

Based on ISM-MICMAC, a study was conducted to identify the barriers to green finance promotion in less developed regions

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Abstract. It is particularly important to study the impediments to the promotion of green finance in less developed regions to help promote the promotion of green finance. Through literature analysis, case studies and expert interviews, this paper thoroughly explores thirteen impediments to green finance promotion in less developed regions at four levels, and constructs an explanatory model (ISM) to elucidate the four-level recursive correlations among the factors, and uses the cross-influence matrix multiplication method (MICMAC) to study the driving forces and dependencies of these various factors, as well as their interaction mechanisms. The results show that: backward corporate awareness and green finance policies are the bottom-level factors that are barriers to the diffusion of green finance in less developed regions, with the new crown pneumonia epidemic, government finance and financing costs having various degrees of influence.

Keywords: green finance, impeded pathways, ISM-MICMAC, less developed regions.

1. Introduction

The significance of green finance has risen steadily in light of China's economy's quick development. The 20th Party Congress report stressed the importance of improving the financial standard system to support green development in order to finance the growth of green and low-carbon industries. It was suggested that achieving carbon neutrality requires a significant and comprehensive change in economic and social systems. Green finance has emerged as the primary source of funding for the "double carbon" objective, but there are now numerous barriers to its promotion, which has an impact on the overall growth of the economy and the environment, and there aren't many recent research on the subject.

Strengthening the promotion of green finance is a crucial stage in the growth of green finance in China, according to MA [1] et al., who researched the current condition, issues, and worldwide experience of green finance development in China. By using the Dagum Gini coefficient decomposition method and the Kernel density estimation method based on the green financial development index in recent years, HUANG [2] et al. examined regional differences and dynamic evolutionary trends of green financial development. They came to the conclusion that inter-regional differences are the primary cause of regional differences in green financial development in China. To investigate the regional impact of governmental action on green financing regions. To investigate the regional impact of governmental action on green financing regions, PAN [3] et al. built dynamic panel system GMM models and spatial Durbin models. According to ZUO [4], developing a green financial system should come first and that green financial innovation serves to revitalize rural areas. Combining the aforementioned literature study demonstrates that green finance promotion is regional and specific. Based on the aforementioned studies, this paper explores the variables that limit the efficiency of green finance promotion in less developed regions.

In this context, we investigate the factors influencing the path of obstacles to the promotion of green finance in less developed regions, and through the development of a system engineering-related

model, provide a reasonable explanation and analysis of the associated paths and make reasonable recommendations. The conclusions made by prior researchers on the basis of their research into green finance had to be examined individually throughout their earlier work; however, this study unifies their findings. constructs a system of hindrance influence factors for green finance promotion in less developed regions, uses the explanatory structure, and identifies relevant hindrance paths through literature analysis method. It then invites experts in related fields to investigate and review the analyzed factors. The study's final findings will offer some recommendations for putting China's dual carbon policy and rural revitalization policy into practice, as well as practical and efficient implementation solutions and service references for businesses and associated banks in less developed regions who run into difficulties promoting green finance.

2. Green Finance Promotion Hindrance Indicator System

2.1. Local economic level

As a result of their lower levels of overall local GDP and GDP per person, less developed areas are at a disadvantage when it comes to promoting green finance on a typical scale. Su et al[5] 's claim that regions with high total and per-capita GDP are more effective at achieving decarbonization with the same inputs. Speaking generally, more advanced equipment with high levels of innovation, greater resources, and cheaper replacement costs may be found in highly developed economic locations [2].

According to the CBRC, the scale of green credit of commercial banks is even smaller in regions with backward regional economies. The growth rate of green loans in the central eastern region was 23.5% and 26.6%, but only 14.5% and 12.4% in the western and northeastern regions, so the backward scale of business becomes a green credit business with low returns with public interest. a significant issue with the spread of green finance [6].

In conclusion, the barriers to green finance promotion at the local economy level identified in this article include. Inadequate per capita GDP (X2), a deficient overall GDP (X1), and a meager scale of green banking business (X3).

