Process of Modern Agriculture in Sichuan Province

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Abstract　Based on relevant literatures，it is found out that modern agriculture is a product of agricultural development at a certain stage. On the one hand，modern agriculture develops with the improvement of economy；on the other hand，it has many realization forms. Different areas and countries can select their own realization forms according to the resource endowment. According to the index systems in the past，evaluation index system of modern agriculture in Sichuan Province is established based on the principles of controllability，operability，comparability and adequacy. Analytical Hierarchy Process is adopted to calculate the weigh of the established index system by multi – persons and multi – criteria. According to the comprehensive level of modern agricultural data in Sichuan Province in the years 1997 – 2007，Comprehensive Index Method is used to calculate the development level of Sichuan agriculture at present. And the development trend of Sichuan agriculture in the years 2008 – 2012 is forested by GM（1，1）model in Gray Forecasting Method. Result shows that level of agricultural development is improving，but shows uneven growth in some years. In the year 2012，development level of modern agriculture reaches 0. 764 2 in Sichuan Province，which is still at initial implementation stage but is pretty close to the basic realization stage.

Key words　Process，Modern agriculture，Index system，Development trend，China

　　As the foundation of national or regional economic development and social stability，agriculture has an important position and role in the development of whole social productivity and society. Currently，as our agriculture is transforming from traditional agriculture to modern agriculture，our modern agriculture is still on the initial stage of development，there is still a large gap compared with the developed cities. Through the understanding of the concept of modern agriculture，using the index system of modern agriculture both at home and abroad for reference and combining the features of agricultural development in Sichuan，the author aims at establishing a set of index system of modern agriculture suitable to Sichuan.

1　Literature review

　　The scholars have different perceptions on the connotation of modern agriculture. In his *Transforming Traditional Agriculture*，the famous American economist Schultz presents the basic features of modern agriculture from the perspective of production factor，the farmers use modern agricultural production factors，any new production factors，as long as it is beneficial，will be adopted shortly after its appearance[1]. In his *Choice of China's Agricultural Modernization*，Bai yuejin points out that agricultural modernization refers to transformation process from traditional agriculture to modern agriculture and the state after the transformation，including the modernization of production means，labor forces，organization and management，and operation mechanism，the improvement of resources and environment and internationalization under the open economy[2]. In *Evaluation of Agricultural Modernization*，Yang wanjiang proposes that，with a broad application of modern science and technology and modern scientific management

methods to the production and operation，modern agriculture closely connects the production，supply and sales with the market，it has close relationship with agriculture before，between and after the production，it is highly developed commercial agriculture and highly socialized agriculture with high technology content，high consumption，high output，high commodity rate，and high efficiency[3]. In *Development of Agricultural Mechanization* and *Construction of Modern Agriculture* written by Yang minli，it points out that modern agriculture is essentially a new-type agriculture with high efficiency and high yield based on modern science and technology and its application，modern industrial technology and its equipment，modern management skills，modern agricultural products processing technology，modern agricultural products circulation techniques and its sales，which combines the production，supply and sales together and integrates the trade，industry and agriculture as a whole[4]. In *Modern Agriculture and the Development of Agricultural Mechanization*，Yao baogang points out，modern agriculture takes its shape since the industrial revolution with the application of agricultural machinery to agricultural production as the starting point and gradually moves towards the commercialization and marketization[5]. In summary，modern agriculture has a very rich connotation and should not be percepted from only one angle and at certain level. Modern agriculture is the product of the agricultural development at a certain stage as opposed to traditional agriculture，as a historical and relative concept，it is both general and special. To say it is general means that the evaluation criteria of modern agriculture will gradually increase as the economy develops and reach the development level of medium countries with the internationally recognized standards as the benchmark；to say it is special refers to that there are a variety of specific realization forms and different countries and different regions can adopt different methods according to their own resource endowment.

