

## **Analysis on the Influencing Factors and Mechanism of Farmers' Will to the Treatment of Livestock and Poultry Breeding Pollution**

—Survey from 447 Farmers in Hunan Province

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**Abstract**—Farmers are the main participants involved in livestock and poultry breeding pollution control, whether they are willing to control the breeding pollution by the mutual influence of many factors. Based on the field survey data of 447 households in Hunan Province, the Logistic regression model and the ISM model analysis results show that among the significant factors affecting farmers' willingness of livestock and poultry breeding pollution control, on-site supervision and publicity of environmental protection personnel, waste management provisions of the villages and towns, national antifouling regulation policy constraints, the cognition of the surrounding ecological environment, and the cognition of the livestock and poultry waste pollution degree to the environment are the surface direct factors; Education, social work experience, breeding training in situation, and the specialized degree are the middle indirect factors. Breeding scale is the deep root factor. Promoting the standardized scale of livestock and poultry breeding, multi-channel enhancing the culture quality of farmers, and improving the breeding pollution-control system will help farmers to improve pollution governance will and to reduce the pollution.

**Keywords**-farmer; livestock and poultry breeding pollution; theory of planned behavior; influence factors; ISM model

### I. PROBLEM INTRODUCTION

In recent years, with the livestock farming scale expands unceasingly in our country, China has become the world's largest producer of livestock and poultry. Although the government continues to increase the ecological breeding technology and the pollution treatment technology promotion efforts, but the situation of the livestock and poultry feces pollution is still serious. The first national pollution census bulletin shows that in 2007 the generation of the China's livestock and poultry breeding excrement and urine respectively were 243 million tons, 163 million tons, and the main water pollutants emissions of chemical oxygen demand (cod), total nitrogen, total phosphorus respectively were 12.6826 million tons, 1.0248 million tons, 12.6826 million tons, accounting for the agricultural pollution sources, the main water pollutants (loss) of the proportion

of chemical oxygen demand (cod), total nitrogen, total phosphorus respectively were 95.78%, 37.89%, 56.34%, accounting for the various pollution sources in the country, the main water pollutants (loss) of the proportion of chemical oxygen demand (cod), total nitrogen, total phosphorus respectively were 41.87%, 21.67%, 37.90%[1]. This suggests that livestock and poultry breeding pollution has become the main environmental pollution sources in China. With the expansion of the amount of livestock farming, livestock and poultry breeding emissions will continue to rise.

In the existing literature, to control technology as the core of environmental engineering research occupies the mainstream of livestock and poultry breeding pollution prevention, but related research results about the farmers' willingness to control the pollution of livestock and poultry breeding are less, which are mostly combined with the households agricultural non-point source pollution research. About farmers in livestock and poultry breeding pollution of cognition and intention and its influence factors, scholars research mainly embodied in the individual characteristics of farmers, breeding characteristics, cognitive attitude and the constraints of the government of livestock and poultry breeding pollution remediation measures. Individual factors such as age, sex, cultural level, social identity, and so on, are the important variables influencing the willingness of governance. Yu Xiao etc. (2014) based on the analysis of Fujian 286 copies of questionnaires, found that the relationship between farmers' education level and farmers' willingness to participate in livestock and poultry breeding were positively correlated. The higher the education level, the higher the willingness to participate [2]. The breeding characteristics of farmers breeding specialization degree, family income structure, the scale of the breed, the breed, breeding technical training experience are the important factors which influence the farmers' willingness to control the pollution. In the behavior of livestock and poultry breeding, the expansion of the scale of farming can significantly improve the farmers' willingness to deal with the pollution of animal husbandry [3] [4]. Usually, farmers have more rich knowledge, more attention to the

surrounding ecological environment, the cognitive ability for breeding pollution and environmental problems is stronger, and the breeding of the harm of waste emissions at random to itself and the surrounding environment cognition the more deep, its management of aquaculture pollution will more strong[5]. The disposition behavior of the farmer's breeding pollution is a choice, which is made under various institutional constraints or incentives, including relevant environmental control policies, local economic development level, and so on. The study found that government subsidies, waste management regulations, the number of the village committee to carry out publicity etc. will have a significant impact on the harmless treatment of the livestock pollution [6] [7].