2.2. Insufficient national policy guidance

Early on, China's green finance system lacked adequate regulatory direction; as an illustration, the Yangzhou Baoying green financial sector faces challenges such challenging certification procedures and a lack of funding [7]. The central bank recommended "the implementation of special policies for financial support of green low-carbon development and the establishment of carbon emission reduction support tools report, clearly indicating that the dual policies of fiscal and monetary policies directly support the green economy in 2021." The dual fiscal and monetary policies directly support the financial system, and the market for green credit is expanding quickly under the policy of universal access, with a balance that exceeds 20 trillion yuan, indicating that green finance has reached a stage of full-scale development [8].

The difficulties that have arisen in Baoying, Yangzhou's green sector are an example of the absence of control and direction in the promotion of green finance in less developed places [7]. As a result, creating and enhancing the legal framework for green finance is a necessary condition for its development and sustainable distribution in the nation [5]. The national policy guidance thus has a long-term role in strengthening the dissemination and development of green financing in less developed regions, regardless of the policy perspective. In summary, the impediments to the promotion of green finance in less developed regions at the level of insufficient national policy guidance constructed in this paper are fiscal policy (X4), monetary policy (X5), regulatory policy (X6), and guidance policy (X7).

2.3. Individual local business factors

Companies that are environmentally conscious and actively promote green finance can not only lead the way in creating a new system of green development companies for themselves, but they can also inspire other businesses to collaborate on their own development by choosing greener raw material sources and engaging in greener forms of cooperation. Also, according to the research, the development of green financial technologies like Ant Forest suggests that corporate innovation can speed up the promotion of green finance by cutting transition costs and information asymmetry as a strategy to raise public awareness of the environment [8].

It is expected that, when faced with an environmental shift, an industrial business with reduced financing costs can smooth out its cash flow by increasing credit efficiency. Also, businesses with smaller transition costs are under less pressure to finance the changeover and the best use of green finance regulations. The green financial economy trailed behind in economically disadvantaged regions, with greater transition costs and financing expenses, making it more challenging to create a coordinated green financial economy, according to the study of the green financial reform and innovation pilot area [3].

In conclusion, the local individual enterprise level barriers to the promotion of green finance in less developed regions identified in this paper are industrial enterprises' environmental culture awareness (X8), their capacity for innovation (X9), their cost of transformation (X10), and their financing costs.

2.4. General Environmental Factors

The regional economic gap widened [9] and GDP in the first quarter of 2020 decreased by 6.8% year over year in the context of the new crown. The new crown also had a direct impact on X1, X2, X4, and X10 factors, which in turn indirectly hampered the promotion of green finance in less developed regions.

In 22 years compared to other years, the financial environment of nations is more serious, domestic financial institutions and businesses to issue green bonds abroad, commercial banks internationalization capacity building is hampered, the entire international green financial system received the impact [10], which directly results in the promotion of green finance in remote areas is hampered.

To sum up the overall environmental level that was constructed in this work, new crown pandemic shock (X12), international financial trade friction, and other issues that prevent the promotion of green finance in less developed regions (X13).

The green finance promotion hindrance indicator system constructed in this paper is shown in Table 1.

Table 1. The green finance promotion hindrance indicator system

Secondary indicators	Three Layered Indicia	Description of the Indicator	Indicator number	Reference
Local economic level	Total GDP is insufficient	GDP lags behind compared to other regions	F1	[2],[5]
	GDP per capita is insufficient.	Regional GDP per capita lags behind compared to other regions	F2	[5]
	Smaller bank green business	Green financing accounts for a minor fraction of commercial banks' overall activity.	F3	[6]
Insufficient national policy guidance	Inadequate financial policy support	Insufficient government investment funds	F4	[8]
	inadequate support for monetary policy transmission	Local monetary policy transmission is weak and has a time lag in terms of money.	F5	[8]
	Inadequate regulatory system	Inadequate rule of law system for green finance	F6	[5],[7]
	Insufficient introduction of incentive policies	Additional textual regulations that exclude monetary and fiscal regulations	F7	[5],[7]
Individual business factors	Backward corporate awareness	Overall corporate support for environmental charity	F8	[8]
	Poor innovation ability	The capacity of businesses to innovate their technologies and goods	F9	[8]
	High financing costs	Costs when companies issue debt	F10	[3]
	High Cost of Transformation	costs associated with switching a company's business model or mode of production	F11	[3]
General Environmental Factors	Shock of the new crown epidemic	The many effects of human epidemics	F12	[9]
	International Trade Friction	Contemporary International Trading Environment	F13	[10]

