Structural Analysis of the Factors Influencing the Financing of Forestry Enterprises Based on Interpretive Structural Modeling (ISM)

Zhen WANG[1], Weiping LIU[2*], Xiaomin JIANG[2]

1. College of Management, Fujian Agriculture and Forestry University, Fuzhou 350002, China; 2. College of Economics, Fujian Agriculture and Forestry University, Fuzhou 350002, China

Abstract Through the collection of related literature, we point out the six major factors influencing China's forestry enterprises' financing: insufficient national support; regulations and institutional environmental factors; narrow channels of financing; inappropriate existing mortgage-backed approach; forestry production characteristics; forestry enterprises' defects. Then, we use interpretive structural modeling (ISM) from System Engineering to analyze the structure of the six factors and set up ladder-type structure. We put three factors including forestry production characteristics, shortcomings of forestry enterprises and regulatory, institutional and environmental factors as basic factors and put other three factors as important factors. From the perspective of the government and enterprises, we put forward some personal advices and ideas based on the basic factors and important factors to ease the financing difficulties of forestry enterprises.

Key words Forestry enterprises, Financing, Interpretive structural modeling (ISM)

1 Introduction

Difficult financing for the forestry enterprises is a major obstacle to China's forestry development, and many domestic experts and scholars have done a lot of researches on this issue. There are many problems in the financing of China's forestry enterprises. First of all, there is a shortage of funds for the production of forestry enterprises, and insufficient funds have become a constraint on the development of forestry enterprises. Secondly, the fund input structure is irrational, and from the forestry fund composition for nearly three years, the vast majority of the funds are from the budget. In addition, the self-financing capacity of enterprises is poor, and in recent three years, the proportion of self-raised funds of enterprises to the budget funds is no more than 14%, and the self-raised funds were only 6.3 million yuan in 2012, accounting for only 10.54%. There are many reasons for the difficulties in the current financing of China's forestry enterprises. Liang Zhenjun (2008) believes that the main reason for the currently difficult financing of China's forestry enterprises lies in the single financing channels, difficult pledge of assets and unsound laws and regulations[1]. Zhu Yangsheng (2009) analyzes the problems in the current financing of China's forestry enterprises and points out two influencing factors (weakness of enterprises and inadequate government's macroeconomic policy support[2]. In the context of financial crisis, Gao Xuefeng (2009) analyzes the factors restricting the financing of China's forestry enterprises, mainly including profit decline of enterprises, internal financing problems and decreasing credit[3]. Wang Junqiu (2012) maintains that the factors responsible for the current insufficient investment of forestry enterprises and slow financing include inadequate government financial investment, slow development of forestry capital market and heavy tax burden[4]. From the perspective of investors, Cao Huazheng (2012) summarizes the main difficulties of financial institutions in supporting the development of forestry enterprises, including slow development of China's forest ownership transfer market and difficult supervision on loan assets[5]. From the perspective of the credit guarantee, Yuan Mei (2013) explores the problems in the financing of forestry enterprises, and she believes that the main factors influencing the debt financing of China's forestry enterprises include false credit of forestry enterprises and imperfect credit guarantee law[6]. Xu Jinyu (2013) analyzes the current situation and problems of difficulties in the financing for small and medium-sized forestry enterprises, and he believes that imperfect financing channels and credit guarantee system are the main factors affecting the financing of China's forestry enterprises[7]. According to previous research, we summarize the reasons for difficult financing of China's forestry enterprises in three aspects: government policies, financial credit, and forestry enterprises themselves. Based on the three aspects, we use interpretive structural modeling (ISM) method in system engineering to build a hierarchical structure model to identify the fundamental factors and advanced factors affecting the financing of forestry enterprises in order to provide a theoretical basis for easing the financing difficulties of forestry enterprises.

2 Definition of the factors influencing the financing of forestry enterprises

The factors affecting the financing of forestry enterprises involve not only the aspects concerning national and financial institutions, but also the factors concerning the enterprises. Through the review of previous studies, we summarize six major factors affecting the financing of China's forestry enterprises (Table 1).

