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Based on Hierarchy Analysis Model of the New Rural Cooperative System Development Related Research

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The new rural cooperative system development has become a focus in the study of today's problem, in this paper, by applying the analytic hierarchy process (ahp) model for the new rural cooperative system development problem to do the research, the choice of the weight of each indicator gives numerical, after that will develop the new rural cooperative system model is applied in the 14 parts of China on the issue of development of the new rural cooperative system. Finally, it is concluded that the ranking of various areas, including Changsha somewhere in various indicators ranked first, prove that the new type of rural cooperative system of the region is good and consistent with the actual development, illustrates the rationality and validity of the model.

1. Introduction

Cooperative has already become a trend in current social development, as a kind of market economy system, it drives rural economy to steady move forward, due to the aspect emergency in China is later than foreign countries, it has many imbalanced phenomenon, and so research on rural cooperatives has important significances in current new rural development (He and Lu, 2009).
Xue Ping in comparison of domestic and foreign rural cooperatives theories development, found Chinese rural cooperatives correlation theories shortcomings by comparing each country legislation and academic aspects, and through discussion on comparison of China and foreign countries, she put forward suggestions to perfect China's rural cooperatives countermeasures, verified feasibility and effectiveness of developing new pattern rural cooperatives (Zhang *et al.*, 2013).
Just on the basis of above researches, the paper carries on further analysis and researches on new pattern rural cooperatives development problems, makes quantization on them by applying questionnaire survey, analytic hierarchy process and other methods, the result is reasonable and effective (Huang and Yang, 2011).

2. Indicators selection

After entering into 21st century, China joined into WTO organization, its economy gradually fused into world economy entity, China's agricultural products and others due to family decentralized operation, it caused low competitiveness, low productivity as well as other drawbacks increasing, in the background of one place market economy gradually fusing into rural small-peasant economy, peasants started to establish various of producers' cooperatives (Chen and Wu, 2009), from which it mainly includes: economic complex, professional association, professional cooperatives, community cooperatives and so on, then, with economic development (Zheng, 2015), China established new pattern rural cooperatives, but from which some aspects were urgently to be improved, main aspects were as following (Zhang *et al.*, 2015):
(1) Government roles in new rural cooperatives development were relative fuzzy;
(2) New rural cooperatives continuously development weakness;
(3) New rural cooperatives lacked of normalized internal running mechanism;
(4) New rural cooperatives professional extent was not good enough;

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(5) New rural cooperatives scales were small, proportions were little;
(6) New rural cooperatives cover area was small, cooperation extent was single

To solve above problems, the paper studies system development problems of them, selects correlation indicators from “New rural cooperatives” and other articles, analyzes obtained data by questionnaire survey, mathematical statistics and other methods (Chen, 2013), finally it gets each indicator table as following Table 1:

Table 1: New rural cooperatives system development problem system table

First grade indicator	Second grade indicator	Third grade indicator
U1 Insurance system	T1 System requirements	T11 City one location scale
		T12 Techniques
		T13 Constitutional order
		T14 Product price changes
		T15 Factor price changes
		T16 Marketing channel
	T2 New rural social insurance system	T21 Peasants aged relief law
		T22 Aged and disabled social insurance law
		T23 Work injury insurance law
		T24 Sickness insurance law
	T3 System conditions	T31 Interaction between supply and demand
		T32 System innovation
		T33 Balance between supply and demand
U2 Legal safeguard	T4 System supplies	T41 Constitutional order
		T42 Anticipated system cost
		T43 System designing cost
	T5 System accumulation	T51 Upper level decision net profit
		T52 Current system arrangement
		T53 Knowledge accumulation
	T6 Cooperative medical care system	T61 Financial aid
		T62 Social relief and aid
		T63 Typical system fostering
	T7 Vulnerable groups security system	T71 Legal aid system
		T72 Minimum subsistence guarantee system
		T73 Execution of rescuing measures