3. ISM Method

The ISM model is a comprehensive systems analysis technique, proposed by Professor J. Warfield in 1973[11], which can effectively analyse the various elements of a complex socio-economic system and decompose it into a multi-level structural model, so as to explore the fundamental and surface-level influences of the system in depth. It uses computer technology, based on the correlation matrix principle, through directed graphs and structural matrices, it can achieve hierarchical and regionalisation of the elements of a complex system, so as to better understand the operating mechanism of the system and effectively predict the development trend of the system, thus better controlling the operating state of the system and improving its efficiency and stability. ism model can effectively combine the complex factors in [12] into a hierarchical structural model, thus making the relationship between various factors clearer and more explicit. In addition, the ISM model can be used to explore the internal complexity of the system in depth through comprehensive and quantitative analysis. Research on system structure analysis, content structure of teaching resources and design and development of learning resources has been widely used with significant results. The steps of ISM calculation are as follows.

STEP1. Identify the main influencing factors.

STEP2. By analysing the interactions between the factors, an adjacency matrix A. The relationships between the elements of the model and the elements are abstractly determined from the

objectives of the research problem, and finally the adjacency matrix is obtained. The relationships between the elements can be determined through actual research, by forming ISM groups for discussion, or by using expert surveys. After several rounds of discussion, we found that S_i has an effect on S_j with $a_{ij} = 1$ and $a_{ij} = 0$. By collating this information, we arrived at the adjacency matrix A .

STEP3. By calculating the adjacency multiplication matrix m , the reachable matrix M can be derived by continuously multiplying the elements according to the logical relationship between each neighbouring element until the matrix no longer changes. reachable matrices are matrix forms that reflect the extent to which each element can be reached by a certain path and can be implemented using Boolean algebra rules. The matrix M reveals not only the direct relationships between the elements but also the indirect connections between them.

STEP4. Hierarchical level classification of the reachability matrix. The hierarchical decomposition of the model is performed by means of the reachability matrix, and the final hierarchy of the model is obtained. The top level is generally considered to be the ultimate goal of the system, and the lower level is the cause of the upper level.

STEP5. Draw the explanatory structure model diagram. Once the hierarchy has been delineated, the model hierarchy is then represented more visually by drawing a directed connectivity diagram.

4. MICMAC Method

The Micmac method, also known as the cross-influence matrix multiplication method, has been widely used to study the interconnectedness within and between the important factors in a system. MICMAC is a method proposed by Duperrin and Godet 1973 to analyse the interaction of various influences in a system, which can help us to better understand the relationships in [13] and to achieve a classification of system factors by generating a matrix of driving force dependencies for more targeted management and intervention. the MICMAC calculation steps are as follows.

STEP1: The driving force of the factor calculated by summing the corresponding values of the rows of the elements of the reachable matrix is $D_i = S_i$ and the dependence of the factor in that column corresponding to the sum of values, i.e. $D_j = S_j$.

STEP2: By drawing a drivingforce-dependency classification diagram, in which the dependency and driving force are each divided into four different ranges using the maximum $1/2$ as a boundary: Autonomous, Dependent, Linked and Free. The greater the driving force, the greater the degree of influence of that influence on the other factors; the greater the dependency, the greater the dependency of that influence on the other influences.

5. Calculation and Analysis

5.1. ISM Calculation and Analysis

By examination of the local economy, policies, and businesses, research into pertinent literature, consultation with ten experts, and analysis of the data (three from universities, three from enterprises and four from government). The adjacency matrix A was developed to reflect the interaction relationship between the elements after the direct influence link between the factors was detected and rated based on the maximization affiliation principle. $A = [a_{ij}] = 0$ indicates that there is no direct influence link between the F_i element and the F_j element, and the adjacency matrix is produced as indicated in Table 2. $A = [a_{ij}] = 1$ indicates that there is a direct influence relationship between the F_i element and the F_j element.