Received: November 26, 2014 Accepted: February 6, 2015
* Corresponding author. E-mail: wangzhen5288@163.com

Table 1 The factors affecting the financing of forestry enterprises

Factors	Explanation
Insufficient national support	Insufficient national aid; inadequate national credit policy support for the weak forestry industry
Regulations, institutional environmental factors	Forestry property rights system; logging quota system; forestry tax burden
Narrow channels of financing	Mainly indirect financing
Inappropriate existing mortgage-backed approach	Cumbersome mortgage procedures, scarce collaterals and low business credit
Forestry production characteristics	Long periodicity of forestry production; great risk of forestry production; low comparative benefit of forestry production
Forestry enterprises' defects	The problems for forestry enterprises in terms of finance, management, technological development and product

3 Structural analysis of the factors influencing the financing of forestry enterprises

3.1 Model selection According to the above six factors as elements of the structural model, we build a structural model indicating the relationship between the factors. In this paper, the interpretive structural modeling (ISM) is chosen as the analytical model of this study. Interpretative structural modeling (ISM), a systematic analysis method developed by John N. Warfield in 1973, can translate vague ideas into a model with well-structured relationship. ISM steps include selecting the members implementing ISM, setting the questions, choosing the elements that constitute the problem, establishing the mutual relationship between the elements, building the structural model, and explaining the meaning of structural model. Building the structural model includes building the reachability matrix, and thus establishing structural analysis model[8]. The interpretive structural modeling defines the six major factors as a system, and the highest level of the system is the research topic of this paper-the financing of forestry enterprises. A subsystem consisting of various influencing factors is below the highest level. We use the interpretive structural modeling to decompose the whole subsystem and identify the level of each influencing factor in order to establish a structured hierarchical model. And we clearly determine the fundamental factors and advanced factors.

3.2 Model establishment and analysis

3.2.1 Determining the correlation between the factors influencing the financing of forestry enterprises. Assuming S_1, S_2, S_3, S_4, S_5 and S_6 represent the six major influencing factors, and S_0 represents the dependent variable of financing. If S_i has an impact on S_j, then $S_{ij}=1$, indicating that the two factors are correlated, otherwise $S_{ij}=0$, as shown in Table 2.

Table 2 The correlation between the factors influencing the financing of forestry enterprises

		S_0	S_1	S_2	S_3	S_4	S_5	S_6
Financing	S_0	0	0	0	0	0	0	0
Insufficient national support	S_1	1	0	0	1	0	0	0
Regulations, institutional environmental factors	S_2	1	0	0	1	1	0	0
Narrow channels of financing	S_3	1	1	0	0	0	0	0
Inappropriate existing mortgage-backed approach	S_4	1	0	0	0	0	0	0
Forestry production characteristics	S_5	1	0	0	0	0	0	1
Forestry enterprises' defects	S_6	1	0	0	1	0	0	0

3.2.2 Establishing the adjacency matrix and reachability matrix. These six factors in the model are correlated, and the adjacency matrix (B) is used to describe the relationship between them. The matrix element b_{ij} means that element S_i has a direct impact on S_j, otherwise, $b_{ij}=0$. After the analysis and discussion, the adjacency matrix is established (Table 3). The adjacency matrix simply reflects the direct relationship between the elements, and the reachability matrix M can reflect the indirect relationship between them. The reachability matrix can be calculated by matrix B: $B_1=B$, $B_2=B^2$, $B_3=B^3\cdots\cdots$, eventually we get the reachability matrix M[9].

$$\begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 1 & 1 \\ 1 & 0 & 0 & 1 & 0 & 0 & 1 \end{bmatrix}$$

3.2.3 Dividing the reachability matrix to obtain the skeleton matrix. Regional decomposition is performed on M. Then we calculate the reachable set and preceding set of various elements in the system, as well as common set of two. The reachable set is $R(S_i)$, preceding set is $B(S_i)$, and common set is $C(S_i)$, as shown in Table 3.

Table 3 The first level of reachability set and preceding set

Elements	$R(S_i)$	$B(S_i)$	$C(S_i)$
S_0	0	0, 1, 2, 3, 4, 5, 6	0
S_1	0, 1, 3	1, 3, 5	1, 3
S_2	0, 2, 3, 4	2, 5	2
S_3	0, 3	1, 2, 3, 5, 6	3
S_4	0, 4	2, 4, 5	4
S_5	0, 5, 6	5	5
S_6	0, 3, 6	5, 6	6

At this level, only $R(S_0)=R(S_0)\cap B(S_0)$, so highest-level element is 0, and the first layer element is S_0. After scoring out

the rows and columns that S_0 corresponds to, we get the second level R and B, as shown in Table 4:

Table 4 The second level of reachability set and preceding set

Elements	$R(S_i)$	$B(S_i)$	$C(S_i)$
S_1	1, 3	1, 3, 5	1, 3
S_2	2, 3, 4	2, 5	2
S_3	3	1, 2, 3, 5, 6	3
S_4	4	2, 4, 5	4
S_5	5, 6	5	5
S_6	3, 6	5, 6	6

At this level, $R(S_1) = R(S_1) \cap B(S_1)$, $R(S_3) = R(S_3) \cap B(S_3)$, $R(S_4) = R(S_4) \cap B(S_4)$, so the second level elements are S_1, S_3 and S_4. After scoring out S_1, S_3 and S_4, we get the third level R and B, as shown in Table 5:

Table 5 The fifth level of reachability set and preceding set

Elements	$R(S_i)$	$B(Si)$	$C(S_i)$
S_2	2	2, 5	2
S_5	5, 6	5	5
S_6	6	6	6

At this level, $R(S_2) = R(S_2) \cap B(S_2)$, $R(S_6) = R(S_6) \cap B(S_6)$, so the third level elements are S_2 and S_6, and the fourth level elements is S_5.