3. Model establishments

AHP features are layering complicated problems, making clear about primary and secondary, possessing stronger logicality and hierarchical structure, the algorithm mainly is calculating indicators’ weights. It is applicable to comprehensive assessment system, is a powerful mathematical method that converts problems into quantitative research. Nowadays analytic hierarchy process has already widely used in each field to solve practical problems (Cai and Cao, 2015). New pattern rural cooperatives system development problem involves multiple reference indicators; the decision problem is suitable to analytic hierarchy process. Analytic hierarchy process respectively reflect each factor interactive relationship both in horizontal and vertical directions, due to decision-maker weights on different factors are not certainly the same, so it establishes hierarchical structure model to compare mutual importance, therefore it needs to construct judgment comparison matrix.

In formula, b_{ij} the two compared importance uses quantized value to express, it uses 1-9 number to describe, and number representative meaning is as following Table 2 show:

Table 2: 1-9 scale meaning

Scale	Meaning
1	Indicates two factors have equal importance by comparing
3	Indicates the former is slightly more important than the later by comparing two factors
5	Indicates the former is more important than the later by comparing two factors
7	Indicates the former is relatively more important than the later by comparing two factors
9	Indicates the former is extremely more important than the later by comparing two factors
Even number	Represents importance is between two odd numbers
Reciprocal	Represents factors positive and negative comparison order

3.1 Weight vector and maximum features calculation

According to first grade indicators judgment matrix vectors, carry on normalization processing with them, solve the sum by line and then make normalization, it can get weight vectors. According to feature values and feature vectors relationships, it can solve feature values.

3.2 Consistency test

To matrix $u=(b_{ij})_{n*n}$, if matrix element meets $b_{ij}b_{jk}=b_k$, then matrix is consistent matrix. Among them, $b_{ij>0}$, $b_{ij=1}/b_{ii}$. In order to use it to calculate factor weight, it requires that matrix inconsistency only under acceptable conditions. When problems are relative complicated, we cannot take all factors into account, which causes paired comparison construct judgment matrix instant, judgment matrix cannot arrive at ideal state consistency. Judgment matrix consistency indicator *CI*, and judgment matrix consistency ratio *CR*, its computational method is as following formula show: CI=(λ_{max}-*n*)/(*n-1*)

Among them, *n* represent order number of judgment matrix that is also the number of compared factors: $CR=\frac{CI}{RI}$

Among them, *RI* represents Random Consistency Index value.

When $CR\geq 0.1$, it is thought that judgment matrix occurs inconsistency that needs to make adjustment on judgment matrix again. When $CR<0.1$, judgment matrix inconsistency is within acceptable range.

Next step is doing combination consistency testing. Assume that in one layer, m pieces of factors weight calculation result is α_m, corresponding consistency indicator value respectively is CI_m, combination consistency test consistency ratio is:

$$CR=\frac{\sum_{j=1}^{m}\alpha_j CI_j}{\sum_{j=1}^{m}\alpha_j RI_j}$$

By calculating, combination consistency ratio calculated value is: $CR<0.1$

So hierarchical total arrangement's consistency testing meets consistency requirement.

3.3 Weight calculation arrangement

If in one layer, m pieces of factors weight calculation result is α_m, corresponding consistency indicator value respectively is CI_m, in next layer *n* pieces of factors to *A* layer calculation weight is β_{nm}, then in *T* layer factors total arrangement weight is:

$$w_i=\sum_{j=1}^{m}\alpha_i\beta_{ij}$$

By above formula calculating, it gets each indicator weight in total target.