Table 2. Adjacency matrix A

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
F1	0	0	0	0	0	0	0	0	0	0	0	0	0
F2	0	0	0	0	0	0	0	0	0	0	0	0	0
F3	0	0	0	0	0	0	0	0	0	0	0	0	0
F4	0	0	1	0	0	0	0	0	0	0	0	0	0
F5	0	0	0	0	0	1	1	0	0	0	0	0	0
F6	0	0	0	1	0	0	0	0	0	0	0	1	1
F7	0	0	0	0	0	0	0	0	0	0	0	1	1
F8	0	0	0	1	0	0	0	0	1	0	0	1	1
F9	1	1	0	0	0	0	0	0	0	0	0	0	0
F10	0	0	0	0	0	0	0	0	0	0	1	0	0
F11	0	0	0	0	0	0	0	0	0	0	0	1	1
F12	0	0	1	0	0	0	0	0	0	0	0	0	0
F13	0	0	1	0	0	0	0	0	0	0	0	0	0

The adjacency matrix is constantly self-multiplied until the matrix no longer changes to produce the reachable matrix, which is then subdivided into hierarchical levels. The reachable matrix performs the model's hierarchical breakdown, and the ultimate hierarchical situation of the model is obtained. The output results obtained using SPSSPRO are shown in Table 3 for the reachable matrix B, as well as the ISM hierarchy diagram shown in Figure 1.

Table 3. Reachable Matrix B

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13
F1	1	0	0	0	0	0	0	0	0	0	0	0	0
F2	0	1	0	0	0	0	0	0	0	0	0	0	0
F3	0	0	1	0	0	0	0	0	0	0	0	0	0
F4	0	0	1	1	0	0	0	0	0	0	0	0	0
F5	0	0	1	1	1	1	1	0	0	0	0	1	1
F6	0	0	1	1	0	1	0	0	0	0	0	1	1
F7	0	0	1	0	0	0	1	0	0	0	0	1	1
F8	1	1	1	1	0	0	0	1	1	0	0	1	1
F9	1	1	0	0	0	0	0	0	1	0	0	0	0
F10	0	0	1	0	0	0	0	0	0	1	1	1	1
F11	0	0	1	0	0	0	0	0	0	0	1	1	1
F12	0	0	1	0	0	0	0	0	0	0	0	1	0
F13	0	0	1	0	0	0	0	0	0	0	0	0	1