3.2.4 Interpretive structural modeling. By the decomposition of reachability matrix, we finally get the interpretive structural modeling as shown in Fig. 1.

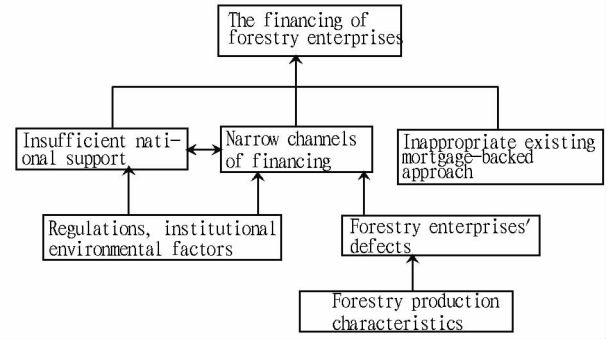

Fig. 1 The interpretive structural modeling

4 Conclusions

As can be seen from Fig. 1, the factors affecting the financing of forestry enterprises present a four-level hierarchical structure model. The financing of forestry enterprises is regarded as the ultimate goal; insufficient national support, narrow channels of financing and inappropriate existing mortgage-backed approach are regarded as the advanced factors; regulations, institutional environmental factors, forestry enterprises' defects and forestry production characteristics are regarded as the fundamental factors. The forestry production characteristics are not determined by human. The regulatory and institutional factors are the influencing factors at national macro-level. The main institutional constraints on the current financing of forestry enterprises include the forestry property rights system, logging quota system and forestry tax burden[10], so the government should appropriately relax the policy from the three aspects. For forestry enterprise itself, there are many problems such as weak technology foundation, poor management and chaotic operation[11], so it is necessary to strive to regulate the business operation and management. The advanced factors include inappropriate existing mortgage-backed approach, narrow channels of financing and insufficient national support. Government and financial institutions should develop the forest loan management practices and guarantee mechanism in line with reality, and use the laws to protect the legitimate rights and interests of private lenders for forestry enterprises[7]. In addition, the government should offer some preferential tax, finance and service policies for forestry enterprises. The development of forestry enterprises not only affects the benefits of basic forestry industry and economic industry, but also has a significant impact on people's daily life. In order to solve the financing problem for forestry enterprises, it not only needs the national policy support, but also needs the sound management of forestry enterprises. It is necessary to establish good organizational structure and management system, actively introduce innovative products, and change the single industrial structure, to promote the sustainable economic development in China.

References

[1] LIANG ZJ. Study on channel of investment and financing of forestry in China[J]. Shanxi Forestry Science and Technology,2008,6(2):54-55. (in Chinese).
[2] ZHU YS. On financing of forestry enterprises[J]. Forestry Economics,2009(5):71-73. (in Chinese).
[3] GAO XF. The discussion of financial crisis influence on financing of forestry enterprises[J]. Forestry Economics,2009(8):31-33. (in Chinese).
[4] WANG JQ. Study on enhancing investment and financing management of forestry enterprise[J]. Corporation Research,2012(16):103-106. (in Chinese).
[5] CAO HZ. Policy suggestions on improving policy-oriented finance to better support small and medium-sized enterprises related to forestry[J]. Forestry Economics,2012(11):47-50. (in Chinese).
[6] YUAN M. Debt financing problems and countermeasures based on the credit guarantee on forestry enterprise[J]. Forestry Economics,2013(6):118-121. (in Chinese).
[7] XU JY, YANG XQ. Forestry small and medium-sized enterprise financing difficulties and countermeasures[J]. China Forestry Economy,2013,119(2):12-15. (in Chinese).
[8] WANG YL. System engineering(the 4th edition)[M]. Beijing: China Machine Press,2011:6-9. (in Chinese).
[9] CHENG B, LI BX. Interpretative structural modeling method based on analysis of entrepreneurs capacity factors [J]. Journal of Xi'an University of Technology,2010,26(2):239-241. (in Chinese).
[10] ZHANG LH, YANG JZ. Review on literature of national forestry financing problems[J]. Green Finance and Accounting,2008,38(9):15-19. (in Chinese).
[11] WANG BP, WANG X, NIU GX. Analysis on related problems of forestry financing[J]. Economic Research Guide,2012,180(34):89-90. (in Chinese).