The above research results to promote the management of livestock and poultry breeding pollution, to reduce the pollution of breeding and to promote the sustainable development of breeding have important theory value and practical significance. But they mostly focus on the on one aspect of the influence of household livestock and poultry breeding pollution governance willing, extremely lack of the overall and comprehensive research perspective, and they mostly stay in remarkable influence factors and to what extent and direction of the levels, lack of the related relationship among the influencing factors in-depth inquiry. At the same time, in the agricultural non-point source pollution, the proportion of livestock and poultry pollution is very big, but there are few studies on the behavior of farmers' livestock and poultry breeding environment in the academic field. Based on the above practical and academic background, this paper on the basis of existing research, combined with the survey data of farmers in Hunan Province, using the logistic model and the ISM model, comprehensive analysis of farmer livestock and poultry farming pollution governance willing and its influencing factors and tried to reveal the layer structure between the influencing factors, in order for the relevant departments to develop on promoting farmers livestock pollution to participate in the pollution will provide a reference.

## II. THEORETICAL ANALYSIS AND THE RESEARCH HYPOTHESIS

### A. *the Theoretical Analysis*

Theory of Planned Behavior (TPB) is a classical theory to explain and predict human behavior in the area of social psychology. According to the theory, all the factors that may affect the behavior are mostly influenced by behavior intention indirectly, and the behavior intention is mainly controlled by the behavior attitude, subjective norm and perceived behavior control. Generally speaking, for an act of individual attitudes, positive subjective norms, and perceived behavioral control more forward stronger, the stronger the individual's behavioral intention[8][9].

Farmers of livestock and poultry breeding pollution control actions are farmers planned behavior decision, following the theory of planned behavior. On factors influencing the farmers of livestock and poultry breeding pollution control will, behavioral attitude is the individual

on the implementation of a specific act of cognition and evaluation [10], farmers' cognition and evaluation of livestock and poultry breeding pollution and the tendency to some extent, determine its governance farmers processing of livestock excrement attitude. Farmers on the surrounding ecological environment, the more attention, the cognition of breeding waste pollution to the environment, the greater the possibility of governance; the greater the likelihood of the governed; Subjective norms are farmers in the disposal of livestock and poultry breeding waste, may be subject to the external pressure or thrust, such as the national livestock and poultry breeding pollution prevention and related environmental protection laws and regulations and restriction and incentive, the surrounding neighbors or friends agricultural waste disposal demonstration and information feedback, where villages and towns village about constraints or punishment, etc.; Perceived behavioral control is farmers of governance arbitrarily discarded farming excreta or execution of factors to consider, by the mutual influence of many factors, including family endowment resources, social resources and the breeding of past experience summary.

### B. *the Research Hypothesis*

Based on the theory of planned behavior, drawing lessons from existing research results, this paper from the individual characteristics of the farmers, breeding behavior, cognitive features and social environment, proposed the farmers of livestock and poultry breeding pollution willingness influencing factors hypothesis.

- The individual characteristics of farmers affect the willingness to control the pollution of livestock and poultry breeding

Farmers' individual characteristics mainly include age, gender, cultural factors, social positions, the difficult degree of information obtained. (1) Older farmers tend to be more conservative, more satisfied, more willing to governance on breeding pollution;(2) In the countryside, the male master knowledge of livestock and poultry breeding pollution was more abundant than women, and thus its governance of breeding pollution will more strong;(3) The cultural quality of farmers determines the economic behavior of the farmers to a large extent, the higher the level of the cultural level, the greater awareness of the harm to the environment, and the higher the participation in governance;(4) Due to the farmers to access information (government propaganda, neighbor communication channels and sufficient or not, the farmers in the face of breeding pollution, often in the presence of revenue, cost, risk, whether farmers are willing to pollution control and understanding of these risks has great relationship. In addition, Individual and diverse social work experience will have an important impact on the governance of the willingness.

- The characteristics of breeding behavior have influence on farmers' willingness to control the pollution of livestock and poultry breeding

Farmers breeding behavior characteristics mainly include the scale of farming, the degree of specialization, the breeding training to participate in the training.