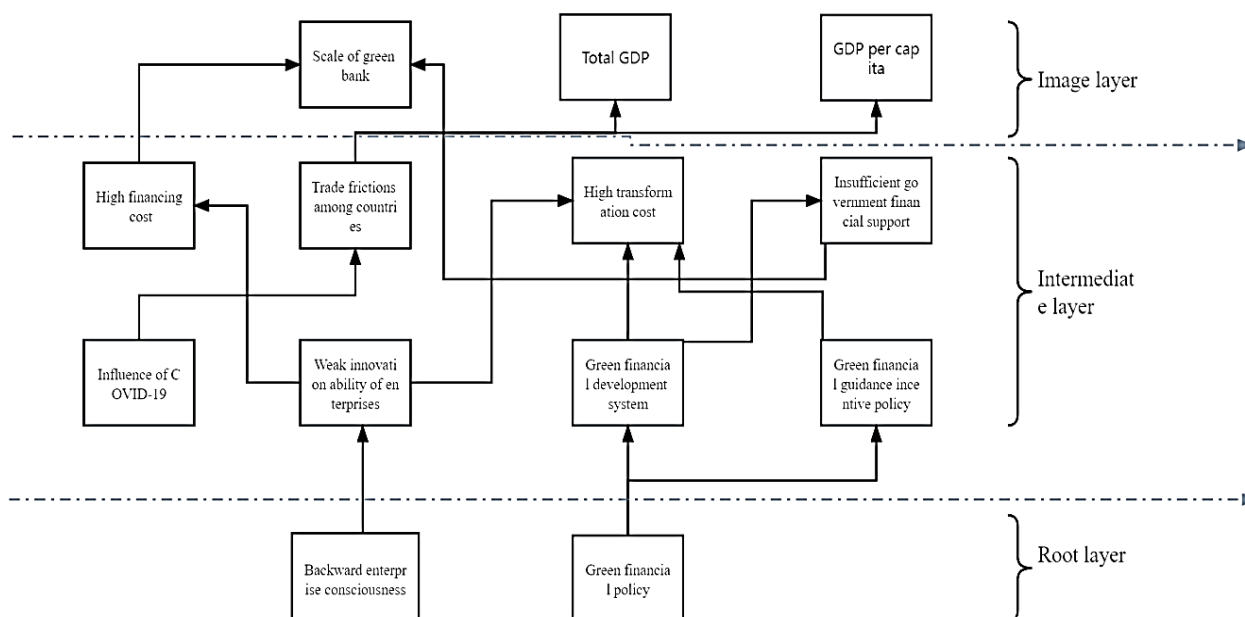


Figure 1. ISMHierarchical directed graphs

The barriers to promoting green finance are split into four layers in accordance with the standardized reachable matrix. The influencing elements with associated relationships are then further connected, and the relationships between the layers show their influence paths.

The fundamental layer, the intermediate layer, and the apparent layer are the four layers that make up the barriers to the promotion of green finance, as shown in Figure 1. The second and third layers are intermediate layers, the first layer is the superficial layer, and the fourth layer is the fundamental layer.

a) Surface layer

The first level is the direct factors that hinder the promotion of green finance, including the three factors of insufficient total GDP (F1), lagging GDP per capita (F2), and small scale of green business of banks (F3). Despite China's rapid economic development, the GDP per capita is still more backward than that of developed countries, which undoubtedly makes the development of green finance from the objective economic level affected. In addition, as China has proposed and established green banks for a relatively short period of time, it is still at the early stage of development, and many businesses and systems have not yet had time to develop and broaden, and some users' needs cannot be met, which are direct factors that hinder the development of green finance.

b) Middle layer

The second and third layers are the intermediate layers in the explanatory structure model, containing insufficient government financial support (F4), insufficient green financial regulatory system (F6), green financial guidance and incentive policies (F7), the impact of new crowns (F12), trade frictions among countries (F13), weak innovation ability of enterprises (F9), high transition cost (F11), and high financing cost (F10). As the intermediate structure of the model bearing the top and bottom, the intermediate factors are not only the influencing factors but also the influenced factors. Under the influence of the new crown epidemic, trade frictions among countries are also expanding, and it is self-evident that the emerging green finance market is inhibited; in addition, as the development system of green finance is still in the early stage, it is not perfect, which makes the transformation and financing cost of enterprises unable to be reduced, which brings certain worries to enterprises and discourages their transformation, thus inhibiting the green finance even more. healthy development.

c) root level

The fourth layer of the explanatory structure, the root cause layer, contains two important factors, green finance policy (F5) and backward corporate awareness (F8). It is the most fundamental factor that hinders the development of green finance. Although green finance is currently the new trend and

trend of the present era, the lack of investment discernment of many enterprises in related professional fields and the imperfection of related policies make there are still many resistances on the way of green finance development.

5.2. MICMAC Calculation and Analysis

The cross-influence matrix multiplication method, MICMAC, is mainly used to analyze the influence and dependence relationships among the factors in the system, and the results can be expressed by the coordinate axes, where the dependence is expressed by the vertical coordinate and the driving force is expressed by the horizontal coordinate. The MICMAC model constructed in Section 4 is combined with the results in Table 3 to calculate the driving force and dependency of each hindering factor, and the results are shown in Table 4 and Figure 2, respectively.

Table 4. Drive and dependency calculation results

Tertiary indicators	Driving force	Dependency
F1	1	3
F2	1	2
F3	1	2
F4	2	2
F5	7	2
F6	5	2
F7	4	2
F8	8	2
F9	3	1
F10	5	0
F11	4	0
F12	2	0
F13	2	0

