business, and green bonds, carbon finance and other products were rarely involved. At the beginning of 2016, China opened the green bond market, and most of the 14 commercial banks selected participated in the green bond market, so the product ecological innovation saw a substantial growth in 2016. In 2017, the national carbon market was launched, and the product ecological innovation index showed significant growth in 2017. In 2020, the central government funded the establishment of a green development fund, and a number of banks participated in it, making the product ecological innovation in 2020 significantly increase.

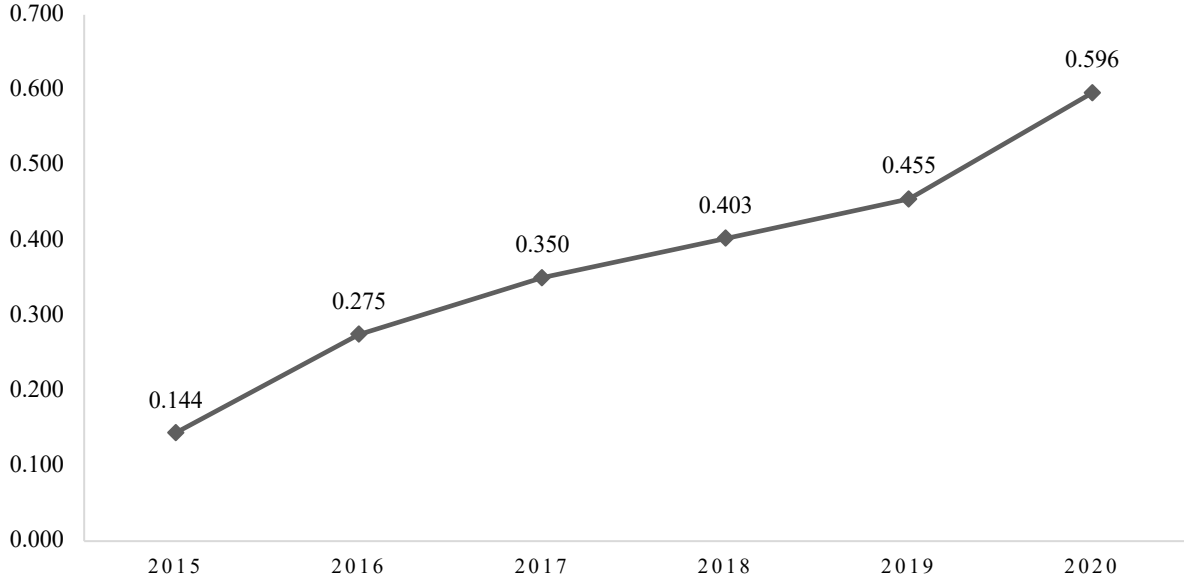

Figure 3: Trend chart of green product innovation score.

In the product ecological Innovation Index score, Industrial Bank ranked first, more than double the score of the second place. Industrial Bank participated in the carbon emission trading pilot in 2011, became the main settlement bank of Guangzhou carbon emission trading, and created carbon emission rights pledge financing. Industrial Bank is rich in other green financial instruments, green leasing is the traditional advantage of Industrial Bank, launched green trust business in 2012, issued the first green index financial product in 2017, and now Industrial Bank has become a leader in domestic green finance. Bank of Ningbo has not participated in the carbon market as of 2020.

Table 5: Score of product ecological innovation.

Bank	2015	2016	2017	2018	2019	2020	Average	Rank
Industrial Bank	1.074	1.313	1.349	1.606	1.434	1.350	1.354	1
Agricultural Bank of China	0.023	0.270	0.770	0.783	0.776	0.778	0.567	2
Hua Xia Bank	0.012	0.502	0.495	0.503	0.742	1.098	0.559	3
Pudong Development Bank	0.274	0.753	0.511	0.512	0.519	0.511	0.513	4
China CITIC Bank	0.245	0.490	0.544	0.493	0.493	0.492	0.459	5
Construction Bank of China	0.027	0.030	0.276	0.537	0.534	0.775	0.363	6
Industrial and Commercial Bank of China	0.021	0.028	0.290	0.294	0.559	0.775	0.328	7

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Table 5: (continued).

