



# Research on the Obstacles to the Promotion of Green Finance in China's Underdeveloped Regions

## --Based on I-M Model

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**Abstract.** To explore the factors that hinder the promotion of green finance and help China achieve the “dual carbon” goals efficiently. This paper identifies 21 obstacles to the promotion of it through grounded theory. Interpretative Structural Modeling (ISM) is used to analyze the internal logical relationship of each obstacle, and the key intervention objects are identified through Cross-Impact Matrix Multiplication Applied to Classification (MICMAC). The results show that the system of obstacles to the promotion of green finance includes 6 levels, including surface factors such as the single type of green financial products and the lack of green investment concept of investors, etc. Moreover, there are 3 core underlying factors, including the time lag of policies, the imbalance of green financial markets in various regions, and the large income gap. This study provides effective suggestions for the problem of promoting green finance in underdeveloped regions in China.

**Keywords:** Underdeveloped Regions, Green Finance, Obstacle Identification, ISM, MICMAC.

## 1 Introduction

Nowadays, the proposal of carbon peak and carbon neutrality provides a direction for China's economic transformation. As an important tool to achieve the “dual carbon” goals, green finance can promote the effective supply and green allocation of funds, and then promote economic green transformation and financial industry development<sup>1</sup>. Objectively analyzing the factors of green finance promotion has important theoretical and economic significance for the adjustment of green finance development strategies in underdeveloped regions of China.

At present, the factors affecting the development of green finance can be divided into two categories: promoting factors and hindering factors. Many scholars analyze the factors that promote the development of green finance from specific aspects. In terms of the policy environment, LING et al.<sup>2</sup> conclude that the introduction of government subsidies can increase the market share and profit of green products under the

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Stackelberg game model. In terms of technology, KONG et al.<sup>3</sup> conduct a nonlinear test based on the threshold effect and conclude that financial technology promotes green credit delivery. Additionally, from the perspective of investors, ZOU et al.<sup>4</sup> conduct regression analysis and conclude that green securities investors pay more attention to the environmental benefits brought by investment than financial performance. However, only a few scholars have analyzed the obstacles to the promotion of green finance, whose research has focused on the policy. Based on the theory of enterprise life cycle, ZHANG et al.<sup>5</sup> conclude that green credit policy has a crowding-out effect on green innovation of enterprises in different enterprise life cycles. By analyzing the current situation of China's green bond information disclosure system, FENG et al.<sup>6</sup> conclude that the imperfect information disclosure system is difficult to regulate the alienation of the use of green bonds to raise funds.

The previous studies show that scholars have done a lot of analysis on the promoting factors of green finance promotion, but the obstacles to it are not fully considered. In addition, the promotion is a complex systematic project, which is required to explore the relationship between factors. Therefore, this paper aims to use grounded theory to identify the relative obstacles. Then, based on Interpretative Structural Modeling (ISM) and Cross-Impact Matrix Multiplication Applied to Classification (MICMAC), the relationship between obstacles is analyzed. The innovation of this paper is to use matrix and graph theory to analyze the obstacles hierarchically. It can not only break through the defects of the existing research on the single analysis of obstacles, but also construct the hierarchical structure diagram of obstacles, clarify the key obstacles to the promotion of green finance in the region, and then provide empirical research and theoretical reference for the government to formulate relevant policies.

## **2 Identification of obstacles to green finance promotion in underdeveloped regions**

### **2.1 Policy environment**

Green financial policies are conducive to guiding and encouraging enterprises and financial institutions to invest more in green projects. However, the relevant green financial systems in underdeveloped regions of China are imperfect, including relative product evaluation standards, information disclosure systems, and regulatory systems<sup>6,7</sup>. Moreover, the promotion is also affected by the limited financial subsidies and the time lag of policies<sup>8</sup>.

### **2.2 Environment cognition**

A good awareness of environmental protection is conducive to improving investors' acceptance of green financial products. It also promotes the transformation of enterprises to green to a certain extent and encourages more investment in green projects.

However, due to the lack of educational resources, the residents in underdeveloped areas have a low level of cognition of environmental protection<sup>9</sup>. In addition, the promotion is also affected by the poor publicity of local governments<sup>10</sup>.

