Research on the Evaluation of the Effect of Agricultural Brand Management Based on AHP+DEMATEL Model

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Abstract—In this paper, through the analysis of the current situation of the management of agricultural products regional public brand, the AHP model is used to explore 20 factors affecting the effect of the management of agricultural products regional public brand, and the initial weights of indicators are revised and the final weights are obtained by combining with the DEMATEL method. It was found that the operability of brand strategy, traceability of quality and safety, integrity of quality monitoring system, application level of scientific and technological innovation, and brand positioning on value enhancement degree were the five main influencing factors. Finally, rationalization suggestions for the management of agricultural products regional public brands are proposed to promote the healthy development of agricultural products regional public brands.

Keywords- Brand management; Effectiveness evaluation; DE-MATEL method; AHP model

1 INTRODUCTION

In recent years, China's agricultural branding continues to break through, based on the regional characteristics of the development of the regional public brand of agricultural products momentum, but the brand management of poor and other problems have emerged. For example, "Wuchang rice is the best in the world, but the world's rice is fake Wuchang" reflects the lack of brand supervision and maintenance, the difficulty in pursuing responsibility for brand quality problems shows that the brand quality management efforts are small, the lack of space for brand appreciation reflects the weak innovation ability of the brand, and the easy imitation or poor reputation of the brand shows the lack of brand crisis management [1]. "Tragedy of the commons" and other inaction phenomena reflect the poor execution of brand management. The emergence of these problems has dealt a serious blow to the reputation and competitiveness of regional public brands, and it is urgent to propose a set of effective management strategies for regional public brands of agricultural products. Therefore, this paper will explore the current situation of the construction of regional public brands of agricultural products, trace back to the

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main factors affecting the effectiveness of brand management, and propose brand management strategies to help the sustainable development of regional public brands of agricultural products.

2 LITERATURE REVIEW

The existing domestic literature on the construction of regional common brand of agricultural products has various contents and methods, and the perspective is novel. In terms of research content, Yu Shiquan explored the registration and maintenance of regional common brands of agricultural products in Chun'an County and proposed measures such as "several unified" standards to achieve orderly management of the brands. Wang Shisheng took the example of "Yuanyang rice" and found that one of the reasons for its business predicament was the erosion of brand value due to the lack of management, and proposed corresponding measures from the perspective of government functions. Xiao Yun, Chen Tao, and Zhu Zhiju investigated the phenomenon of "free-riding" by members of farmers' professional cooperatives based on the perspective of public governance. They analyzed the causes, manifestations and hazards of the "free-riding" behavior of cooperative members, and put forward governance suggestions. Yang Yan and Yang Wenxuan , in their analysis of the roles of stakeholders of agricultural regional public brands, explain that the management and protection of brands are key in the mature stage, and discuss the roles of government, cooperatives, and farmers in brand management and protection.

3 SPECIFIC PRINCIPLES OF RESEARCH METHODS

3.1 The basic principle of AHP model

The AHP method, or hierarchical analysis, is a hierarchical weighting decision analysis method proposed by American operations researcher Professor Satie of the University of Pittsburgh in the early 1970s [2]. The method decomposes the decision objectives and related elements into levels such as objectives, criteria and programs, relies on expert consultation, experimental data, etc. to determine the relative importance weights of each program level, and on this basis, it is a decision-making method of qualitative and quantitative analysis.

3.2 The basic principle of DEMATEL optimization method

The DEMATEL method is a system analysis method using graph theory and matrix tools, proposed by A. Gabus and E. Fontela, scholars from Battelle Laboratories, USA. In this paper, based on the initial weights obtained by the AHP method, the DEMATEL method will be applied to calculate the degree of influence of each element on other elements and the degree of being influenced, so as to calculate the centrality and the comprehensive influence of each element. The initial weights are optimized using Matlab software in order to determine the causal relationship between the elements and the position of each element in the system [3].

4 EVALUATION ANALYSIS OF THE MANAGEMENT EFFECT OF AGRICULTURAL PRODUCTS REGIONAL PUBLIC BRAND

4.1 Data source and processing

In this paper, based on the current literature and relevant information, combined with the existing problems in the management of agricultural products regional public brand, 20 factors indexes affecting the effect of management of agricultural products regional public brand are extracted from five aspects: brand execution, brand quality management, brand enhancement and expansion, brand supervision and maintenance, and brand crisis management, and the opinions of 10 experts are integrated through expert consultation method, and the average of all experts' ratings is taken as the valid value. The average value is taken as the valid value, and MatlabR2018b is used to determine the size of the initial weights of each influencing factor. Then the final weights of each index are calculated by calculating the final weights of each index according to the experts' scoring of the inter-influence weights of each index [4].