Standardized scale farmers. (1) Standardized scale farmers (field) implement intensive and professional farming, with a higher degree of attention of the society and the local government, the behavior of not handling arbitrary discharge breeding excreta will not only can lead to increased risk of disease in itself, but also a greater impact on the environment and the surrounding neighbors, which will make the farmers face punishment and reputation loss, therefore, compared with free-range farmers, scale farmers (farm) of breeding pollution control wishes will more intense; (2) The high degree of specialization of the farmers, less avocation situation, breeding industry as the main source of family income, their breeding pollution control may be higher than the wishes of the low degree of specialization of farmers; (3) Cultivation training can improve the farmers' ability in the aspects of ecological farming, pollution prevention and control of the cognitive level and application, promote the farmers between the exchange and study of science, ecological farming, therefore, the farmers who participated in the training of training have more profound than those who did not participate in the training of farmers for awareness of pollution, more strong willingness to harness breeding pollution; (4) Farmer cooperative organization or association on the basis of farmer, can provide effective services for farmers in farming the whole process, such as varieties of livestock and poultry, feed, veterinary drugs, money and technology consulting and services, sales, etc. As a result, the farmers who joined the cooperative organization had better material base and information condition and poultry pollution control will than those who did not.

- Cognition characteristics affect farmers' willingness to control the pollution of livestock and poultry breeding

Cognitive characteristics refers to the farmers' knowledge of livestock waste pollution to the environment and perception of the surrounding ecological environment. (1) The farmers in livestock waste pollution to the environment of the cognitive degree is higher, the more they can understand the importance of livestock and poultry breeding pollution prevention, the tendency of its governance is more intense; (2) The more the farmers pay attention on the surrounding ecological environment, the more they have cognition of the pollution of the breeding in place, the greater the possibility of pollution control of the breeding is.

- The characteristics of social environment have influence on Farmers' will to control the pollution of livestock and poultry breeding

The characteristics of the social environment mainly include the restriction of the national anti-pollution regulations and policies and regulations of the management of rural garbage, the supervision and publicity of the government departments. (1) The national breeding pollution control policy to regulate the behavior of farmers breeding waste disposal has a constraint function, of the scale farmers are particularly effective; (2) The government's supervision and publicity can enhance the cognition of the breeding pollution of the farmers, and guide the breeding

behavior of farmers, and to a certain extent increase farmers farming pollution control willingness; (3) Rural garbage management regulations will restrict or punish the improper environmental behavior of farmers, so that farmers face penalties and credit losses. Therefore, the farmers who are bound by the mandatory waste management provisions of the villages and towns, their willingness to control the pollution of livestock and poultry breeding is higher than that of the farmers without restriction.

### III. ANALYSIS ON INFLUENCING OF FARMERS' WILL OF POLLUTION CONTROL IN LIVESTOCK AND POULTRY BREEDING

#### A. Model Selection And Data Sources

##### 1) The model definition

This paper studies the factors that affect the willingness of farmers to control the pollution of livestock and poultry breeding, the dependent variable is "farmers willing to control aquaculture pollution", of which, the "willing to = 1", "won't = 0", for binary type variable. Logistic regression analysis is widely used in the dependent variable regression model for binary type variable. Therefore, this paper choose the Logistic regression model to analyze the influence factors of farmers of livestock and poultry breeding pollution control will. The model function form is:

$$p_i = F(Y) = F\left(\beta_0 + \sum_{i=1}^n \beta_i x_i\right) = \frac{1}{1 + \exp\left[-\left(\beta_0 + \sum_{i=1}^n \beta_i x_i\right)\right]}$$

Through deformation, converting the type into:

$$\ln \frac{p_i}{1 - p_i} = y = \beta_0 + \sum_{i=1}^n \beta_i x_i$$

Of which,  $P_i$  is the probability of farmers' willing to farming pollution control,  $y$  is the dependent variable, expressed the willingness of farmers breeding pollution control,  $x_i$  is the independent variable, represented the  $i$ -th factors,  $\beta_i$  represents the regression coefficient of factors,  $n$  represents the number of factors,  $\beta_0$  is the intercept of the regression equation.