### 2.3 Market demand

The increasing market demand is conducive to improving the utilization of green products, encouraging enterprises to transform to green. However, market demand for green finance in underdeveloped regions is relatively small, mainly affected by the small-scale green financial market and the low-income level of residents<sup>11</sup>. Moreover, the lack of green investment concepts and the long return period of green projects have hindered the promotion<sup>12</sup>.

### 2.4 Enterprise participation

High participation is conducive to providing a large amount of financial support for green projects, accelerating the development of green industries. However, enterprises in underdeveloped regions rarely participate in green finance due to the weak profitability of green projects and the incremental costs, which conflict with the goal of maximizing corporate profits<sup>13</sup>. Additionally, the alienation of the use of raising funds and the less voluntary environmental information disclosure have hindered the promotion in the region<sup>14</sup>.

### 2.5 Financial institutions input

Financial institutions' investment has a direct impact on the development of green financial markets. They provide necessary financial support for green industries and promote the innovation of green technologies. However, in underdeveloped regions, financial institutions have smaller investments in green finance, which is attributed to the imbalanced development of green businesses, the imperfect information-sharing mechanism, and the business organization framework<sup>14</sup>. Additionally, green financial products are simple due to their lack of innovation ability. Indicators are shown in Table 1.

**Table 1.** Indicators of obstacles to green finance promotion

| First indicators       | Second indicators   | Indicators description   | References |
|------------------------|---|--|------------|
| Policy environment (A) | Unclear evaluation criteria (A <sub>1</sub> )             | There is a lack of unified evaluation criteria for sustainable green financial products. |            |
|                        | Imperfect information disclosure system (A <sub>2</sub> ) | The laws lack the specific explanation of green financial information disclosure.        | 6          |
|                        | Imperfect regulatory system (A <sub>3</sub> )             | The design of green financial supervision system is imperfect.                           | 7          |
|                        | Insufficient financial subsidies (A <sub>4</sub> )        | The fiscal incentive system and subsidy policy of green finance are imperfect.           | 8          |
|                        | Time lag of policies (A <sub>5</sub> )                    | The interval between the implementation and effectiveness of green policy is long.       |            |

|                                  |   |  |    |
|----------------------------------|---|--|----|
| Environment cognition (B)        | Weak awareness of environmental protection (B <sub>1</sub> )          | Some consumers fail to form the awareness of environmental protection.   |    |
|                                  | Low cognitive level (B <sub>2</sub> )                                 | There is a lack of understanding of green finance and its benefits.  | 9  |
|                                  | Insufficient government propaganda (B <sub>3</sub> )                  | The government's promotion of environmental protection is not effective.   | 10 |
| Market demand (C)                | Imbalanced regional green financial market (C <sub>1</sub> )          | There are significant differences in the green finance development between underdeveloped and developed areas.         |    |
|                                  | Large income gap (C <sub>2</sub> )                                    | The income gap between different regions is large, which limits residents' consumption of green financial products.    | 4  |
|                                  | Lack of green investment concepts among investors (C <sub>3</sub> )   | Most investors only pay attention to the financial performance of investment.  | 11 |
|                                  | Long return period of green project investment (C <sub>4</sub> )      | The investment of green financial projects requires a long return period.  | 12 |
|                                  | Subject target contradiction (D <sub>1</sub> )                        | The green projects' weak profitability contradicts the enterprises' profit purpose.                                    |    |
| Enterprise participation (D)     | High cost of green project evaluation (D <sub>2</sub> )               | Green financial projects need to hire third-party assessment agencies, increasing the incremental cost of enterprises. | 6  |
|                                  | Alienation of the use of raising funds (D <sub>3</sub> )              | Some green projects did not flow into qualified projects.  | 7  |
|                                  | Less voluntary environmental information disclosure (D <sub>4</sub> ) | The asymmetry of corporate environmental information increases the risk of investment uncertainty.                     | 13 |
| Financial institutions input (E) | Imbalanced development of green business (E <sub>1</sub> )            | Green business is mainly concentrated in national banks while that in underdeveloped areas is small.                   |    |
|                                  | Inadequate information-sharing mechanisms (E <sub>2</sub> )           | China has not established an authoritative information sharing platform.   |    |
|                                  | Imperfect business organization framework (E <sub>3</sub> )           | There is a shortage of professional personnel and the development of professional departments is imperfect.            | 10 |
|                                  | Single variety of green financial products (E <sub>4</sub> )          | Green financial products are single, mainly based on traditional project financing.                                    | 14 |
|                                  | Weak innovation of green financial service (E <sub>5</sub> )          | Financial institutions lack innovation and system R & D capabilities.  |    |