4.2 Empirical analysis based on AHP model

The selection of indicators in the AHP method includes the target layer, the criterion layer and the program layer, and the hierarchical structure model for evaluating the factors of agricultural regional public brand management effectiveness.

4.2.1 Determination of the weights of the influence factors in the criterion layer

The factors B1-B5 are compared two by two to obtain the judgment matrix of the influence factors of the criterion layer, as shown in the following table. The judgment matrix with weight vector $\omega 1$= (0.1580, 0.4397, 0.1580, 0.1580, 0.0863)T, CI= 0.0050, CR= 0.0044 < 0.1, passed the consistency test. The degree of influence of the factors at the criterion level was ranked according to the weights: B2 (0.4397) > B1 (0.1580) = B3 (0.1580) = B4 (0.1580) > B5 (0.0863), that is, brand quality management has the greatest influence on the management of agricultural products regional public brands, the influence of brand execution, brand enhancement and expansion, and brand supervision and maintenance is The influence of brand quality management on the management of agricultural regional public brands is the greatest, and the influence of brand execution, brand enhancement and expansion, and brand supervision and maintenance is the least.

Table 1 Judgment matrix of influence factors at the criterion level

M	B_1	B_2	B_3	B_4	B_5
B_1	1	1/3	1	1	2
B_2	3	1	3	3	4
B_3	1	1/3	1	1	2
B_4	1	1/3	1	1	2
B_5	1/2	1/4	1/2	1/2	1

4.2.2 Determination of the weights of program level impact factors

Similarly, the judgment matrix of each program level influence factor can be obtained, and the results are shown in Table 2, Table 3, Table 4, Table 5, and Table 6, respectively. The weight vector of the criterion layer under brand execution is ω2= (0.0954, 0.4673, 0.1601, 0.2772)T, CI=0.0103, CR=0.0116＜0.1, which passes the consistency test. The order of importance of each influencing factor is C12 (0.4673) > C14 (0.2772) > C13 (0.1601) > C11 (0.0954), that is, for brand execution, the magnitude of the influencing effect is in the order of operability of brand strategy, involvement of brand subject, implementation of brand strategy tactics, and feasibility of brand strategy.

Table 2 Judgment matrix of factors influencing brand execution

B_1	C_{11}	C_{12}	C_{13}	C_{14}
C_{11}	1	1/4	1/2	1/3
C_{12}	4	1	3	2
C_{13}	2	1/3	1	1/2
C_{14}	3	1/2	2	1

The weight vector of the criterion layer under brand quality management was ω3= (0.1210, 0.5385, 0.2196, 0.1210)T with CI=0.0069 and CR=0.0077 <0.1, which passed the consistency test. The ranking of the importance of each influencing factor is C22 (0.5385) > C23 (0.2196) > C21 (0.1210) = C24 (0.1210). Therefore, in terms of brand quality management, the magnitude of the impact of each indicator is: the traceability of quality and safety has the greatest impact, the integrity of the quality monitoring system has the second greatest impact, and the standardization of the production process and the level of application of scientific and technological innovation has the least impact.

Table 3 Judgment matrix of factors influencing brand quality management

B_2	C_{21}	C_{22}	C_{23}	C_{24}
C_{21}	1	1/4	1/2	1
C_{22}	4	1	3	4
C_{23}	2	1/3	1	2
C_{24}	1	1/4	1/2	1

The weight vector of the criterion layer under brand enhancement and expansion was ω4= (0.1722, 0.5862, 0.0694, 0.1722)T, CI=0.0202, CR=0.0227 <0.1, which passed the consistency test. The order of importance of each influencing factor is: C32 (0.5862) > C31 (0.1722) = C34 (0.1722) > C33 (0.0694), that is, in terms of brand enhancement and expansion, the magnitude of the influence of each indicator is: the brand positioning has the greatest influence on the degree of value enhancement, the influence of brand appreciation space and the rationality of brand model selection is the second, and the influence of certification registration The influence of positive registration is the smallest.