##### 2) The data source

Used data come from the team in July and August 2014 and January 2015 field survey in Hunan province. Hunan province is a big province of livestock and poultry breeding, slaughter and its value for many years in the forefront of the country. This article selects farmers in Hunan province as investigation object, and has certain representation. The selection of research sample area mainly based on the relevant data of Hunan Province Bureau of animal husbandry and Environmental Protection Bureau in the province, the selection of the livestock industry ranking and livestock pollution seriously areas investigated, taking into account the different economic level, breed type, breeding scale. All sample farmers are not the governance on breeding pollution of livestock and poultry households.

Finally, this paper selects 5 sample counties in Hunan province (city) (Liuyang City, Hengyang County, Xiangxiang County, Ningxiang County, Taoyuan County) to carry out the investigation, in each county (city) selected 2 township (town), 3 villages were selected in each township.

Specific investigation method is: first, we designed the livestock and poultry breeding farmers pollution control intention questionnaire, which questionnaire contents consisted of farmers basic situation, breeding behavior characteristics, cognitive characteristics and environmental impact of livestock and poultry breeding pollution control of the will of farmers social factors, and implement preliminary investigation in Puji Xiang, Zhentou Zhen, Liuyang City, Hunan Province of 20 different farming scale of farmers in March 2014, and then modify the questionnaire by consulting of livestock and poultry breeding of relevant experts based on the preliminary investigation results, after then entered the stage of a formal investigation; Second, according to the selected each county (city) to issue 100 questionnaires of standard,

questionnaires out of 500, we carried out a formal investigation; Finally, investigators interviewed directly with the farmers, questioned on the scene to fill in the questionnaire. After eliminating some missing data of the questionnaire, the real valid questionnaires are 447, the effective rate of the questionnaire recycling was 89.4%. Of which, Liuyang city has 96, accounting for 21.48%; Hengyang county has 85, accounting for 19.01%; Xiangxiang county has 93, accounting for 20.81%; Taoyuan county has 85, accounting for 19.01%; Ningxiang county has 88, accounting for 19.69%.

*B. The Selection of Variables And Descriptive Analysis*

According to theoretical analysis and survey data, this paper selects the four categories, a total of 14 variables analysis the influence factors of peasant household of livestock and poultry breeding pollution control willingness. Variables and descriptive statistics results see table 1 (please see the last page of this paper).

Table 1 MODEL VARIABLES DESCRIPTIVE ANALYSIS

Type	Variables	Variable description	Mean value
<i>Explained variable</i>			
	Breeding pollution control will	willing to = 1, won't = 0	.568
<i>Explaining variables</i>			
Farmers individual characteristics	Age	under 30 = 0, 30-40 = 1, 40-50 = 2, over 50 = 3	1.709
	Sex	male = 0, female = 1	.268
	Degree of education	junior middle school and the following = 0, high school or technical secondary school = 1, junior college or bachelor degree and above = 2	.711
	Social experience	yes = 0, no = 1	.781
Breeding behavior characteristics	complexity of obtaining information	Easy = 0, Normal = 1, Difficult = 2	.676
	Specialization Level	The following 10% = 0, 10%-30% = 1, 30%-50% = 2, 50%-80% = 3, More than 80% = 4	2.130
	Breeding scale	Cage free = 0, small scale = 1, medium scale = 2, large scale = 3*	1.025
	Cooperative organization participation	yes = 0, no = 1	.264
Social environment characteristics	Breeding training participation	yes = 0, no = 1	.528
	Environmental protection personnel on-site supervision and publicity	yes = 0, no = 1	.385
	Waste management provisions of villages and towns	yes = 0, no = 1	.678
Cognitive characteristics	State anti-pollution regulation policy constrains	yes = 0, no = 1	.481
	Cognition of ecological environment around	Better = 0, generally = 1, poor = 2	.957
	Pollution level of livestock and poultry excrement	No pollution = 0, pollution not serious = 1, serious pollution = 2	.862

\*Classification standard of the scale of breeding, see the "national agricultural product cost and income data compilation"

*C. The Empirical Result Analysis*

According to the research hypothesis, this paper using SPSS20.0 software, using backward stepwise regression based on the maximum likelihood estimation method to

estimate farmers of livestock and poultry breeding pollution will influence factors of Logistic model, gets the model 1 and the model 2, which two models estimation results close to, so the final results are shown in table 2 (please see the last page of this paper).