Source: CNKI

### 3 ISM method

Interpretative Structural Modeling (ISM) was proposed by Warfield in 1973, which is a method to explain the structural relationship of system influencing factors. This method can deeply analyze the internal logic mechanism between various obstacles in a complex system and present the overall structure of the system and the specific relationship between different obstacles more clearly and reasonably in the form of a directed graph<sup>15</sup>. The specific steps of ISM are as follows:

**STEP1: Identify Obstacles Affecting Research Objectives.** The obstacles to the promotion of green finance in underdeveloped regions could be emanated from relevant literature.

**STEP2: Establish Adjacency Matrix *A*.** The adjacency matrix *A* indicates that two obstacles in the system have a direct influence. The relationship between obstacles is

evaluated based on expert evaluation marks. That is, when  $Q_i$  has a significant effect on  $Q_j$ ,  $a_{ij} = 1$ , otherwise  $a_{ij} = 0$ . Based on this logic, the adjacency matrix  $A$  is established.

**STEP3: Calculate Reachability Matrix  $M$ .** The reachability matrix indicates that each hindered node in the system has any transfer relationship. By using Boolean algebraic operation rules, the above adjacency matrix  $A$  is iterated to reachability matrix  $M$ . Specifically, the sum of the adjacency matrix  $A$  and the identity matrix  $B$  is subjected to a matrix power operation. If the adjacency matrix  $A$  satisfies  $M = A + A^2 + A^3 + \dots + A^n = (1 + A)^{n-1}$ , then  $M$  is the reachability matrix.

**STEP4: Construct and Draw ISM.** Based on the reachability matrix  $M$ , the reduced reachability matrix  $M_1$  is obtained by rearrangement according to the decomposition rules, and then the levels in the system are divided. Finally, the ISM is constructed and the relative diagram is drawn.

## 4 MICMAC method

Cross-Impact Matrix Multiplication Applied to Classification (MICMAC) was proposed by Duperrin and Godet in 1973. Based on the principle of matrix multiplication, this method analyzes the position of each obstacle in the system and the degree of mutual influence by calculating their driver power and dependence. The calculation results are presented by two-dimensional coordinates, where the abscissa is the dependence and the ordinate is the driver power. The four quadrants are I(Autonomous), II(Dependent), III(Linkages), IV(Independent). The model is helpful to identify the key promotion obstacles requiring intervention and management<sup>16</sup>. The specific steps are as follows:

**STEP1: Calculate the Driver Power and Dependence of Each Obstacle.** The driver power is the sum of the rows in the reachability matrix where the obstacle is located, as shown in Formula (1). The dependence is the sum of the columns in the reachability matrix where the obstruction is located, as shown in (2).

$$DR(i) = a_i = \sum_{j=1}^n a_{ij} \quad (1)$$

$$DE(j) = a_{.j} = \sum_{i=1}^m a_{ij} \quad (2)$$

**STEP2: Draw Power Map.** According to the calculated driver force and dependence, obstacles are divided into the corresponding quadrants in turn and the analysis is carried out with a power map.

## 5 Empirical analysis

### 5.1 Questionnaire collection

To analyze the impact of the 21 identified obstacles on the promotion of green finance in China's underdeveloped regions and construct the ISM model, it is necessary to judge

the relationship between the obstacles. This paper first conducts an ISM panel discussion; then invites 15 experts from administrative organs and financial institutions to vaguely score the closeness of the 21 known obstacles. If more than half of the experts believe that the row factor has a significant impact on the column factor, it is marked as 1, otherwise 0. After integrating the scoring results, the adjacency matrix *A* is obtained, as shown in Table 2.