Table 4 Judgment matrix of factors influencing brand enhancement and expansion

B_3	C_{31}	C_{32}	C_{33}	C_{34}
C_{31}	1	1/4	3	1
C_{32}	4	1	6	4
C_{33}	1/3	1/6	1	1/3
C_{34}	1	1/4	3	1

The weight vector of the criterion layer under brand regulation and maintenance was ω5= (0.0729, 0.1699, 0.2844, 0.4729)T, CI=0.0170, CR=0.0191 <0.1, which passed the consistency test. The order of importance of each influencing factor is: C44 (0.4729) > C43 (0.2844) > C42 (0.1699) > C41 (0.0729), that is, in terms of brand regulation and maintenance, the development ability of chain management has the greatest influence, followed by the organizational leadership of industry associations, the third is the strength of technological means to combat counterfeiting, and the least influential is the threshold of trademark registration.

Table 5 Judgment matrix of factors influencing brand regulation and maintenancee

B_4	C_{41}	C_{42}	C_{43}	C_{44}
C_{41}	1	1/3	1/4	1/5
C_{42}	3	1	1/2	1/3
C_{43}	4	2	1	1/2
C_{44}	5	3	2	1

The weight vector of the criterion layer under brand crisis management was ω6= (0.4852, 0.2968, 0.1090, 0.1090)T, CI=0.0069, CR=0.0077 <0.1, which passed the consistency test. The order of importance of each influencing factor is: C51(0.4852) > C52(0.2968) > C53(0.1090) = C54(0.1090), that is, in terms of brand crisis management, the soundness of the crisis prevention system has the greatest influence, followed by the ability to respond to crisis events, and the least influential is the ability to reshape the image after the crisis and the ability to communicate and collaborate with the media. The least influential is the post-crisis image reconstruction ability and communication and collaboration with media.

Table 6 Judgment matrix of factors influencing brand crisis management

B_5	C_{51}	C_{52}	C_{53}	C_{54}
C_{51}	1	2	4	4
C_{52}	1/2	1	3	3
C_{53}	1/4	1/3	1	1
C_{54}	1/4	1/3	1	1

Comprehensive weight analysis of inf Through the comprehensive calculation of the criterion layer and the program layer, the total weights of the indicator layer to the target layer can be finally obtained as shown in Table 7. The order of importance of factors affecting the management effect of agricultural regional public brand is: C22(0.2368)>C23 (0.0966)>C32(0.0926)>C44(0.0747)>C12(0.0738)>C21(0.0532)=C24(0.0532)>C43(0.0449)>

C14(0.0438)>C51(0.0419)>C31(0.0272)=C34(0.0272)>C42(0.0268)>C52(0.0256)>C13(0.0253)>C11(0.0151)>C41(0.0115)>C33(0.0110)> C53(0.0094) = C54(0.0094).

Table 7 Weighting and ranking of factors influencing the management effect of regional public brands of agricultural products

Criteria layer	Criterion layer weights	Scheme layer	Weight calculation method	Scheme layer weights	Sorting
B1	0.1580	C_{11}	0.1580*0.0954	0.0151	16
		C_{12}	0.1580*0.4673	0.0738	5
		C_{13}	0.1580*0.1601	0.0253	15
		C_{14}	0.1580*0.2772	0.0438	9
B2	0.4397	C_{21}	0.4397*0.1210	0.0532	6
		C_{22}	0.4397*0.5385	0.2368	1
		C_{23}	0.4397*0.2196	0.0966	2
		C_{24}	0.4397*0.1210	0.0532	6
B3	0.1580	C_{31}	0.1580*0.1722	0.0272	11
		C_{32}	0.1580*0.5862	0.0926	3
		C_{33}	0.1580*0.0694	0.0110	18
		C_{34}	0.1580*0.1722	0.0272	11
B4	0.1580	C_{41}	0.1580*0.0729	0.0115	17
		C_{42}	0.1580*0.1699	0.0268	13
		C_{43}	0.1580*0.2844	0.0449	8
		C_{44}	0.1580*0.4729	0.0747	4
B5	0.0863	C_{51}	0.0863*0.4852	0.0419	10
		C_{52}	0.0863*0.2968	0.0256	14
		C_{53}	0.0863*0.1090	0.0094	19
		C_{54}	0.0863*0.1090	0.0094	19