2 Source of data and research method

2.1 Source of data The data concerning the comprehensive level of modern agriculture comes from *China Statistical Yearbook*, *Sichuan Statistical Yearbook*, *China Rural Statistical Yearbook* and the internet of Development Research Center of the State Council (Table 1).

Table 1 The comprehensive level of Sichuan modern agriculture during 1997 to 2007

Year	Amount of chemical Fertilizer per unit area kg/hm²·a	Total power of agricultural machinery per unit area kW/hm²	Effective irrigation rate//%	Proportion of agriculture in GDP//%	Ratio of animal husbandry output value in total agricultural output value//%	Proportion of agricultural employees %	Grain yield of sown area kg/hm²	Agricultural labor productivity Yuan/per person·a	Relative number of ATM members %	Quality of agricultural labor forces//%
1997	445.36	2.98	52.9	0.43	37.81	42.0	4 652	4 858	1.32	47.09
1998	456.74	3.27	53.2	0.42	38.08	41.1	4 942	5 152	1.38	48.84
1999	472.09	3.61	54.5	0.40	39.63	40.1	5 027	5 259	1.51	49.94
2000	489.17	3.86	56.8	0.38	41.24	38.6	5 206	5 612	1.61	50.26
2001	494.82	4.05	58.0	0.36	43.85	38.1	4 605	5 913	1.67	51.39
2002	516.27	4.51	61.6	0.33	47.64	36.6	5 097	6 203	1.73	52.51
2003	533.85	4.84	64.1	0.33	46.64	36.9	5 228	7 187	1.74	53.50
2004	549.89	5.14	64.1	0.35	48.73	36.6	5 252	9 209	1.91	54.87
2005	565.54	5.59	64.2	0.33	50.06	36.2	5 243	10 149	2.17	60.26
2006	582.74	6.38	63.5	0.30	50.63	34.7	4 718	11 280	2.20	59.42
2007	602.53	6.39	63.3	32.00	54.21	33.9	4 693	14 871	2.30	60.935

Year	Agricultural products processing rate//%	Export rate of agriculture products %	Proportion of leading enterprise value in total agriculture output value %	Farmers participation %	Urbanization Level//%	Natural growth rate of population %	Engel's coefficient %	Urban-rural income ratio %	Natural disasters index//%	Forest coverage rate//%
1997	1.832	0.670	2.460	19.467	17.2	8.7	62.0	3.03	56.1	20.40
1998	3.856	0.737	6.583	23.429	17.0	7.5	61.0	2.87	54.1	24.23
1999	7.360	1.000	10.706	27.391	18.0	6.8	58.0	2.97	54.9	24.23
2000	8.050	1.120	18.000	28.700	18.6	5.1	54.6	3.09	58.1	24.23
2001	8.740	1.320	15.400	34.160	19.2	4.4	54.7	3.20	67.4	24.23
2002	10.490	1.350	25.400	40.250	19.6	3.9	53.9	3.13	55.9	24.23
2003	12.800	1.340	23.300	46.000	21.0	3.1	53.9	3.16	78.4	24.23
2004	14.870	1.550	26.200	47.600	22.3	2.8	55.6	2.99	15.4	27.94
2005	20.350	1.440	40.800	51.000	23.2	2.9	48.1	2.99	40.7	28.98
2006	20.048	1.480	39.567	52.000	23.7	2.9	50.8	3.11	13.8	30.27
2007	15.520	1.340	44.376	58.583	24.3	4.2	3.13	52.30	8.5	31.27

Table 2 Index system and weight distribution of Sichuan modern agriculture

First-level indexes	First-level indexes weight	Second-level indexes	Second-level indexes weight	Community indexes	Single weight	Target value
Level of agricultural development	0.40	Means of agricultural production	0.28	Amount of chemical Fertilizer per unit area	0.22	700 kg/hm²·a
				Total power of agricultural machinery per unit area	0.36	15 kW/hm²
				Effective irrigation rate	0.42	85%
		Agricultural economic construction	0.25	Proportion of agriculture in GDP	0.45	10%
				Ratio of animal husbandry output value in total agricultural output value	0.28	60%
				Proportion of agricultural employees	0.27	20%
		agricultural output	0.20	Grain yield of sown area	0.54	7 500 kg/hm²
				Agricultural labor productivity	0.46	40 000 Yuan·a