Bank of Communications	0.020	0.115	0.331	0.267	0.268	0.515	0.252	8
Ping An Bank	0.247	0.248	0.264	0.256	0.245	0.244	0.250	9
China Post Bank	0.008	0.007	0.017	0.261	0.507	0.507	0.218	10
Bank of China	0.019	0.052	0.040	0.032	0.274	0.766	0.197	11
China Merchants Bank	0.020	0.015	0.015	0.015	0.013	0.529	0.101	12
Bank of Ningbo	0.002	0.002	0.002	0.078	0.002	0.001	0.014	13
Minsheng Bank	0.020	0.020	0.000	0.000	0.000	0.001	0.007	14

Data source: Data collected from annual reports and social responsibility reports of banks.

4.4. Analysis of Cultural Ecological Innovation Index

The cultural ecological innovation index of commercial banks fluctuated slightly from 2015 to 2020, grew rapidly from 2015 to 2017, remained flat in 2018, and declined in 2020.

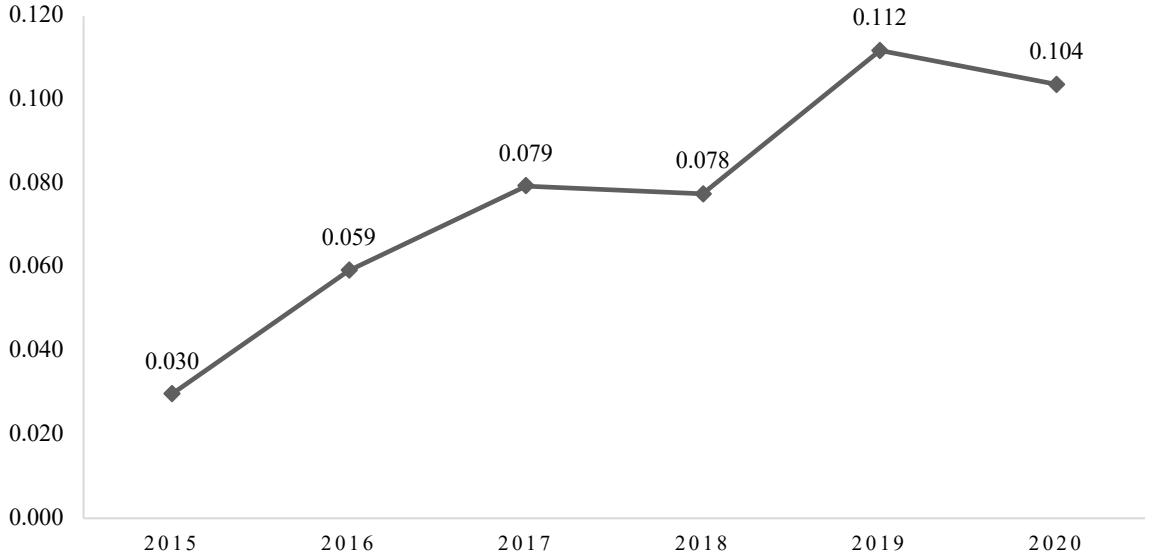

Figure 4: Trend chart of green cultural innovation score.

In the 2020 bank social responsibility report, a large part of the report reported the social responsibility of banks under the epidemic, resulting in a significant decline in the score of the cultural ecological Innovation index in 2020. Overall, Industrial Bank and Industrial and Commercial Bank of China ranked first and second, and were the first two banks among the 14 sample banks to train their employees on green finance. Postal Savings Bank, ranked third, has conducted special training on green finance for its employees since 2016, but has slightly less space on green business concepts in its social responsibility report. There is a large gap between the scores of the inter-bank cultural and ecological innovation index, and the score of the first cultural and ecological innovation is 17 times that of the last, indicating that commercial banks have enthusiasm for green financial cultural innovation, but it needs to be improved.

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Table 6: Score of cultural ecological innovation.

Bank	2015	2016	2017	2018	2019	2020	Average	Rank
Industrial Bank	0.134	0.159	0.134	0.134	0.133	0.139	0.139	1
Industrial and Commercial Bank of China	0.130	0.149	0.133	0.130	0.122	0.148	0.136	2
China Post Bank	0.011	0.123	0.131	0.123	0.147	0.123	0.110	3
Agricultural Bank of China	0.016	0.124	0.128	0.127	0.136	0.126	0.109	4
Hua Xia Bank	0.007	0.125	0.123	0.118	0.137	0.132	0.107	5
Pudong Development Bank	0.019	0.020	0.134	0.131	0.147	0.121	0.095	6
Bank of China	0.002	0.004	0.118	0.113	0.134	0.125	0.083	7
Construction Bank of China	0.000	0.002	0.116	0.112	0.124	0.113	0.078	8
Bank of Communications	0.016	0.034	0.024	0.016	0.157	0.142	0.065	9
Ping An Bank	0.027	0.026	0.017	0.027	0.146	0.127	0.062	10
Minsheng Bank	0.025	0.015	0.019	0.025	0.126	0.123	0.055	11
China CITIC Bank	0.010	0.018	0.014	0.010	0.027	0.012	0.015	12
China Merchants Bank	0.012	0.017	0.013	0.012	0.017	0.013	0.014	13
Bank of Ningbo	0.006	0.013	0.007	0.006	0.013	0.009	0.009	14

Data source: Data collected from annual reports and social responsibility reports of banks.

