

Research on Performance Evaluation of Green Food Marketing Channel Based on Fuzzy-AHP Model

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Abstract: The marketing channel performance of agricultural products is the ultimate measure of whether the product value can be maximized, as well as an important indicator to measure the marketing level of agricultural products enterprises. This paper takes Beidahuang Group's green food marketing channel as the research object, and combined with its green food marketing status quo, builds a green food marketing channel performance evaluation system from the aspects of channel environment, channel management, channel members, etc. and uses the AHP and fuzzy comprehensive evaluation to analysis the marketing channel performance of Beidahuang Group green food empirically. Finally, this paper puts forward some suggestions on improving the performance of Beidahuang Group's green food marketing channels based on the results of empirical analysis, and provides reference for the decision-making of green food enterprises.

1. Introduction

The issue of marketing channel is one of the central issues in marketing research.and the issue of marketing channels of agricultural products is even more theoretical frontier in agricultural economic management and agribusiness management[1].The marketing channels of agricultural products are the ways which agricultural products transfer from producers to consumers. Whether the marketing channels are smooth, stable and efficient will affect the ultimate interests of producers, middlemen and consumers to a certain extent, thus affecting the marketing decision-making performance.With the development of society and economy and improvement of people's living standards, green food, as a non-polluting, pollution-free, safe, high-quality and nutritious agricultural product, has stimulated consumers' strong demand for food greening and more and more enterprises started develop green food industry, and strive to create a well-known green food brand to seize the market. However, with the continuous intensification of the competition in the green food market, the problems such as high channel costs, poor circulation and inefficiency have become increasingly prominent, which directly affect the channel performance and inhibit the maximization of consumer welfare. Therefore, Evaluating and analyzing the performance of green food marketing channels is of great significance to improving the circulation efficiency of green food, reducing circulation costs and increasing the income of agricultural products enterprises and farmers. This paper makes use of Fuzzy-AHP evaluation model in fuzzy mathematics to quantify various indicators of green food marketing channel performance comprehensively, eliminate their subjectivity and uncertainty, and provide some reference for marketing decision-making.

2. Construction of Marketing Channel Performance Evaluation System

In order to reflect the actual performance of the object comprehensively, objectively and truly, the evaluation system should be constructed in a scientific, systematic and operational manner. As the channel is a complex overall organization, from manufacturers to consumers to go through multiple levels, multiple links, with some complexity and variability[2]. Therefore, in evaluating its performance, it is necessary to consider various factors comprehensively both inside and outside, and select a reasonable evaluation indicators, build a scientific evaluation model.

2.1. Indicator selection and data source

Based on the above analysis, this article combines with the characteristics of the green food industry, from the perspective of the enterprise, takes the channel as a whole evaluation object and builds a green food marketing channel performance evaluation system that includes channel environment, channel management and channel members three dimensions 18 indexes to evaluate its performance.

1) Channel environment. Channel environment can be embodied by market share and competitiveness of the two indicators.

2) Channel management. In every aspect of the marketing channel, we pay attention to the maximization of our own interests. Therefore, we need to manage and control the channel process strictly. Under the precondition of ensuring safety, we can reduce the operation cost of the channel and improve the operation efficiency. Therefore, channel management can be identified as a first-class indicators, channel safety and channel efficiency as a secondary indicator.

3) Channel members. Channel members, including producers, agents, wholesalers and retailers, because of the difficulty of collecting data in this part of the study, only the customer as the research object. The secondary indicators includes customer satisfaction, customer loyalty, customer maintenance capabilities.