Continued

First-level indexes	First-level indexes weight	Second-level indexes	Second-level indexes weight	Community indexes	Single weight	Target value
		The investment of agricultural science and technology	0.27	Relative number of ATM members	0.73	10%
				Quality of agricultural labor forces	0.27	90%
Commercialization extent of agriculture production and operation	0.17	Agricultural commercialization level	0.44	Agricultural products processing rate	0.79	80%
				Export rate of agriculture products	0.21	10%
		Agricultural industrialization level	0.56	Proportion of leading enterprise value in total agriculture output value	0.50	50%
				Farmers participation	0.50	90%
Socio-economic development level in rural area	0.27	The level of rural development	0.64	Urbanization Level	0.75	50%
				Natural growth rate of population	0.25	5%
		The peasants' life quality	0.36	Urban-rural income ratio	0.48	2
				Engel's coefficient	0.52	35
Capacity for sustainable development	0.16	Environment and resources	1.00	Natural disasters index	0.29	30%
				Forest coverage rate	0.71	40%

2.2 Research method Comprehensive Index Method is adopted in the research because of its more standard testing process, visual results and fixed calculation formula[6].

2.2.1 Data preprocessing

$$Z_i = \begin{cases} P_i / Q_i & \text{when the index is positive (which means that the bigger the index value, the better)} \\ Q_i / P_i & \text{when the index is negative (which means that the smaller the index value, the better)} \end{cases}$$

In this formula, Z_i is the evaluation value of community index; P_i is the actual value of community index; Q_i is the corresponding standard value of community index.

2.2.2 The calculation of comprehensive evaluation value. The formula to calculate the evaluation value of the first-level indexes:

$$C_k = \sum_j B_j \times \omega_j$$

The formula to calculate the evaluation value of the second-level indexes:

$$B_j = \sum_i A_i \times \omega_i$$

The formula to calculate the composite evaluation indexes:

$$Z = \sum_k C_k \times \omega_k$$

In the above formulas, i is the serial number of main index; j is the serial number of category index; k is the serial number of community index; w_i, w_j, w_k refer respectively to the weight of main index, category index and community index; A_i, B_j, C_k refer to the evaluation value of corresponding community index, category index and main index; Z is the comprehensive evaluation value of modern agriculture.

3 The establishment of Sichuan Evaluation Index System of Modern Agriculture

3.1 The establishment of index system Taking into account the agricultural features in Sichuan (vast population and limited farmland; low commodity rate of agricultural by-products, the domination of planting, food crops and pig feeding in agricultural production and significant regional differences in agricultural production), according to the index systems in the past, evaluation index system of modern agriculture in Sichuan Province is established based on the principles of controllability, operability, comparability and adequacy (Table 2), the realization of modern agriculture in Sichuan can be divided into five stages: preparation stage (below 0.4), initial stage (0.4 – 0.5), initial implementation stage (0.5 – 0.8), basic realization stage (0.8 – 0.9) and full realization stage (above 0.9)[7].

3.2 The determination of the weigh Analytical Hierarchy Process is adopted to calculate the weigh of the established index system by multi-persons and multi-criteria (Table 2). The calculation uses the method of latent vector, the formulas are as follows[8]:

$$\omega_i{}^* = n \sqrt{\prod_{j=1}^n a_{ij}}$$
$$\omega_i = \omega_i{}^* / \sum_{i=1}^n \omega_{i*}$$

In the formulas, a_{ij} determines the matrix elements; $i = 1, 2, \cdots, n$.

4 Results and analysis

4.1 Determining the evaluation values of development level According to relative data about the agricultural development level in Sichuan during 1997 – 2007, the evaluation values of Sichuan modern agriculture of development level during that time can be obtained through the Comprehensive Index Method (Table 3).