Table 2 RESULTS OF LOGISTIC REGRESSION ANALYSIS OF INFLUENCING FACTORS

Type	Model one			Model two		
	B	Wald value	Sig.	B	Wald value	Sig.
Age	.204	.853	.356	—	—	—
Sex	.343	.730	.393	—	—	—
Degree of education	1.750*	20.325	.000	1.664*	22.107	.000
Social service experience	1.227**	5.449	.020	.991**	4.189	.041
Complexity of obtaining information	.368	2.375	.123	—	—	—
Specialization Level	.374***	2.743	.098	.392***	3.044	.081
Breeding scale	.959*	9.567	.002	.942*	9.778	.002
Cooperative organization participation	.080	.016	.898	—	—	—
Breeding training participation	1.563*	12.716	.000	1.460*	11.927	.001
Environmental protection personnel on-site supervision and publicity	.896***	2.934	.087	.833***	3.274	.070
Waste management provisions of villages and towns	2.245*	26.705	.000	2.276*	28.268	.000
State anti-pollution regulation policy constrains	1.063**	5.803	.016	.948**	5.108	.024
Cognition of ecological environment around	.852**	4.050	.044	.907**	4.698	.030
Pollution level of livestock and poultry excrement	2.065*	23.312	.000	1.948*	23.087	.000
Constant	-10.021	46.752	.000	-8.943	52.994	.000
-2Log likelihood		219.155 <sup>a</sup>			222.684 <sup>a</sup>	
Cox & Snell R Square		.584			.581	
Nagelkerke R Square		.784			.779	

※、※※、※※※Respectively show coefficient values in 1%, 5%, 10% significant level

### 1) Effects of individual characteristics of farmers on the will of pollution control

In farmers' the individual characteristic variables, (1) the coefficient of the degree of culture is positive, and the significance test of the 1% level of statistics is adopted. This is consistent with the original hypothesis, that the farmers' cultural level has a positive effect on the willingness of pollution control. According to the results of the survey, junior high school and below, high school or technical secondary school, college or university degree or above sample farmers willing to the proportion of breeding pollution respectively were 31.08%, 63.35%, 100.00%, indicating the higher the educational level of farmers were, the deeper the awareness of the hazards of the arbitrary emission excreta of breeding to the environment were, the higher the degree of acceptance were, thus governance will were more obvious.(2) The social work experience variable coefficient is positive, and pass the 5% statistical level of significance test. This suggests that multiple social experience could be able to open the farmer's field of vision, make farmers more deeply recognize the relationship between the environmental, health, development, and improve the awareness of the hazards of the breeding pollution to their health, the local ecological environment and sustainable development, the more positive attitude to participate in the management of pollution was, more intense willing to join in the work of pollution control was.

### 2) Effects of farmers' behavior characteristics on the willingness of pollution control

In breeding behavior characteristic variables, (1)the variables of the situation of the breeding training participation in the model passed the 1% level of statistical

significance test and positive coefficient is positive. By taking part in the training, farmers can get more information about the technology and pollution control, and promote the exchange and study of science and ecological culture between farmers. From the sample data, the trained farmers of the willingness of pollution control is 88.93%, much higher than the 24.56% not trained farmers;(2) the farming scale variable passed the 1% level of statistical significance test and the coefficient is positive. This conclusion is consistent with the theoretical hypothesis, with the increase of the scale of farming, the greater the tendency of farmers breeding pollution control were;(3)the degree of specialization of variables in the model passed the 10% level of statistical significance test and the coefficient is positive. By appropriately expanding the scale of farming, implementing of standardized scale farming, it played a very important role in promoting the behavior of the farmers of livestock and poultry breeding pollution control.

