

A Study on Influencing Factors of Differential Management System of Tobacco Farmers Based on ISM Model

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Abstract: This paper uses the method of literature metrology to statistical analyze related literatures. 14 influencing factors of differential management system of tobacco farmers are determined and selected from predecessors' research achievements. Relational structure of 14 influencing factors are analyzed by ISM model. This results show that sales average price, family members participated in the cooperative, yields per acre, production costs per acre and situation of accepting professional service are fundamental factors. The study have important significance for grasping the formation, development and evolution mechanism of differential management system of tobacco farmers.

Introduction

In recent years, agricultural production in our country gets into high cost, high risk, tight constraints of resources and influencing, youth labor shortage stage. Part-time Farmer, empty villages and ageing population are increasingly apparent. The number of farmers, especially young farmers, has sharply decreased. "Who farming" problem caused a heated debate, also caused attention of center. As an important part of agricultural industry, tobacco industry also faces the same problem.

With change of agricultural production and deepening of industry internal reform, the voice of building service brand is increasing. classification management of tobacco farmers is a new thing. Its differential management and service introduce a new guided competition and humane care mechanism between tobacco farmers, which still have some problems that need to explore and improve. According to the demand of modern tobacco agriculture development in southwestern Guizhou, we establish classification of tobacco farmers, differential management and service that are suitable for the production practice, to improve performance consciousness, contract execution and loyalty of tobacco farmers, improve production level, establish a team who have culture, technology and good management, promote sustainable and healthy development of modern tobacco agriculture.

At present, there is little research on differential management system and influencing factors of tobacco farmers at home and abroad. P. J. Taylor (2014) studied the operation of differential management system of tobacco farmers in northeast United States tobacco growing regions. The tobacco growing regions, according to classification of tobacco growers, combined with current tobacco production support policies, determine differential management measures between different categories of farmers, achieve the purpose of supporting, promotion, training all types of farmers,

establish a stable, high level team of tobacco farmers. Annual turnover of tobacco in this production areas which is the center of national tobacco production, trade and business , accounted for more than a third of the United States ^[1].

F. Sager (2014) ,with case study, analyzed differentiated management system and its influencing factors of tobacco farmers in London tobacco-producing areas. He found yield per acre and output value per acre, sales average price and proportion of superior tobacco are the influencing factors. Among them, yield per acre and output value per acre are the most important influencing factor, whose impact contribution rate more than 73% ^[2].

E. J. Meijers (2015) analyzed differentiated management system and its influencing factors of tobacco farmers in pacific coast of Japan tobacco-producing areas. He considered the planting area, situation of accepting professional service, family members participated in cooperatives, times of professional training, production cost and proprietary large agricultural machinery operation have a significant effect on differentiation management system of tobacco farmers. Times of professional training is the biggest influencing factors. By multivariate statistical regression methods, every one percent increasing in the number of professional training will lead to 0.74% increasing in output efficiency ^[3].

Influencing Factors Determination of Differential Management System of Tobacco Farmers

The literature metrology studies the quantity, quality and application of essence and structure about various types of documents by using the theory and method of mathematics, statistics and logic ^[4]. In this paper, this method is used to determine and select influencing factors of differential management system of tobacco farmers from predecessors' research achievements. Chinese journal full-text database did not have papers about influencing factors of differential management system of tobacco farmers before 2000. There are 34 papers of which title contains "influence factors of differential management system of tobacco farmers" in Chinese journal full-text database from January 2000 to July 2015. With the method of literature metrology, We analyze influencing factors that were studied or mentioned in various literatures, and get 14 important factors, including yield per acre, output value per acre, sales average price, proportion of superior tobacco, planting area, situation of accepting professional service, family members participated in cooperative, times of professional training, production cost per acre, proprietary large agricultural machinery operation, intensive baking, leaf baking and other special skills, income proportion of tobacco, years of continuous planting tobacco.

Relationship Structure Analysis of Influencing Factors

Determination of the Relationship between Various Factors

In order to analyze the impact of these factors on differential management system, we establish a interpretation structure model^[5]. First, combined with previous research results, we clarify the logical relationship between various factors, as shown in figure 1. The "A" in the figure represents

the row factors have a direct impact on the column factors. The "V" represents the column factors have a direct impact on the row factors. "X" represents the row factors and the column factors have a direct impact on each other. "O" represents the row factors and the column factors do not have a direct impact on each other.