**Table 2.** Adjacency matrix *A*

|                       | <i>A</i> <sub>1</sub> | <i>A</i> <sub>2</sub> | <i>A</i> <sub>3</sub> | <i>A</i> <sub>4</sub> | <i>A</i> <sub>5</sub> | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> | <i>D</i> <sub>1</sub> | <i>D</i> <sub>2</sub> | <i>D</i> <sub>3</sub> | <i>D</i> <sub>4</sub> | <i>E</i> <sub>1</sub> | <i>E</i> <sub>2</sub> | <i>E</i> <sub>3</sub> | <i>E</i> <sub>4</sub> | <i>E</i> <sub>5</sub> |   |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---|
| <i>A</i> <sub>1</sub> | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1 |
| <i>A</i> <sub>2</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0 |
| <i>A</i> <sub>3</sub> | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0 |
| <i>A</i> <sub>4</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1 |
| <i>A</i> <sub>5</sub> | 1                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>B</i> <sub>1</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>B</i> <sub>2</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>B</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>C</i> <sub>1</sub> | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0 |
| <i>C</i> <sub>2</sub> | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>C</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>C</i> <sub>4</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>D</i> <sub>1</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>D</i> <sub>2</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>D</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>D</i> <sub>4</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>E</i> <sub>1</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 1 |
| <i>E</i> <sub>2</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>E</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>E</i> <sub>4</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>E</i> <sub>5</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |

Source: created by author

### 5.2 Calculation and analysis of ISM model

Based on the adjacency matrix *A* obtained in 5.1, the adjacency multiplication matrix is calculated by SPSSPRO; then the reachability matrix *M* can be obtained by continuously multiplying until the matrix does not change, as shown in Table 3. Following certain decomposition rules, 5 extractions are performed. Finally, it can be concluded that the system consists of six levels: B2, C3, D3 and E4 are the first layer; D4, E3, and E5 are the second layer; B1, D1, E1, and E2 are the third layer; A2, B3, C4, and D2 are the fourth layer; A1 and A4 are the fifth layer; A3, A5, C1, and C2 are the sixth layer. The ISM hierarchy is shown in Fig. 1.

**Table 3.** Reachability matrix *M*

|                       | <i>A</i> <sub>1</sub> | <i>A</i> <sub>2</sub> | <i>A</i> <sub>3</sub> | <i>A</i> <sub>4</sub> | <i>A</i> <sub>5</sub> | <i>B</i> <sub>1</sub> | <i>B</i> <sub>2</sub> | <i>B</i> <sub>3</sub> | <i>C</i> <sub>1</sub> | <i>C</i> <sub>2</sub> | <i>C</i> <sub>3</sub> | <i>C</i> <sub>4</sub> | <i>D</i> <sub>1</sub> | <i>D</i> <sub>2</sub> | <i>D</i> <sub>3</sub> | <i>D</i> <sub>4</sub> | <i>E</i> <sub>1</sub> | <i>E</i> <sub>2</sub> | <i>E</i> <sub>3</sub> | <i>E</i> <sub>4</sub> | <i>E</i> <sub>5</sub> |   |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---|
| <i>A</i> <sub>1</sub> | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1 |
| <i>A</i> <sub>2</sub> | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1 |
| <i>A</i> <sub>3</sub> | 1                     | 1                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1 |
| <i>A</i> <sub>4</sub> | 0                     | 0                     | 0                     | 1                     | 0                     | 1                     | 1                     | 1                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1 |
| <i>A</i> <sub>5</sub> | 1                     | 1                     | 0                     | 1                     | 1                     | 1                     | 1                     | 1                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1 |
| <i>B</i> <sub>1</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>B</i> <sub>2</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>B</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 1                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>C</i> <sub>1</sub> | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 1                     | 1                     | 1                     | 1                     | 1                     | 1 |
| <i>C</i> <sub>2</sub> | 0                     | 0                     | 0                     | 1                     | 0                     | 1                     | 1                     | 1                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 1 |
| <i>C</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>C</i> <sub>4</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 1                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>D</i> <sub>1</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>D</i> <sub>2</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>D</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>D</i> <sub>4</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0 |
| <i>E</i> <sub>1</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1 |
| <i>E</i> <sub>2</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0                     | 1                     | 0                     | 1                     | 0                     | 1 |
| <i>E</i> <sub>3</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1                     | 0 |
| <i>E</i> <sub>4</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0 |
| <i>E</i> <sub>5</sub> | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 1                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 0                     | 1                     | 1 |