4.2.3 Correction analysis based on DEMATEL method

It can be seen from Figure 1 that the comprehensive influence of the two factors, the traceability of quality and safety (C22) and the integrity of the quality inspection system (C23), is greater than 0.1, indicating that these two factors have the greatest impact on the regional public brand management of agricultural products; The level of application of technological innovation (C24), the operability of brand strategy (C12), and the degree of brand positioning on value enhancement (C32). The comprehensive influence of the three factors is between 0.05-0.1, reflecting the three factors on the regional public brand management of agricultural products The influence of, the other 15 factors have the least influence on it. Therefore, this article will focus on the analysis of the top five influencing factors of comprehensive influence, in order to put forward relevant policies and suggestions in a targeted manner.

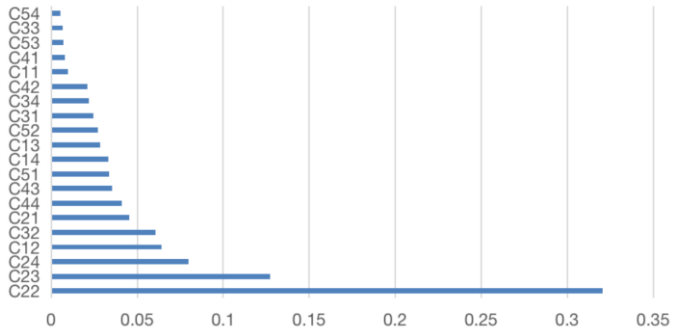

Figure 1. Histogram of the comprehensive influence of each factor.

5 CONCLUSION

Based on the above results, the author takes the five main factors affecting the effect of management of agricultural regional public brands as the main force point, and constructs a set of targeted management strategies for agricultural regional public brands by combining the relevant responsibilities and roles of different subjects.

Formulate practical brand management strategies and mobilize the enthusiasm of all parties: the government and local departments should grasp the general direction of the management of agricultural products regional common brands, provide policy and financial support for the management of agricultural products regional common brands, and stimulate the innovation and participation of industry associations and enterprises. Industry associations should give full play to their role as bridges and links, and provide timely feedback on the problems arising in the management of regional public brands of agricultural products.

Strictly control the quality of agricultural products and improve the quality testing system: the government should improve the information platform of agricultural products quality and safety traceability management, actively promote data opening and sharing, and carry out the development of brand ID cards for agricultural products; the government should improve the quality of after-sales service for regional public brand agricultural products, so that consumers can trace every link of agricultural products from production to sales. In addition, the government should develop and strictly implement standards involving the quality of agricultural products production and crack down on farmers and enterprises producing counterfeit and shoddy products. Industry associations should assist in docking authoritative quality monitoring agencies to regularly sample and test agricultural products to ensure product quality standards [5].

Increase the investment in science and technology to improve the efficiency of brand management: to stimulate brand vitality and improve brand competitiveness, the support of science and technology is indispensable. The government should encourage enterprises to increase investment in science and technology through policy inclination, and encourage the use of Internet of Things and other technologies to monitor the growth environment, growth cycle and other conditions of agricultural products in real time, so that problems can be found

and solved in time. Enterprises should consciously manage the quality of agricultural products, produce in strict accordance with relevant standards in all aspects of the production, supply and marketing process, and innovate in agricultural production technology, continuously learn and accept new technologies, improve varieties of agricultural products, optimize the planting environment, and continuously improve the quality of agricultural products [6]. Agricultural associations should join with enterprises to innovate information technology services, carry out innovation in brand design, brand packaging and brand publicity, so as to obtain consumers' brand recognition of agricultural brands, and enhance the recognizability of agricultural regional public brands by using mass media for publicity and other means.

Differentiated brand positioning to enhance the brand value of agricultural products: localities should fully explore the regional characteristics and differentiate the positioning of the regional common brand of agricultural products in terms of brand history, brand story and quality characteristics. The government, industry associations and enterprises are linked at three levels to select and establish unique images and design unique logos and packaging for the regional public brands of agricultural products. The government publishes the Regional Agricultural Products Brand Catalogue to publicize different brands and their positioning, providing favorable conditions for the gradient value-added of provincial high-quality agricultural products regional common brands.

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