S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	
	A	O	O	O	O	X	O	O	O	O	O	O	O	A	S_1
		O	O	V	O	V	V	V	O	O	O	O	O	A	S_2
			O	A	O	X	O	O	A	O	O	A	O	A	S_3
				O	O	O	O	O	O	O	O	O	O	A	S_4
					O	O	O	V	O	O	O	O	O	A	S_5
						O	O	A	A	O	O	O	O	A	S_6
							A	O	O	A	A	O	O	A	S_7
								V	O	O	O	O	O	A	S_8
									A	O	O	O	O	A	S_9
										O	A	A	O	A	S_{10}
											A	V	O	A	S_{11}
												A	O	A	S_{12}
													O	A	S_{13}
													A	S_{14}	

Fig. 1 Logical Relationship Between Various Factors

According to Figure 1, we can get correlation matrix R, R is 15order square matrix. Elements of R

are defined as $r_{ij} = \begin{cases} 1, & S_i \text{ directly impact } S_j \\ 0, & S_i \text{ not directly impact } S_j \end{cases}, (i, j = 1, 2, \dots, 15),$

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

Relationship Between Different Levels of Various Factors

The reachable matrix $M = (R + I)^4$ is obtained by correlation matrix R, and I is the 15 order

unit array, M is calculated by Matlab software.

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

The data of reachable collection $R(S_i)$, antecedent collection $A(S_i)$ and their Intersection $R(S_i) \cap A(S_i)$ in reachable matrix M are shown in table 1

Table 1 The First Level of Reachable Collection and Antecedent Collection

S_i	$R(S_i)$	$A(S_i)$	$R(S_i) \cap A(S_i)$
1	1,2,3,5,7,8,10,11,12,13,15	1,3,7	1,3,7
2	2,15	1,2,3,5,6,7,8,9	2
3	1,2,3,5,7,8,10,11,12,13,15	1,3,7	1,3,7
4	4,15	4	4
5	2,5,15	1,3,5,6,7,9	5
6	2,5,6,8,9,10,11,12,13,15	6	6
7	1,2,3,5,7,8,10,11,12,13,15	1,3,7	1,3,7
8	2,8,15	1,3,6,7,8,9	8
9	2,5, 8,9,10,11,12,13,15	6,9	9
10	10,11,12,13,15	1,3,6,7,9,10	10
11	11,12,13,15	1,3,6,7,9,10, 11,12,13	11,12,13
12	11,12,13,15	1,3,6,7,9,10, 11,12,13	11,12,13
13	11,12,13,15	1,3,6,7,9,10, 11,12,13	11,12,13
14	14,15	14	14
15	<u>15</u>	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15	<u>15</u>

(1) The first node of influencing factors can be obtained from data in table 1 : $L_1 = \{15\}$.

(2) Delete the line 15 and the column 15 of reachable matrix, get the second node:

$$L_2 = \{2,4,11,12,13,14\}.$$

(3) Delete the line 2、4、11、12、13、14 and the column 2、4、11、12、13、14, get the third node: $L_3 = \{5,8,10\}$.

(4) Similarly [6], the fourth node and the fifth node: $L_4 = \{1,3,7,9\}$, $L_5 = \{6\}$.

According to the above analysis, we establish interpretive structural model of influencing factors of differential management system of tobacco farmers, as shown in figure 2.