Source: SPSSPRO

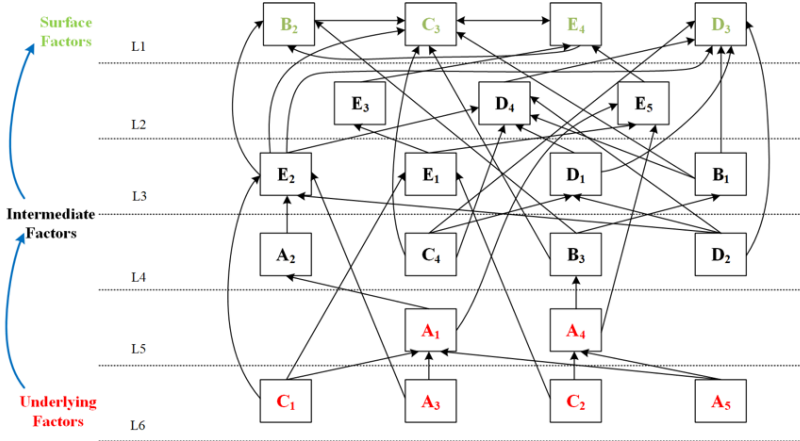


Fig. 1. ISM hierarchy diagram

Source: created by author

From Fig. 1, the ISM of the obstacles to the promotion of green finance in China's underdeveloped regions is a multi-level hierarchical system of 6 levels. According to the logical relationship between the factors of the system, level 1 is summarized as the surface factor. Levels 2,3 and 4 are summarized as the intermediate factors. Finally, levels 5 and 6 are summarized as the underlying factors.

The surface factor is affected by other factors, including 4 obstacles such as B<sub>2</sub>, C<sub>3</sub>, and E<sub>4</sub>. As for the obstacles containing the low level of cognition and the lack of green investment concept of investors, the government should increase the publicity of green financial products in underdeveloped regions through media and other channels to strengthen investors' understanding of the product. In terms of the alienation of the use of funds, China needs to formulate relevant policies to regulate the behavior of enterprises. In addition, the local government needs to improve the ability of product innovation and system research and development, increasing relative products.

The intermediate factors play a connecting role in the system, including 11 obstacles such as A<sub>2</sub>, B<sub>3</sub>, and E<sub>2</sub>. From the perspective of financial institutions, the main obstacles are the imbalanced development of green businesses, imperfect relative organizational framework, and weak service innovation. So, institutions should take the initiative to set up a green financial department; improve the professional level of employees; and carry out relevant business according to local conditions. In terms of enterprises, there is less voluntary environmental information disclosure because of the conflict between the green project and the profit of corporations. Additionally, information disclosure systems and sharing mechanisms are imperfect in such areas. So, the government needs to strengthen supervision and standardize the content and methods of information disclosure of relevant enterprises through administrative means and establish an open green information database.

The underlying factors play a decisive role in the system, including 6 obstacles such as A<sub>3</sub>, A<sub>5</sub>, and C<sub>2</sub>. As for the problems including unclear evaluation standards, imperfect supervision system, and time lag of policies, the government should formulate relevant

green standards and establish a green screening system by drawing on international experience. In addition, the accountability system of regulatory organizations should be constructed to clarify the legal responsibility of regulators. In terms of the obstacles such as the large income gap among regions, the imbalance of green financial market, and the lack of financial subsidies, China should strengthen the financial agglomeration effect in underdeveloped regions and further promote the rational allocation of green financial resources. Moreover, they should also improve the system of tax incentives.