Table 3 Evaluation values of Sichuan modern agriculture development level during 1997 to 2007

Year	Evaluation value	Year	Evaluation value
1997	0.377 4	2003	0.489 7
1998	0.407 4	2004	0.543 9
1999	0.427 8	2005	0.569 5
2000	0.454 2	2006	0.591 7
2001	0.454 5	2007	0.599 1
2002	0.486 4		

4.2 The evaluation of comprehensive level

4.2.1 Agricultural development level keeps improving. As table 3 shows, the comprehensive level of modern agriculture in Sichuan improves annually from 0.377 4 in 1997 to 0.599 1 in 2007, successfully achieving two-stage leap from the preparatory stage to initial implementation stage, an increase of 11.06 percentage points from 0.489 7 in 2003 to 0.543 9 in 2004 completes the stride from initial stage to preliminary realization stage. The comprehensive evaluation values of Sichuan modern agriculture in 2007 has reached 0.599 1, 58.74 percentage points higher than the 0.377 4 in 1997, which shows that the construction of modern agriculture in Sichuan has made considerable achievement. If this growth rate could be maintained, Sichuan is expected to reach the basic realization stage before 2020.

4.2.2 Agricultural development is uneven. The growth rate of agricultural development during 2000 – 2001 and 2002 – 2003 are relatively low, while that in other periods are much higher. This unbalance is mainly caused by its unbalanced first-level index, meanwhile, the substantial increase during 2004 –2005 is resulted from the substantial changes of two indexes. On the one hand, the value of natural disaster index (negative index) in 2005 is 63 percentage points less than in 2004; on the other hand, the improvement of labor productivity is above the average level. Moreover, the change is weak because the improvement of some indexes, such as natural growth rate of population, have been near, up to or above the target value and the change has on big effect on the changes of comprehensive evaluation values; certain index values, such as agricultural products processing rate and export rate of agricultural products, remain at a relatively low level and have no big change, which should be taken notice of and improved during the development of modern agriculture.

4.3 The prediction of development level In order to have a better knowledge of the development trend of Sichuan agriculture during latter period of time and make corresponding adjustments according to internal and external environment for agricultural development, it is necessary to predict the development of Sichuan agriculture during 2008 –2012. Various methods are adopted to predict various social problems, in view that the accumulative sequence or cumulative sequence techniques adopted in the grey prediction can weaken the randomness of time serials and other external interference signals, there is a feedback to conduct the residual test, correlation test and posterior-variance test. The mode can be corrected if it failed to pass the test. Therefore, using the GM(1,1) mode in the grey forecas-

ting method, the author obtains that the predicted values of Sichuan modern agricultural development in next five years are respectively 0.328 2, 0.667 6, 0.689 4, 0.730 6 and 0.764 2. It is predicted that the development level of Sichuan modern agricultural development can reach 0.764 2 in 2012, although it is still at the initial implementation stage, it has already been very close to the basic realization stage. Following this development rate and then integrating some favorable and unfavorable factors in agricultural development, it is easy to realize the ambitious goal of basic realization of modern agriculture in 2020.

5 Conclusions

Through the analysis of Sichuan modern agriculture and the set of indexes as well as the quantitative measurement of current Sichuan modern agricultural development level and the forecast of its development level in next five years, the following conclusions can be obtained. ① Sichuan agricultural development is still at the initial implementation stage, the development level improved steadily in the ten years from 1997 to 2007, great achievements have been made from the preparatory stage in 1997 to the current initial implementation stage. The modern agriculture in Sichuan will maintain its momentum of development if operated properly. ② It is predicted that the value of Sichuan modern agricultural development level in 2012 will be close to 0.8, the number is expected to be above 0.8 in 2014, reaching the basic realization stage, in 2020 it is expected to fulfill the full realization of modern agriculture. ③ Among the four first-level indexes of Sichuan modern agriculture, the weight of agricultural development level is in a relatively important position, obviously higher than any other indexes. In order to improve the development of Sichuan modern agriculture, the optimization of agricultural economic structure and the technological input should be paid more attention to.