In summary, the green food marketing channel performance evaluation index system as shown in the following table:

Table 1 Performance Evaluation Index System of Green Food Marketing Channel

First level indicators	Secondary indicators	Three indicators
Channel environment(U1)	market share (U11)	All market share(U111)
		Relative market share(U112)
	Competitiveness(U12)	Reach market share(U113)
		Brand awareness(U121)
Channel management(U2)	Channel safety(U21)	Product quality(U122)
		Price advantage(U123)
		Repayment rate(U211)
	Channel efficiency(U22)	Period of payment(U212)
		Average shipments(U221)
		Average delivery cycle(U222)
Channel members(U3)	customer satisfaction(U31)	Average daily sales(U223)
		Customer retention(U311)
		Sales rate of change(U312)
	Customer Loyalty(U32)	Customer complaint rate(U313)
		Purchase frequency(U321)
	Customer maintenance capabilities(U33)	Price sensitivity(U322)
Mining customer ability(U331)		
		Maintain customer ability(U332)

2.2. Construction of Performance Evaluation Model

The performance evaluation of marketing channel is a multi-level, multi-factor and multi-objective comprehensive evaluation problem[3]. Simply evaluating by single factor method can not

comprehensively reflect its actual situation. Meanwhile, due to the factors affecting and reflecting the performance of green food marketing channel and many variables, various factors are intertwined and influence each other, and the index system is complex, so the evaluation of the performance of green food marketing channels has some ambiguities and it is difficult to judge them comprehensively and accurately. Based on the above reasons, this paper uses AHP and fuzzy comprehensive evaluation to analyze the performance of the system by establishing Fuzzy-AHP comprehensive evaluation model[4]. Specific steps are as follows:

1) Establish evaluation index set.

The first level: $U = \{U_1, U_2 \dots U_n\}$ ($n = 3$)

The second level: $U_n = \{U_{n1}, U_{n2} \dots U_{ni}\}$ ($i = 1, 2, 3 \dots n$)

The third level: $U_{ni} = \{U_{ni1}, U_{ni2}, U_{ni3} \dots U_{nij}\}$ ($j = 1, 2, 3 \dots n$)

2) Set up evaluation comment set

The set of performance evaluation of marketing channels is determined as the set of evaluation results made by the evaluators on the evaluation objects, including four evaluation samples, $V = \{V_1, V_2, V_3, V_4\}$, $V_1 - V_4$ which represent excellent, good, medium and bad respectively.

3) Determine the weight distribution set, construct the fuzzy evaluation membership matrix.

The weight of U_i to U is a_i , and the weight distribution set of each index of n th criterion layer is $A = \{A_1, A_2, A_3\}$, the weight of U_{ij} to U_i is a_{ij} , and the weight assignment set of each index in the sub-criteria layer is: $A_i = \{a_{i1}, a_{i2}, a_{i3}, \dots, a_{ij}\}$. The values of a_i and a_{ij} above can be determined by (AHP).

4) Establish the membership matrix R

$$R = (r_{ij})_{m \times n} = \begin{pmatrix} r_{11} & r_{12} & \dots & r_{1j} \\ r_{21} & r_{22} & \dots & r_{2j} \\ \vdots & \vdots & \vdots & \vdots \\ r_{i1} & r_{i2} & \dots & r_{ij} \end{pmatrix} \quad r_{ij} (i = 1, 2 \dots m, j = 1, 2 \dots n)$$

This matrix represents the fuzzy matrix of the third-level factor corresponding to i factor in the second-level index, n is the number of influencing factors in the third-level index, m is the number of evaluation set elements, and R_{ij} is calculated through questionnaire The frequency of arrival, and i get V_i, V_j -level evaluation of the first f indicators, $R_{ij} = \frac{V_{ij}}{K}$

5) Multi-level fuzzy comprehensive evaluation

First level fuzzy comprehensive evaluation:

$$R_i = \begin{pmatrix} r_{i11} & r_{i12} & \dots & r_{i1p} \\ r_{i21} & r_{i22} & \dots & r_{i2p} \\ \vdots & \vdots & \vdots & \vdots \\ r_{im1} & r_{im2} & \dots & r_{imp} \end{pmatrix} \quad r_{ijk} (i = 1, 2, 3 \dots n, j = 1, 2, 3 \dots m, k = 1, 2 \dots p)$$