### 3) Effects of farmers' cognitive characteristics on the willingness of pollution control

In cognitive characteristics variables, (1) the farmer's perception of the surrounding ecological environment variable coefficient is positive, and passed the 5% level of statistical significance test. The higher farmers pay attention to the surrounding ecological environment, the more you appreciate the importance and the necessity of protecting the environment, thus to participate in attitude is positive, the greater the likelihood of control breeding pollution is;(2) the degree of livestock waste pollution to the environment variables passed the 1% level of statistical significance test and the coefficient is positive. When farmers understand the harm that arbitrary discharge livestock and poultry breeding waste can cause pollution to the environment, the governance will would more intense. It also verify the

above hypothesis, the cognition of environmental problems can affect an individual's environmental attitudes and behaviors.

4) *The influence of social environment characteristics on Farmers' willingness to harness pollution*

In characteristic variables of social environment, the environmental protection personnel on-site supervision and publicity, rural garbage management provisions, and the state anti-pollution regulation policy constraint condition of the variables respectively passed 10%, 1%, 5%, the level of statistical significance test and the coefficient is positive. This is consistent with the hypothesis of this paper, the farmers perceived outside constraints and pressure in the disposal of breeding waste, the greater the control breeding pollution will would more intense.

IV. ANALYSIS ON THE INFLUENCING FACTORS AND MECHANISM OF FARMERS' WILL TO CONTROL THE POLLUTION OF LIVESTOCK AND POULTRY BREEDING

A. Model Selection

This paper is on the basis of the analysis of farmers' livestock pollution will influence factors, basing on the logistic model analysis results, utilizing the ISM model to implement deep structure analysis of farmer livestock pollution will mechanism.

ISM model is a kind of model which is used to describe the structure relation of components in complex systems by using matrix representation method and logic operation, proposed by the American professor Walter Field in 1973. ISM belongs to the conceptual model, is a kind of structure modeling technology, and its characteristic is to use people's practical experience and knowledge and computer help, relations of the system between the various elements of the complex is decomposed into a clear hierarchical structure to observe levels among the factors structure relation and find the most important key factors. In recent years, the model is widely used in exploring the relationship between the factors affecting the concrete phenomenon and the relationship between the level structure and the causal relationship. The main steps to build the ISM are as follows:

(1) Set the key problems and the factors affecting choice; For to analyze the influencing factors of  $S_i$ , according to two factors whether there is mutual influence and mutual premise of logic relations, construct the adjacency matrix A and value the adjacency matrix A of the constituent elements  $a_{ij}$  to 1 (when  $S_i$  has effect on  $S_j$ ) or 0 (when  $S_i$  has no effect on  $S_j$ ), among them,  $i=1,2,3 \dots n$ ,  $j=1,2,3 \dots n$ , and  $i \neq j$

(2) Establish reachable matrix based on the correlation between the factors. Based on the derived adjacency matrix A, determine reachable matrix M based on the laws of Boolean algebra:

$$M = (A+I)^{1+k} = (A+I)^k \neq (A+I)^{k-1}$$

In the above formula, I is the unit matrix,  $2 \leq k \leq n$ .

(3) Division of the reachable matrix. To hierarchical decomposition of matrix, among them, the highest level factor determination method is as follows:

$$L_1 = \{S_i / R_{(S_i)} \cap Q_{(S_i)} = R_{(S_i)}\}$$

In the above formula,  $L_1$  represents the highest level of impact factor set,  $Q_{(S_i)}$  is the set of all factors of  $S_i$ ,  $R_{(S_i)}$  is the set of all factors that can be reached from  $S_i$  [11]. The  $L_1$  is contained in the factors corresponding to the row and column removed, in accordance with the same rules to determine the next level factors set  $L_2$  contains the factors, and so on.

B. The Determination of the Logical Relationship between Influencing Factors

According to the ISM analysis method of the specific steps, this paper use  $S_0$  said willingness of pollution control of livestock and poultry breeding, with  $S_1, S_2, \dots, S_{10}$ , respectively said, degree of education, social service experience, specialization level, breeding scale, breeding training, environmental protection personnel on-site supervision and publicity, waste management provisions of villages and towns, the state anti-pollution regulation policy constrains, the cognition of ecological environment around and the pollution level of livestock and poultry excrement of 10 significant variables, through analysis and consulting experts and scholars, determined above 10 logical relations between the influencing factors as shown in figure 1, among them, "D" said column factors on line factors, "V" said row factors on column factors, "0" said procession factors had no effect, and the adjacency matrix said each influence factor between the direct relationship ((1)).