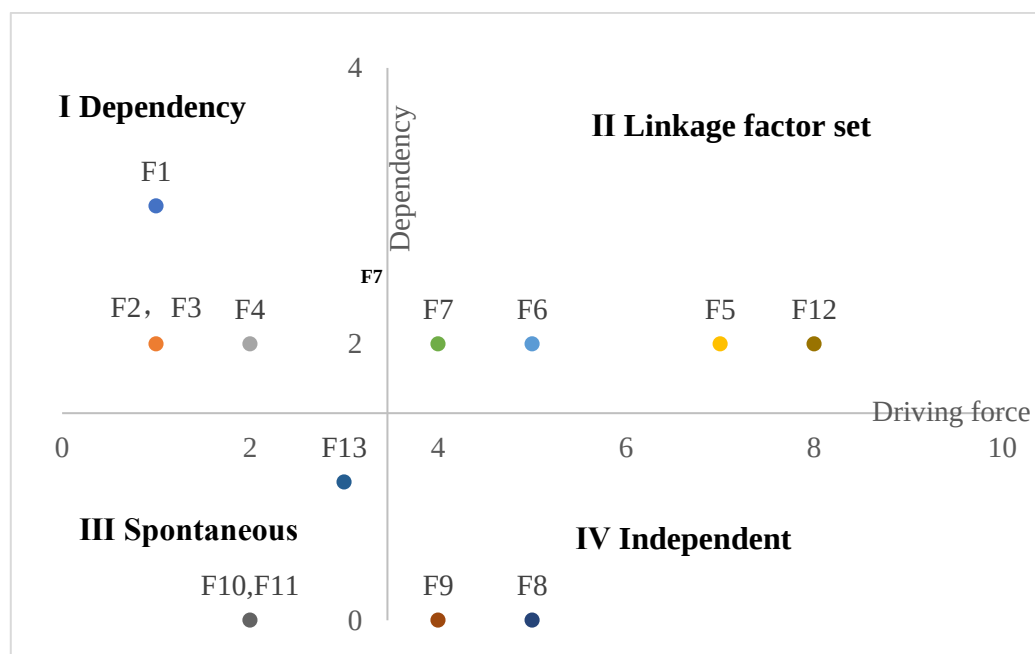


Figure 2. Power map

From Figure 2 combined with MICMAC theory, the following analysis can be conducted.

Total GDP, insufficient government financial support, and green bank scale belong to the set of dependent factors, characterized by their low drive and high dependence, i.e., they are highly correlated with other factors and influenced by other factors. For example, the size of green banks is influenced by insufficient government finance and high cost of transformation of enterprises.

High transition costs, high financing costs and trade frictions in various countries belong to the set of spontaneous factors, whose drive and dependence are low and can be attributed to non-systemic factors and exist independently. In this study, although high transition costs, high financing costs and trade frictions in various countries are not high in dependence and drive, they are in the middle layer of the system and still play the role of carrying on the top and bottom, which can influence the factors in the top layer while also being influenced by the bottom factors.

Green financial policy, green financial development system, green financial guidance and incentive policy, and new crown impact are in the set of linkage factors, and the factors in this quadrant have higher dependence and drive, often their role of carrying on the top and passing on the characteristics of the lower layer factors to the upper layer factors.

The weak innovation ability of enterprises and backwardness of enterprise consciousness are located in the independent factor set, with high driving force and low dependency characteristics are often the deepest level of the influencing factors, taking on the task of dominating the system, if it is positively promoted, the whole system can also gradually pass the intermediate factors thus playing a comprehensive positive promotion.

6. Conclusion

Climate change has become a global concern, and various countries have adopted various countermeasures to deal with the issue. China has proposed a double carbon target and promoted the development of green finance. Finance is the foundation of social development, and green development also needs financial support. Through literature analysis, case studies and expert interviews, this paper summarises thirteen factors that affect the promotion of green finance in less developed regions and develops an explanatory structural model (ISM) to reveal a four-level recursive relationship between these factors. In addition, this paper also uses MICMAC analysis to explore in depth the driving forces and dependencies of these factors, as well as their mechanisms of action.

Finally, it is concluded that, firstly, corporate awareness is backward and green finance policy is the lowest-level factor research significance. To this end this paper provides practical reference implications and methods for the promotion of green finance in less developed regions, actively responding to the national dual carbon policy and combining it with the rural revitalisation strategy to propose a new research approach. By integrating multiple social resources, strengthening the organisational system and improving the incentive and constraint mechanism, it provides support for the development of green industries. Cultivate green financial talents and develop innovative green financial products. Rely on the advantages of financial technology and improve the mechanism of collaborative development. Strictly control the various risks in green finance business and establish an effective incentive mechanism to promote the development of green finance by banks. Secondly, there are certain shortcomings in this study: on the one hand, scoring errors, including subjective errors in scoring and objective errors in the scorers' own perceptions, and on the other hand, the indicators of various influencing factors may not be reasonable and comprehensive.

Finally, a more accurate model analysis could help green finance and rural revitalization develop faster and better.

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