5. Conclusion

5.1. Main Finding

Through the above analysis, the development of green finance in China's commercial banks is as follows:

1. On the whole, the development of green finance in Chinese commercial banks is on the rise, thanks to the strong support and incentive of national policies, and the continuous improvement and improvement of green finance policy system. However, the development of green finance among banks is unbalanced, and the development of Industrial Bank, Huaxia Bank and state-owned banks is stable. And at the average level or above.

2. In terms of organizational innovation, the management policies and full-time institutions of commercial banks have been continuously improved and improved, and the overall level has increased steadily, but there are still many banks that need to pay attention to the construction of management systems related to green finance. Among the sample banks, 12 banks implement the one-vote veto system, and only Industrial Bank implements the equator principle. The Bank of Ningbo has few relevant policies and no full-time green finance institutions and departments.

3. In terms of product innovation, the score of the product ecological innovation index of commercial banks continues to rise sharply. Among them, the proportion of green credit increased steadily, the scale of green bond issuance continued to increase, and social funds tilted to green industries. The green financial products of commercial banks are constantly abundant, but the products in the field of carbon finance are relatively simple. The green financial instruments of commercial banks are mainly green credit and green bonds. The construction of China's carbon financial market is not perfect, and the products of carbon financial market are mainly spot transactions, resulting in the lack of carbon financial products of commercial banks.

4. In terms of cultural innovation, the business concept of green finance of commercial banks is not profound enough. Starting from 2017, it developed steadily before 2017, fluctuated after 2017, reached a peak in 2019, and showed a sharp decline in 2020 due to the impact of the epidemic. Under the background of the popular concept of green environmental protection, enterprises with high pollution and energy consumption have gradually lost their living space, and commercial banks need

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to find new profit growth points and adopt green business models to achieve sustainable economic growth.

5.2. Suggestions

1.Improving policies related to green finance. China has made preliminary achievements in the construction of green financial system, and the classification standards of green industry, green credit and green bonds have been preliminarily formed. On the one hand, with the continuous development of green finance in China's commercial banks, the state should continuously improve relevant policies and issue new policies and measures to support and encourage the development of green finance in the banking sector in light of the actual development of green finance. On the other hand, the state indirectly guides commercial banks to flow funds to the green field through strong support for the green industry, and state-owned banks should actively participate in the construction of green finance, do a good job and play an exemplary role.

2.Improve the green finance management and evaluation system. Commercial banks should continue to improve green financial standards, improve green financial management system, strict requirements with international standards, and better in line with international standards. A sound green financial management system helps to improve the quality of green assets of commercial banks, reduce business risks, support resource-saving and environment-friendly enterprises, and then promote green industries to achieve stable and sustainable economic development.

3.Strengthen the training of green financial talents and increase the innovation of green financial products. To enrich green financial products, on the one hand, we can learn more about the design experience of foreign green financial products, increase exchanges with international counterparts, and actively participate in or hold special green financial activities. On the other hand, product innovation cannot be separated from the research of professionals. Green finance business involves environmental factors and requires interdisciplinary talents with knowledge of chemical industry, environment and law, etc. Colleges and universities can offer basic courses related to green finance at undergraduate level to inspire students to actively explore and understand, hold or promote relevant lectures to spread basic knowledge of green finance and stimulate students' research interest.

4.Deepen the concept of industry-wide green finance development. Faced with increasing extreme weather and serious environmental pollution problems, commercial banks, as an important part of the national economy, should actively promote sustainable economic and social development and assume social responsibilities. At the ideological level, in-depth study of green finance ideas, so that the concept of sustainable development into the business operation of commercial banks. Green finance theme training and meetings are carried out within the bank to make employees realize their social responsibilities and let the concept of green development be deeply rooted in the hearts of the people, so as to promote the development of green finance business, pool more funds into the green industry and realize the green economy. Commercial banks should increase the selection of interdisciplinary talents, invite authoritative figures to train them, cultivate a professional green finance team, form a sound training system, and increase the training of green finance talents.

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