D	D	D	D	D	D	D	D	D	D	$S_0$
V	V	0	0	0	0	0	0	0	0	$S_1$
V	V	0	0	0	0	0	0	0	0	$S_2$
V	V	V	V	V	V	D				$S_3$
0	0	V	V	V	V					$S_4$
V	V	0	0	0						$S_5$
0	0	0	0							$S_6$
0	0	0								$S_7$
0	0									$S_8$
0										$S_9$
										$S_{10}$

Fig. 1 logical relations among influencing factors

$$\begin{matrix}
 S_0 \\
 S_1 \\
 S_2 \\
 S_3 \\
 S_4 \\
 S_5 \\
 S_6 \\
 S_7 \\
 S_8 \\
 S_9 \\
 S_{10}
 \end{matrix}
 \begin{bmatrix}
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 1 \\
 1 & 0 & 0 & 1 & 0 & 1 & 1 & 1 & 1 & 1 & 1 \\
 1 & 0 & 0 & 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\
 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 1 & 1 \\
 1 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 \\
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1
 \end{bmatrix}
 \quad (1)$$

C. Construction And Analysis of Interpretative Structural Modeling

On the basis of adjacency matrix, according to the laws of the calculation of elements of the reachable matrix with the aid of Matlab7.9 software, get the influence factors of matrix (2). For up to matrix, according to the above the ISM model level factor method for determining available  $L_1=\{S_0\}, L_2=\{S_6, S_7, S_8, S_9, S_{10}\}, L_3=\{S_1, S_2, S_5\}, L_4=\{S_3\}, L_5=\{S_4\}$

$$\begin{matrix}
 S_0 \\
 S_6 \\
 S_7 \\
 S_8 \\
 S_9 \\
 S_{10} \\
 S_1 \\
 S_2 \\
 S_5 \\
 S_3 \\
 S_4
 \end{matrix}
 \begin{bmatrix}
 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 1 & 1 & 0 & 1 & 0 & 0 & 0 \\
 1 & 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 & 0 & 0 \\
 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 0 \\
 1 & 1 & 1 & 1 & 1 & 1 & 0 & 0 & 1 & 1 & 1
 \end{bmatrix}
 \quad (2)$$

According to the level of the relationship, through the directed edge connecting with the various factors, get that figure 2 which shows the level of farmers and livestock and

Figure 2 shows that the 10 factors affecting farmers' willingness of livestock and poultry farming pollution control are both independent and correlative.

(1) The direct surface factors. The first level factors include five aspects, respectively, environmental protection personnel on-site supervision and publicity, rural garbage management provisions, the state constraints anti fouling regulation policy constraint condition, on the surrounding ecological environment cognition, and breeding waste on the environment, they are the key factors of farmers' willingness of surface pollution of livestock and poultry breeding. In these five factors, the former three factors reflect the farmers (especially the head of the household) at the disposal of breeding waste felt subjective norm; after two factors reflect the famers control breeding pollution behavior attitude.

(2) The middle layer factors. The middle layer factors include the second and the third layer influencing factors. The second level factors have cultural level, social

poultry breeding pollution control will affect the level of structure and relationship.

