Application of Fuzzy Comprehensive Evaluation in the Selection of Retailers of Distribution Channel

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Abstract. As one of the members of the distribution channel, retailers play an important role in the channel operation. With the development of trend of channel flatting, more and more enterprises choose to distribute products through retailers directly, and choose the right retailers to become one of the important decision-making problems in enterprise distribution. Based on the manufacturers’ point of view, this paper puts forward the application of the fuzzy comprehensive evaluation method to the retailers, and illustrates the application of this method in practice.

Introduction

Distribution is an important link in the supply chain of enterprises, and the product distribution is an important part of the marketing activities of enterprises. With the development trend of flat channels, in order to reduce distribution costs, improve the efficiency of distribution, come closer to the end-consumers, more and more enterprises select a channel model ‘manufacturers-retailers-consumers’, thus bypassing wholesalers, cooperating with retailers directly [1].

Retailers, as a kind of members of distribution channels, get closest to the end-consumers, and understand the consumers demand best, are important members who provide accurate information of consumers’ demand for manufacturers [2]. On the other hand, in an ‘eyeball economy’ society, retailers' counters are also important places to attract consumers’ attention and bring economic benefits for enterprises. With the concept of ‘channel is the king, win the terminal market’ recognized by more and more enterprises, because of retailers’ special advantage of the closest to the terminal market, the retailers have become more and more important in the distribution channel operation [3] [4].

As for the enterprises that cooperate with the retailers, whether they will succeed or not in the competitive environment of the drive of market and customers, except for their own efforts, they also have to collaborate closely with the retailers as one of important members of the channel. Therefore, it’s very important for distribution channel design of production enterprises to select the appropriate retailers, which is one of important decision making problems in the distribution processes [5].

Select Retailers by Using the Fuzzy Comprehensive Evaluation Method

Nowadays, when many manufacturers choose retailers as partners for product distribution, they usually collect some data based on their experience to evaluate, as a result, the
manufacturers often unable to select retailers scientifically and accurately. Because many indexes are uncertain and subjective, and lack of necessary data analysis, the results may have a large deviation with the reality, which directly affects the accuracy of the evaluation results. The above problems can be solved well by using the fuzzy comprehensive evaluation method. Fuzzy comprehensive evaluation is a branch of fuzzy mathematical field, which uses mathematical methods to study and deal with the phenomenon of fuzziness, and makes comprehensive evaluation to objective things by determining the correct fuzzy evaluation domain and constructing the fuzzy evaluation matrix [6].

When the production enterprises select the retailers, they should use fuzzy comprehensive evaluation method to avoid the problem of poor roughness and accuracy of simple qualitative method, qualitative factors and fuzzy factors can be rationed by this method, which makes there retailers’ evaluation results more accurate.

**Application Examples**

A large food producer needs to choose three retailers as its partners in the five retailers: A₁, A₂, A₃, A₄ and A₅ in a specific area. According to the fuzzy comprehensive evaluation method, the steps of selecting retailers for the enterprise are as follows:

**Determine the Evaluation Index Set U of Retailer Selection**

According to the reality of the company, the evaluation index of retailer selection for the food manufacturer as shown in Table 1.

Suppose the evaluation index set as U. Among them, U= (U₁, U₂, ..., U₇), U₂=(U₂₁, U₂₂), U₄=(U₄₁, U₄₂, U₄₃), U₅=(U₅₁, U₅₂), U₇=(U₇₁, U₇₂, U₇₃).

<table>
<thead>
<tr>
<th>Target Level</th>
<th>First-Level Index</th>
<th>Second-Level Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluation Index System Of Retailer Selection</td>
<td>Geographical Location (U₁)</td>
<td>commodity throughput(U₂₁) annual average sales(U₂₂)</td>
</tr>
<tr>
<td></td>
<td>Operation Scale (U₂)</td>
<td>financial strength(U₄₁) the rate of return payment on time(U₄₂) inventory turnover(U₄₃)</td>
</tr>
<tr>
<td></td>
<td>Market Reputation (U₃)</td>
<td>Promotional funds of quasi investment(U₅₁) the type of promotion means(U₅₂)</td>
</tr>
<tr>
<td></td>
<td>Financial Position (U₄)</td>
<td>the importance degree for products(U₇₁) the willingness to promote products effectively(U₇₂) the degree of maintenance and implementation for sales policies(U₇₃)</td>
</tr>
<tr>
<td></td>
<td>Market Development (U₅)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information Communication (U₆)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooperative Willingness (U₇)</td>
<td></td>
</tr>
</tbody>
</table>

**Determine Comment Sets**

Let V={v₁, v₂, v₃, v₄, v₅}, they show that retailers’ comprehensive strength are in five grades: Very good, Good, General, Poor and Very poor. And the corresponding score is: {1.0, 0.8, 0.6, 0.4, 0.2}.
Determine the Weight $W$ of Evaluation Indexes

The manufacturer invited 10 experts to vote according to the degree of the importance of each evaluation index, and the statistic data are shown in Table 2.