### 5.3 Calculation and analysis of the MICMAC model

Based on the reachability matrix  $M$  obtained from Table 3 and combined with Chapter 4, the driver power and dependence values corresponding to each obstacle can be calculated respectively. Then, according to the calculation, it is corresponding to the four quadrants of the coordinate axis. It's noticeable that the obstacles with high driver power are usually the premise to solve other factors. See Fig. 2.

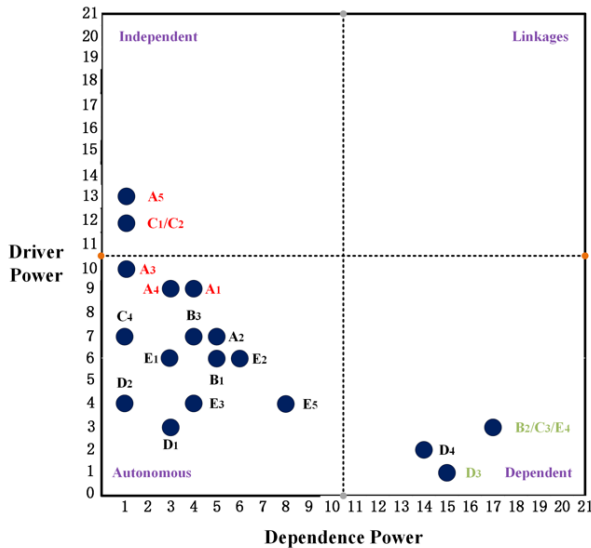


Fig. 2. Driver-Dependent power map

Source: created by author

The results of MICMAC analysis show that there are 13 obstacles belonging to the autonomous factor set, namely A<sub>1</sub>, A<sub>2</sub>, A<sub>3</sub>, A<sub>4</sub>, B<sub>1</sub>, B<sub>3</sub>, C<sub>4</sub>, D<sub>1</sub>, D<sub>2</sub>, E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>, and E<sub>5</sub>. Their driver power and dependence are relatively small, indicating that the correlation with the system is weak and independent of the system to a certain extent. There are five obstacles belonging to the dependent factor set, namely B<sub>2</sub>, C<sub>3</sub>, D<sub>3</sub>, D<sub>4</sub>, and E<sub>4</sub>, which have strong dependence and weak driver power. So they're greatly influenced by other factors. The factors that are concentrated in the linkage sets have strong driver power and dependence. But none of these obstacles belong to them, indicating that the



selected factors have good stability. Moreover, the obstacles belonging to the independent factor set play a leading role in the system, namely  $A_5$ ,  $C_1$ , and  $C_2$ , which have weak dependence and strong driver power. It's noticeable that  $A_5$  has the highest driver power, indicating that the time lag of policies is the deep obstacle to the promotion of green finance. If effective measures can be taken to shorten the time of policy implementation and effectiveness, it will gradually have a positive effect on the other obstacles, promoting the promotion of green finance in underdeveloped regions.

## 6 Conclusions

This paper uses grounded theory to identify and summarize 21 obstacles to the promotion of green finance; invites 15 experts to evaluate their correlation; and uses the ISM-MICMAC method to analyze. Specifically, the hierarchical analysis of the calculated reachability matrix  $M$  is first carried out through the ISM model and the internal structural relationship of obstacles is clarified in the form of a directed graph. Then the MICMAC model is used to calculate the driver power and dependence of each obstacle, determining the key one. The conclusions are as follows:

The ISM of the obstacles to the promotion of green finance in China's underdeveloped regions is a multi-level hierarchical system of 6 levels. The surface includes 4 obstacles, such as the lack of green investment concepts and the alienation of the use of funds. The intermediate includes 11 obstacles such as the imperfect information disclosure system and the long return period of green project investment. The underlying includes 6 obstacles, such as policy lag and the imbalanced regional green financial market. Under the MICMAC model, it can be concluded that the core underlying obstacles are the time lag of policies, the imbalanced green financial markets among regions, and the large income gap.

This paper puts forward corresponding solutions to the obstacles and provides empirical support and theoretical reference for the promotion of green finance in such regions. However, the paper fails to deeply explore the correlation between obstacles and solutions. Subsequent research can further study the interaction between factors to analyze the effectiveness of corresponding strategies and finally form the promotion path of green finance.