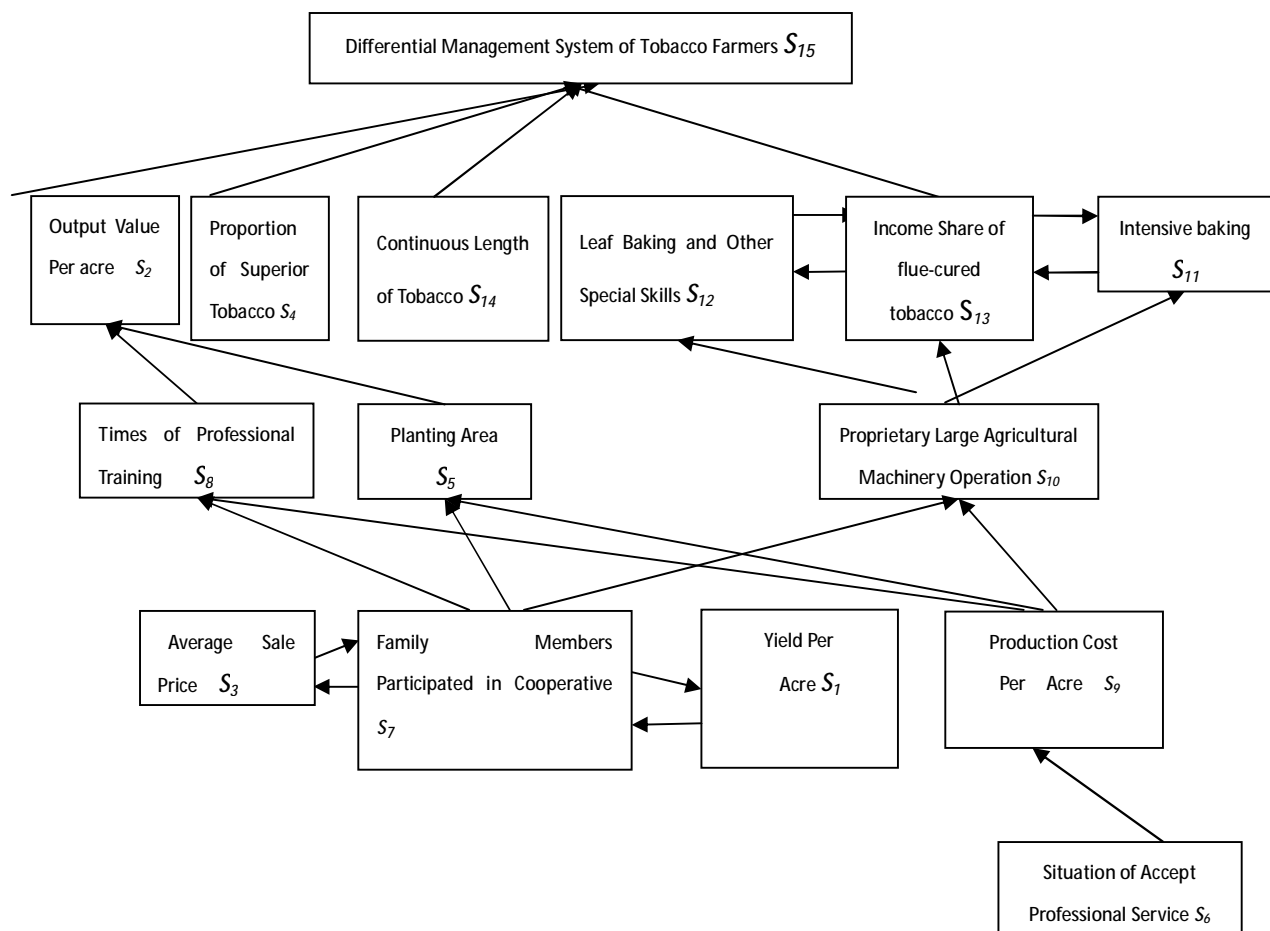


Fig. 2 Interpretive Structural Model of Influencing Factors of Differential Management System

Conclusion

As shown in figure 2, differential management system of tobacco farmers is a hierarchical structure with 5 levels. The first level of influencing factors is differential management system of tobacco farmers (S_{15}). The second level includes output value per acre S_2 , proportion of superior tobacco S_4 , continuous length of tobacco S_{14} , leaf baking and other special skills S_{12} , income share of flue-cured tobacco S_{13} , intensive baking S_{11} . The third level includes times of professional training S_8 , planting area S_5 , proprietary large agricultural machinery operation S_{10} . The fourth level includes average sale price S_3 , family members participated in cooperative S_7 , yield per acre S_7 , production cost per acre S_9 . The fourth level includes Situation of accepting professional

service S_6 .

The relationship of influencing factors of differential management system of tobacco farmers can clear the structure between various factors, by which we can find out surface direct influencing factors, middle and indirect influencing factors, fundamental influencing factors. Average sale price, family members participated in cooperative, yield per acre production cost per acre, situation of accepting professional service are fundamental influencing factors, which produce deep and fundamental impact on the formation, development and evolution of differential management system of tobacco farmers. Distinguishing the function levels and their relationship of each influencing factor has important significance for grasping the formation, development and evolution mechanism of differential management system of tobacco farmers.

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