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical Location ($U_{1}$)</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.222</td>
</tr>
<tr>
<td>Operation Scale ($U_{2}$)</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0.182</td>
</tr>
<tr>
<td>Market Reputation ($U_{3}$)</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.186</td>
</tr>
<tr>
<td>Financial Position ($U_{4}$)</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0.171</td>
</tr>
<tr>
<td>Market Development ($U_{5}$)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0.111</td>
</tr>
<tr>
<td>Information Communication ($U_{6}$)</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>0.079</td>
</tr>
<tr>
<td>Cooperative Willingness ($U_{7}$)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>0.050</td>
</tr>
</tbody>
</table>

According to the formula: $W_i = \frac{\sum (a_j \times n_j)}{N} \times \frac{1}{\sum a_j} = 7+6+5+4+3+2+1=28$

Among them, $W_1 = \frac{(7 \times 4 + 6 \times 4 + 5 \times 2)}{(28 \times 10)} = 0.22$, and so on, available: $W = (0.22, 0.18, 0.19, 0.17, 0.11, 0.08, 0.05)$.

In the same way, the weights of each second-level index are as follows: $W_2 = (0.57, 0.43), W_4 = (0.18, 0.47, 0.35), W_5 = (0.53, 0.47), W_7 = (0.25, 0.37, 0.38)$.

**First-Level Comprehensive Evaluation to Sub Factor Set $U_i$**

Firstly, set up the single factor matrix. The manufacturer invited 10 experts to score for each index of the five retailers according to the V grades, and worked out the average points of each index of the five retailers respectively.

Take the factor ‘geographical position (suppose it as $r_{11}$)’ of Retailer $A_1$ as an example, the results of experts scoring are as the following Table 3.

<table>
<thead>
<tr>
<th>Evaluation Number</th>
<th>Very Good (1.0)</th>
<th>Good (0.8)</th>
<th>General (0.6)</th>
<th>Poor (0.4)</th>
<th>Very Poor (0.2)</th>
<th>Average Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical position</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0.66</td>
</tr>
</tbody>
</table>

Among them, $r_{11} = \frac{(0.8 \times 4 + 0.6 \times 5 + 0.4 \times 1)}{10} = 0.66$.

In the same way, the average points of “geographical position” of retailer $A_2, A_3, A_4$ and $A_5$ are $r_{12} = 0.70, r_{13} = 0.58, r_{14} = 0.64, r_{15} = 0.48$.

So $R_1 = (0.66, 0.70, 0.58, 0.64, 0.48)$, and so on,

$R_2 = \begin{bmatrix} 0.38 & 0.64 & 0.48 & 0.40 & 0.64 \\ 0.66 & 0.58 & 0.36 & 0.60 & 0.64 \end{bmatrix}$

$R_3 = \begin{bmatrix} 0.46 & 0.36 & 0.64 & 0.70 & 0.66 \end{bmatrix}$
The normalized processing to B, available

\[ B = W^T R = \begin{pmatrix}
0.22 & 0.18 & 0.19 & 0.17 & 0.11 & 0.08 & 0.05 \\
0.6 & 0.6 & 0.6 & 0.6 & 0.4 & 0.4 & 0.4
\end{pmatrix}^T \]

\[ = \begin{pmatrix}
0.145 & 0.154 & 0.128 & 0.141 & 0.125
\end{pmatrix}^T \]

The order of good and bad points of the evaluation are \( A_2 > A_1 > A_4 > A_3 > A_5 \), so the manufacturer selected the Retailer \( A_1, A_2 \) and \( A_4 \) as its partners.

**Conclusion**

Firstly, in the process of the actual screening of retailers, it’s not necessary for the manufacturer to select the retailer who has the strongest comprehensive strength. If the manufacturer chooses strong retailers, and their own strength is limited, while retailers may
form the anti control of the manufacturers, so when the manufacturers carry out the channel and brand strategy, they will be in a more passive position. Therefore, the manufacturers should choose the most appropriate rather than the strongest retailers as a cooperative object, which is based on their own reality. Besides, the selection of the retailers’ evaluation is not a one-time, but a dynamic process. After the establishment of a cooperative relation between the two sides, the manufacturers still need to continue to monitor and evaluate the performance of the retailers, and then further adjust their evaluation results in time.

Secondly, this paper is from the manufacturers’ point of view to select retailers. Wholesalers, agents and retailers as middlemen of the distribution channels, they have some common characteristics in some aspects. Therefore, when the manufacturers need to choose other channel members, they could also determine the different evaluation index system according to the characteristics of different types of middlemen, and use the fuzzy comprehensive evaluation method to evaluate it.

Finally, using the fuzzy comprehensive evaluation method to select retailers can reduce the influence of uncertainty and subjectivity on the results. However, in the actual process of applying the fuzzy comprehensive evaluation method, which relies heavily on the experts, and to a certain extent offsets the accuracy and objectivity of the results. We remark that further studies are necessary to dwell on how to make the evaluation method and the final decision more scientific and reasonable.

References