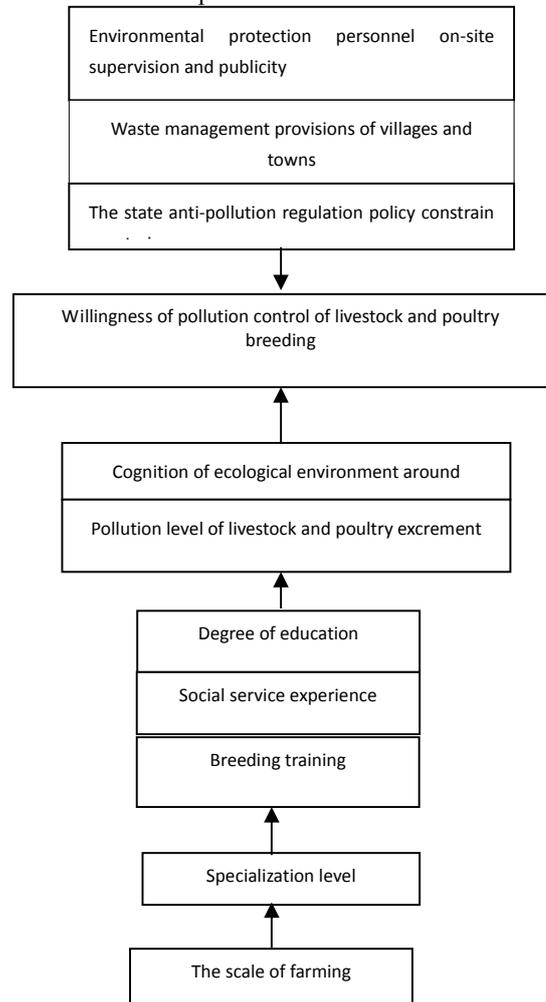


Fig.2 Factors affecting hierarchy

experience, breeding training to attend. The third level factors have a professional degree. The above factors through themselves affect the surface of the key factors, thus indirectly act on farmers of livestock and poultry breeding pollution.

(3) The deep root factors. The scale of farming directly affects the degree of specialization of livestock farmers, is the most fundamental factors affecting farmers' willingness of livestock and poultry farming pollution, and is also the need to fundamentally solve the problem, that also confirms the country vigorously develop the standardization of livestock and poultry breeding policies and ideas. Therefore, appropriately to expand the scale of farming and actively to create standardized scale breeding is a practical and effective way to strengthen the breeding pollution prevention and control.

Above all, the above 10 factors constitute the complete farmers' livestock and poultry breeding pollution will of influence factors of complex system, and jointly influence

the farmers' willingness of livestock and poultry breeding pollution control.

#### V. A BRIEF CONCLUSION AND POLICY SUGGESTIONS

This paper based on the survey data of 447 farmers in Hunan Province, using Logistic regression model to analyze the influencing factors of farmers' willingness of livestock and poultry farming pollution, and then passing the ISM model to explore the relationship and hierarchy among the influencing factors, the main conclusions are as follows:

In 447 sample households surveyed, 254 were willing to participate in the livestock pollution control, accounting for 56.82% of the total sample. The will of farmers of livestock and poultry breeding pollution control affected by many factors together, these factors mainly include the degree of culture, social experience, the degree of specialization, scale of farming, breeding training to participate in the situation, the environmental protection personnel on-site supervision and propaganda, villages and towns of waste management provisions, national antifouling regulation policy constraint condition, the cognition of the surrounding ecological environment, degree of livestock waste pollution to the environment. In the influence factors, the environmental protection personnel on-site supervision and propaganda, villages and towns of waste management provisions, national antifouling regulation policy constraint condition, the cognition of the surrounding ecological environment and the degree of livestock waste pollution to the environment are the direct factors affecting farmers of livestock and poultry breeding pollution control will, cultural degree, social experience, breeding training to participate in the situation, the degree of specialization are the middle layer factors, farming scale is the deep root factor. Based on the above conclusions, this paper suggests as follow:

First, strengthen the credit culture, land use and other aspects of policy support, and solve the problem of farmers in the process of standardization of the scale of farming and land constraints such as lack of funds, to encourage farmers to develop large-scale farming.

Second, through radio, television, network, or printed brochures many kinds of ways, propagandize the necessity and importance of livestock and poultry breeding pollution control and environmental protection, improve farmers for breeding pollution hazard awareness, enhance the understanding of the relation between environmental, health and economic development.

Third, through various channels, carry out ecological breeding and pollution control technology of breeding

training, and provide the necessary technical support, to broaden the channels for the participation of farmers breeding pollution control as far as possible, to provide a good external environment for farmers to participate in breeding pollution control.

Fourth, perfect the regulation system of livestock and poultry farming pollution, give full play to the role of the village committee, strengthen the supervision and guidance of the disposal of livestock excreta, to reduce the negative effect of the breeding process as much as possible.

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