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1 then $g(r) = 641[\frac{1}{1+(1+2.25\%)r} - 1] + 0.2(\frac{1}{1-1\,500r} - 1)$.

Suppose $g(r) = 0$, the unique positive solution $R = 3.60 \times 10^{-4}$.

By substituting $R = 3.60 \times 10^{-4}$, $i = 2.25\%$ into the formula (4), then when $\mu = 1 \times 10^4$, $\psi(u) \leq 2.520\,0\%$ when $\mu = 2 \times 10^4$, $\psi(u) \leq 0.063\,5\%$ when $\mu = 3 \times 10^4$, $\psi(u) \leq 0.001\,6\%$ when $\mu = 5 \times 10^4$, $\psi(u) \leq 0.000\,001\,02\%$.

The results show that the more initial capital leads to lower bankruptcy probability of insurance company and stronger survival capability. Certainly there are some errors in the results. The reasons are as follows：① The samples are relatively small, so it can not cover all the situations. The research mainly takes certain migrant workers in city A as samples to estimate the bankruptcy probability. According to the Probability Theory, the greater the insurance group is, the smaller the bankruptcy probability. ② The results has something to do with the initial capital and working ability of insurance company. ③ The relatively small value of α and β also have certain impact on the results. In conclusion, under the current situation of financial crisis, the implement of new unemployment insurance category is an effective solution for the unemployment of migrant workers.

3　Discussions

In considering whether the unemployment insurance system can cover the urban migrant workers and rural surplus labor forces, the " expansion of scope" should not be pursued blindly while it should be taken into consideration combining with the country's industrial policy, economic development and many other comprehensive factors. With the appearance of multiple-employment, irregular unemployment will be caused and the traditional employment insurance system which aimed at traditional employment style can not solve it. What's more, the short-term temporary jobs can not achieve the minimum payment limit of unemployment insurance, so the number of people who are not entitled to the social security rights will increase. That's the challenge faced by the unemployment insurance system[4].

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金融危机下的农民工失业保险模型探讨

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摘要　基于利率为常数的假设,建立了保费收入、保费支出均为复合 Poisson 过程的农民工失业保险风险模型,其中保单的保费和失业保险的理赔额均为随机序列,给出了模型推导和相关破产概率的性质证明过程,得到了不考虑利率的情况下保险公司破产概率精确值的估计式。以中国某市为例,对 6 个行业的部分农民工进行了失业保险购买意愿调查。根据调查所得数据,利用农民工失业保险风险模型估算了保险公司的破产概率。结果表明,初始资本越多,保险公司破产概率越低,生存能力越强,进而证明了金融危机背景下推行农民工失业保险是国家解决农民工失业问题的有效途径。
关键词　失业保险;农民收入;破产概率

四川现代农业进程研究

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摘要　首先,参考相关文献,指出现代农业是农业发展到一定阶段的产物,其评价标准会随着经济的发展而逐步提高,并且不同的国家、不同的地区根据自己资源禀赋会采取不同的实现形式。其次,参照以往指标体系,根据指标体系建立的科学性、充分性、可控制性、可操作性、可比性原则,建立四川现代农业评价指标体系,采用层次分析法,运用多人多准则对建立的指标体系进行权重计算。最后,依据 1997 ~ 2007 年四川现代农业的综合水平相关数据,采用综合指数法,计算出现阶段四川农业的发展水平,并用灰色预测法中的 GM(1,1)模型对 2008 ~ 2012 年四川农业的发展趋势做出预测。结果表明,农业发展水平不断增加,但有些年份增长不均衡;在 2012 年,四川的现代农业发展水平可达到 0. 764 2,虽还是处于初步实现阶段,但已经离基本实现阶段非常接近。
关键词　进程;现代农业;指标体系;发展趋势