Among them, the i line is the last level of the j factor U_{ij} of the evaluation results, First level fuzzy comprehensive evaluation set is:

$$B_i = A_i * R_i = \begin{pmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{pmatrix}^T * \begin{pmatrix} r_{i1} & r_{i2} & \dots & r_{ij} \\ r_{i21} & r_{i22} & \dots & r_{i2j} \\ \vdots & \vdots & \vdots & \vdots \\ r_{in1} & r_{in2} & \dots & r_{inj} \end{pmatrix} = \begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_m \end{pmatrix}^T \quad (i = 1, 2, 3 \dots n, j = 1, 2, 3 \dots m)$$

After normalized $B = (b_1, b_2 \dots b_m)$

Second-level fuzzy comprehensive evaluation, evaluation membership matrix:

$$B^T = A * B = \begin{pmatrix} a_1 \\ a_2 \\ \vdots \\ a_n \end{pmatrix}^T * \begin{pmatrix} b_{11} & b_{12} & \dots & b_{1j} \\ b_{21} & b_{22} & \dots & b_{2j} \\ \vdots & \vdots & \vdots & \vdots \\ b_{i1} & b_{i2} & \dots & b_{ij} \end{pmatrix} = \begin{pmatrix} b_1 \\ b_2 \\ \vdots \\ b_m \end{pmatrix}^T \quad (i = 1, 2, 3 \dots m, j = 1, 2, 3 \dots n)$$

B^T has been normalized, U is the membership vector of V , which is the result of the total evaluation.

6) The evaluation results were singularized.

Each factor in the comment set V is given a specific numerical value, and the final judgment result is obtained that is $S = B^T V$

3. Empirical analysis

3.1. Empirical analysis process

3.1.1. Data Sources

In order to ensure the reliability of the empirical results, during the process of obtaining the relevant data, a questionnaire was designed to investigate the responsible marketers and related personnel in the store by visiting Beidahuang green food store, obtaining the relative importance among various indicators, And then calculate the quantitative indicators of the score. In this survey, a total of 100 questionnaires were distributed and 80 valid questionnaires were returned, of which 75 were valid.

3.1.2. Determination of weight distribution set U.

The weight distribution set data obtained by the above method is as follows:

$$\begin{aligned}
 U &= \{U_1, U_2, U_3\} = \{0.109, 0.582, 0.309\} \\
 U_1 &= \{U_{11}, U_{12}\} = \{0.559, 0.441\} \\
 U_2 &= \{U_{21}, U_{22}\} = \{0.2, 0.8\} \\
 U_3 &= \{U_{31}, U_{32}, U_{33}\} = \{0.539, 0.297, 0.164\} \\
 U_{11} &= \{U_{111}, U_{112}, U_{113}\} = \{0.333, 0.333, 0.334\} \\
 U_{12} &= \{U_{121}, U_{122}, U_{123}\} = \{0.598, 0.402\} \\
 U_{21} &= \{U_{211}, U_{212}\} = \{0.5, 0.5\} \\
 U_{22} &= \{U_{221}, U_{222}, U_{223}\} = \{0.258, 0.637, 0.105\} \\
 U_{31} &= \{U_{311}, U_{312}, U_{313}\} = \{0.429, 0.429, 0.142\} \\
 U_{32} &= \{U_{321}, U_{322}\} = \{0.75, 0.25\} \\
 U_{33} &= \{U_{331}, U_{332}\} = \{0.667, 0.333\}
 \end{aligned}$$

3.1.3. Set up evaluation comment set

We obtained three-level index membership data through the questionnaire statistics as follows:

Table 2 Three indicators of membership

First level indicators	Secondary indicators	Three indicators	excellent	good	medium	poor
U1	U11	U111	0.11	0.28	0.35	0.26
		U112	0.12	0.32	0.36	0.2
		U113	0.08	0.15	0.44	0.33
	U12	U121	0.41	0.33	0.26	0
		U122	0.53	0.38	0.09	0
		U123	0	0.24	0.54	0.22
U2	U21	U211	0.17	0.45	0.31	0.07
		U212	0.16	0.41	0.25	0.18
		U221	0.12	0.22	0.38	0.28
	U22	U222	0.14	0.21	0.4	0.25
		U223	0.27	0.3	0.32	0.11
U3	U31	U311	0.1	0.25	0.39	0.26
		U312	0.08	0.17	0.56	0.19
		U313	0.15	0.38	0.34	0.13
	U32	U321	0.08	0.24	0.4	0.28
		U322	0.13	0.29	0.28	0.3
U33	U331	0.19	0.26	0.3	0.25	
	U332	0.22	0.34	0.29	0.15	