## References

1. Wang, Y.F., Zhang, S.Q. (2023) The impact of green financial reform and innovation on investment and financing of environmental protection enterprises--Empirical evidence based on the pilot zone of green financial reform and innovation [J/OL]. *China Circulation Economy*:1-11. <http://kns.cnki.net/kcms/detail/11.3664.F.20230511.1111.002.html>
2. Ling, Y., Xu, J., ÜlküM, A. (2022) A Game-Theoretic Analysis of the Impact of Government Subsidy on Optimal Product Greening and Pricing Decisions in a Duopolistic Market[J]. *Journal of Cleaner Production*, (338):13-28.
3. Kong, W.W., Song, T.H., Zhang, Y. (2023) Does financial technology promote commercial banks' green credit allocation? --A non-linear relationship test based on threshold effects

- [J/OL]. Finance and Accounting Newsletter:1-7. DOI: 10.16144/j.cnki.issn1002-8072.20230504.001.
4. Zou, X.P., Hu, J.W., Yao, N. (2019) Financial performance, environmental performance and investor choice of green portfolio investment funds [J]. Shanghai Economic Research, (12):33-44. DOI: 10.19626/j.cnki.cn31-1163/f.2019.12.005.
  5. Zhang, F., Yu, H.T. (2023) Have green credit policies driven green innovation in heavy polluters? -- An empirical test based on firm life cycle theory [J/OL]. Nankai Management Review:1-22. <http://kns.cnki.net/kcms/detail/12.1288.f.20230323.1725.006.html>
  6. Feng, G., Lv, J.X. (2022) Legal prevention of alienation of green bond fund-raising-centering on the improvement of information disclosure system [J]. Hebei Law, 40(11):72-88. DOI: 10.16494/j.cnki.1002-3933.2022.11.004.
  7. Zhou, Q., Zhu, Y.F. (2023) The institutional bottleneck of China's green trust development and the path to break it[J]. Environmental Protection, 51(03):35-39. DOI: 10.14026/j.cnki.0253-9705.2023.03.014.
  8. He, L.Y., Liang, X., Yang, X.L., et al. (2019) Can green credit promote technological innovation of environmental protection enterprises [J]. Studies in Financial Economics, 34 (05):109-121.
  9. Zhou, H.C. (2020) Research on the social governance system of green consumption [J]. China Environmental Management, 12 (01):31-36. DOI: 10.16868/j.cnki.1674-6252.2020.01.031.
  10. Wang, Y., Cheng, L.L. (2023) Strategies for the development of green finance in less developed regions [J]. China Finance, (04):103.
  11. Song, Q.H., Lin, Y.K. (2023) Financial agglomeration and green technology innovation of manufacturing enterprises in the context of accelerating the construction of a manufacturing power [J]. Research in Financial Economics, 38 (01):84-99.
  12. Chen, F.K., Zhang, Y.H. (2022) Can green bond issuance trigger a positive market response? --The policy incentive effect of the "double carbon" target [J]. Securities Market Herald, (07):48-60.
  13. Li, C., Bai, W., Wang, Y., et al. (2016) How can green credit policies be effectively implemented by commercial banks? --A study based on evolutionary game theory and DID model [J]. Nanfang Finance, (01):47-54.
  14. Zhou, Y., Chen, H. (2022) Study on the development of green credit under ESG information disclosure mechanism - based on the perspective of corporate disclosure [J]. Southwest Finance, (11):72-83.
  15. Li, Y.H., Yuan, Y.W. (2021) A study on the mechanism of green transformation in manufacturing industry under carbon neutrality target--based on ISM-MICMAC model [J]. Management Modernization, 41(06):100-104. DOI: 10.19634/j.cnki.11-1403/c.2021.06.023.
  16. Huang, P.P., Liu, W.W., Sun, Z.T. (2022) Analysis of factors influencing personal privacy protection in open government data based on ISM-MICMAC model[J]. Intelligence Theory and Practice, 45(03):65-71. DOI: 10.16353/j.cnki.1000-7490.2022.03.010.

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