3.4 Model application

By using yaah0.53 software, the paper scores new pattern rural cooperatives system development problem involved each indicator, firstly it needs to define judgment matrix, calculate new pattern rural cooperatives system development problems evaluation, specific process is as following Table 3-13 shows:

Table 3: New pattern rural cooperatives system development problem second grade judgment matrix and weights

A	U1	U5	w_i
U1	1	1/5	0.5556
U5	5	1	0.6666

Table 4: New pattern rural cooperatives system development problem U1 fourth grade judgment matrix and weights

U1	T1	T2	T3	T4	w_i
T1	1	1/5	5	5	0.5511
T2	5	1	5	5	0.3900
T3	1/5	1/5	1	5	0.1654
T4	1/5	1/5	1/5	1	0.1143

Note: Weight on total target: 0.5555; Judgment matrix consistency proportion: 0.0343;

Table 5: New pattern rural cooperatives system development problem U2 third grade judgment matrix and weights

U2	T5	T6	T7	w_i
T5	1	1	1	0.5555
T6	1	1	1	0.5555
T7	1	1	1	0.5555

Table 6: New pattern rural cooperatives system development problem T1 sixth grade judgment matrix and weights

T1	T11	T15	T15	T13	T14	T16	w_i
T11	1	4	1/5	1	1/5	1/5	0.1142
T15	1/4	1	1/8	1	1/6	1/4	0.0308
T15	5	8	1	3	1	5	0.5199
T13	1	1	1/3	1	1/3	1/5	0.0736
T14	5	6	1	3	1	1	0.5459
T16	5	4	1/5	5	1	1	0.1945

Table 7: New pattern rural cooperatives system development problem T2 fourth grade judgment matrix and weights

T2	T21	T22	T23	T24	w_i
T21	1	1/4	1	1/5	0.1055
T22	4	1	5	1	0.5974
T23	1	1/5	1	1/4	0.1057
T24	5	1	4	1	0.5972

Table 8: New pattern rural cooperatives system development problem T3 fourth grade judgment matrix and weights

T3	T31	T32	T33	w_i
T31	1	5	5	0.4579
T32	1/5	1	1/5	0.1595
T33	1/5	5	1	0.5554

Table 9: New pattern rural cooperatives system development problem T4 third grade judgment matrix and weights

T4	T41	T42	T43	w_i
T41	1	5	5	0.4955
T42	1/5	1	5	0.5396
T43	1/5	1/5	1	0.1471

Table 10: New pattern rural cooperatives system development problem T4 third grade judgment matrix and weights

T5	T51	T52	T53	w_i
T51	1	5	5	0.410
T52	1/5	1	1	0.5300
T53	1/5	1	1	0.5400

Table 11: New pattern rural cooperatives system development problem T6 third grade judgment matrix and weights

T6	T61	T62	T63	w_i
T61	1	5	5	0.3952
T62	1/5	1	1/5	0.1949
T63	1/5	5	1	0.5108

Table 12: New pattern rural cooperatives system development problem T7 third grade judgment matrix and weights

T7	T71	T72	T73	w_i
T71	1	5	1/5	0.5971
T72	1/5	1	1/5	0.1652
T73	5	5	1	0.4596

Table 13: New pattern rural cooperatives system development problem final weights

Alternative offer	Weight	Alternative offer	Weight	Alternative offer	Weight
T11	0.0088	T53	0.0639	T45	0.0445
T15	0.0051	T51	0.0586	T61	0.1096
T15	0.0535	T55	0.0076	T65	0.0352
T13	0.0048	T55	0.0182	T65	0.0694
T14	0.0198	T31	0.0559	T71	0.0660
T16	0.0141	T35	0.0097	T75	0.0561
T51	0.0168	T35	0.0065	T75	0.1190
T55	0.0638	T41	0.1112		
T55	0.0167	T45	0.0447		

4. Application examples

In order to clearly present the model effectiveness, the paper researches on China's 14 regions new pattern rural cooperatives system development problems, and applies above process into the examples, gets each indicator second grade scores, arranges them, as following Table 14:

Table 14: Fourteen regions new pattern rural cooperatives development scores and ranking