3.1.4. Fuzzy comprehensive evaluation .

First-level comprehensive evaluation matrix:

$$R_{11} = \begin{bmatrix} 0.11 & 0.28 & 0.35 & 0.26 \\ 0.12 & 0.32 & 0.36 & 0.20 \\ 0.08 & 0.15 & 0.44 & 0.33 \end{bmatrix} \quad R_{12} = \begin{bmatrix} 0.41 & 0.33 & 0.26 & 0 \\ 0.53 & 0.38 & 0.09 & 0 \\ 0 & 0.24 & 0.54 & 0.22 \end{bmatrix}$$

$$R_{21} = \begin{bmatrix} 0.17 & 0.45 & 0.31 & 0.07 \\ 0.16 & 0.41 & 0.25 & 0.18 \end{bmatrix} \quad R_{22} = \begin{bmatrix} 0.12 & 0.22 & 0.38 & 0.28 \\ 0.14 & 0.21 & 0.40 & 0.25 \\ 0.27 & 0.30 & 0.32 & 0.11 \end{bmatrix}$$

$$R_{31} = \begin{bmatrix} 0.10 & 0.25 & 0.39 & 0.26 \\ 0.08 & 0.17 & 0.56 & 0.19 \\ 0.15 & 0.38 & 0.34 & 0.13 \end{bmatrix} \quad R_{32} = \begin{bmatrix} 0.08 & 0.24 & 0.40 & 0.28 \\ 0.13 & 0.29 & 0.28 & 0.30 \end{bmatrix}$$

$$R_{33} = \begin{bmatrix} 0.19 & 0.26 & 0.30 & 0.25 \\ 0.22 & 0.34 & 0.29 & 0.15 \end{bmatrix}$$

Come to a comprehensive evaluation:

$$B_{11} = Q_{11} * R_{11} = (0.103 \quad 0.250 \quad 0.383 \quad 0.263)$$

$$B_{12} = Q_{12} * R_{12} = (0.371 \quad 0.336 \quad 0.234 \quad 0.060)$$

$$B_{21} = Q_{21} * R_{21} = (0.165 \quad 0.430 \quad 0.280 \quad 0.125)$$

$$B_{22} = Q_{22} * R_{22} = (0.148 \quad 0.222 \quad 0.386 \quad 0.243)$$

$$B_{31} = Q_{31} * R_{31} = (0.099 \quad 0.234 \quad 0.456 \quad 0.212)$$

$$B_{32} = Q_{32} * R_{32} = (0.090 \quad 0.253 \quad 0.370 \quad 0.285)$$

$$B_{33} = Q_{33} * R_{33} = (0.200 \quad 0.287 \quad 0.300 \quad 0.217)$$

Two-level comprehensive evaluation matrix:

$$R_1 = \begin{bmatrix} 0.103 & 0.250 & 0.383 & 0.263 \\ 0.371 & 0.336 & 0.234 & 0.060 \end{bmatrix} \quad R_2 = \begin{bmatrix} 0.165 & 0.430 & 0.280 & 0.125 \\ 0.148 & 0.222 & 0.386 & 0.243 \end{bmatrix}$$

$$R_3 = \begin{bmatrix} 0.099 & 0.234 & 0.456 & 0.212 \\ 0.090 & 0.253 & 0.370 & 0.285 \\ 0.200 & 0.287 & 0.300 & 0.217 \end{bmatrix}$$