	C1		C2		C3		C4		C5		C6		C7	
	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Changsha city	7.72	1	16.34	1	5.48	1	3.85	1	22.22	1	22.24	1	22.22	2
Hengyang city	6.01	3	12.05	5	5.38	3	2.91	3	9.51	12	18.54	8	14.15	9
Xiangtan city	6.46	2	12．87	3	4.36	6	2.94	2	16.71	2	22.24	1	22.75	1
Zhuzhou city	5.29	6	10.42	9	3.67	12	2.73	4	14.48	3	16.67	13	16.94	6
Changde city	4.60	13	9.01	13	4.01	8	2.05	10	11.35	9	17.35	11	15.54	7
Yueyang city	5.69	5	11.18	7	5.44	2	2.53	5	13.64	4	19.77	5	18.05	3
Shaoyang city	5.77	4	10.04	10	4.36	6	2.44	7	11.52	8	18.54	8	17.98	4
Zhangjiajie	5.12	10	11.87	6	3.13	14	1.88	12	8.92	13	21.13	3	15.45	8
Yongzhou city	5.20	8	13.13	2	4.89	4	2.47	6	11.58	7	19.21	6	13.72	11
Chenzhou city	5.27	7	9.08	12	4.77	5	2.35	8	9.23	11	14.89	14	13.88	10
Yiyang city	5.12	9	9.86	11	4.06	9	2.28	9	11.79	6	18.19	10	17.26	5
Huaihua city	4.65	12	10．55	8	3.99	10	1.87	13	8.80	14	19.06	7	12.24	12
Xiangxi Autonomous Prefecture	5.07	11	12.72	4	3.16	13	1.93	11	12.08	5	21.35	4	11.12	13
Loudi city	4.29	14	8.80	14	3.83	11	11.71	14	10.59	10	17.23	12	9.08	14
Average value	5.45	/	11.27	/	4.33	/	2.42	/	12.30	/	19.03	/	15.75	/
Standard deviation	0.87	/	2.07	/	0.78	/	0.57	/	3.62	/	2.16	/	3.85	/

Apply Excel software to process with above calculation result, and apply formula ISA= $\sum W_i S_i$ (from which S represents each factor standard value, W represents corresponding weight) therefore we can get each indicator total scores, and arrange them that result is as following Table 15 shows:

Table 15: Each region comprehensive ranking

	U1		U2		U3	
	Score	Ranking	Score	Ranking	Score	Ranking
Changsha city	33.3	1	66.6	1	100.0	1
Hengyang city	26.36	3	42.	11	68.7	7
Xiangtan city	26.5	2	61.7	2	88.3	2
Zhuzhou city	21.8	9	48.	4	69.9	6
Changde city	19.7	13	44.	10	62.	11
Yueyang city	24.8	5	51.0	3	75.9	3
Shaoyang city	22.6	7	48.0	5	70.6	4
Zhangjiajie	22.0	8	45.5	7	67.5	9
Yongzhou city	25.70	4	44.5	9	70.2	5
Chenzhou city	21.4	10	38.0	13	59.4	13
Yiyang city	21.3	11	47.2	6	68.5	8
Huaihua city	21.0	12	40.1	12	61.1	12
Xiangxi Autonomous Prefecture	22.8	6	44.5	8	67.42	10
Loudi city	18.6	14	36.9	14	55.5	14
Average value	23.4	/	47.0	/	70.4	/
Standard deviation	3.7	/	8.31	/	11.5	/

5. Conclusion

The paper researches new pattern rural cooperatives system development problem model by applying analytic hierarchy process method, and assigns values on selected each indicator weight, after that applies new pattern rural cooperatives system development problem model into practical problem, makes statistics of China's 14 regions' new pattern rural cooperatives system development problem's second grade indicators, first grade indicators scores and final scores, gets each region ranking, from which Changsha city one place respectively ranks first in each indicator, it proves the region new pattern rural cooperatives system development is good, it is just consistent to practices.

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