Come to two comprehensive evaluation:

$$B_1 = Q_1 * R_1 = (0.221 \quad 0.288 \quad 0.317 \quad 0.173)$$

$$B_2 = Q_2 * R_2 = (0.151 \quad 0.267 \quad 0.365 \quad 0.220)$$

$$B_3 = Q_3 * R_3 = (0.126 \quad 0.268 \quad 0.425 \quad 0.249)$$

3.1.5. The single-valued process of evaluation results:

Each comment on the set of parameters given to the specific value of V, if adopting the percentage system, $V_1 = 100, V_2 = 80, V_3 = 60, V_4 = 40$

$$B^T = A * B = (0.151 \quad 0.270 \quad 0.378 \quad 0.224)$$

$$S = B^T V = (0.151 \quad 0.270 \quad 0.378 \quad 0.224)(100 \quad 80 \quad 60 \quad 40) = 68.34$$

Different grades scores as follows:

Table 3 Different grades have the following scores

Overall score	First level indicators	Score	Secondary indicators	Score
68.34	U1	71.08	U11	63.8
			U12	80.42
	U2	67.16	U21	72.7
			U22	65.44
	U3	69.5	U31	64.46
			U32	62.84
			U33	69.64

3.2. Evaluation results

According to the result of AHP, we can conclude that the channel management in the first level index is the key factor to the channel members and the channel environment. The second level indexes have a greater impact on market share, channel efficiency and customer satisfaction.

Empirical analysis shows that green food marketing channel performance evaluation value is 68.34 of Bei Dahuang business, between medium and good, the marketing channel is more reasonable, but there are still some problems. As can be seen from the above table, in addition to competitiveness, the difference between the index scores is not particularly obvious, and between good and medium, indicating that enterprises in the green food has a good space for development

and competitiveness. A high-to-low level indicators of the channel environment, channel members, channel management, indicating that there are some shortcomings in the management of channels, and did not play its full effectiveness, so we should strengthen customer focus, as much as possible to meet consumer needs and solve customer In the aspect of the existing problems.

4. Conclusions and Countermeasures

Conclusions can be drawn by empirical analysis of the marketing channels of BeiDahuang green food enterprises that are as follows:

1) The market share score is relatively low, and its share of weight that caused the overall performance decreases.

2) The overall competitive advantage is obvious, brand awareness is high, product quality is good, but the price advantage is not obvious, the price is too high compared with other companies, making some customers lost, performance is reduced.

3) Low customer satisfaction and loyalty may result in lower performance due to failure to meet customer needs and lack of service.

4) Channel management performance is the lowest, and its impact on channel performance is relatively large, we can see that there are some loopholes in the channel management, focusing on channel efficiency, such as can not be timely delivery, there is no reasonable choice and appropriate channel model may be wasteful resources, did not maximize efficiency.

Countermeasures which to improve channel performance.

1) Increase market share

In order to improve market share, enterprises must locate the target market based on the sales of products, clear appropriate consumer groups, product promotion planning based on consumer characteristics and needs, so that consumers form a good image of their products; Enterprises should establish a good reputation and quality in terms of quality, and at the same time, take advantage of Internet technology, across space constraints, increase publicity and improve brand image, so that green food not only in the country have a strong influence, but also to the world.

2) Expand competitive advantage

Beidahuang Group has some competitive advantages in green food products and has a high brand awareness among consumers. However, enterprises still need to step up promotion and maintain brand influence and maintain a good image and reputation among consumers and, reduce production costs and transportation and other costs, so that the appropriate reduction in sales prices to attract consumers under the premise of ensuring quality.

3) Enhance customer satisfaction and loyalty.

In order to improve customer satisfaction, Enterprises needs to understand the requirement of consumers, and take a series of acts to meet their requirements as much as possible so as to make them satisfied, only in this way, customers satisfaction and r loyalty will be further increased[5]. To improve customer satisfaction, not only to ensure product quality, but also reflected in the service attitude, to provide customers with convenience, what needs to be done from the consumer's point of view, put ourselves in place for the sake of customers, so that customers feel good, enjoy from interest.

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