The Study of Investment Risk in Franchisee by Grey AHP Method
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Abstract. The servicing industry is more prosperous than others recently, how to alternate a chain store corporation to invest or operate is an important subject today. For the risk reducible and adding more opportunities to profit, the investors should collect some information (such as competition, potential…) of the industry by some rules before to join them. Therefore, it is expected to use the method of the Grey Analytic Hierarchical Process to estimate the competition about the chain store corporation for supporting investors more opportunities to profit in this paper.

Introduction

In recent years, various industries were the most flourishing service, how to choose a franchise system sustainable management is an important issue. Intense competition in accordance with the various service their own business within five years, is still able to business success probability of less than 20%; participate in the franchise system failure rate is less than 20%. However, if the lack of knowledge of the franchise system for a novice want to get into the franchise system in terms of business risk is increased, eventually likely to result in failure. Select high quality franchise system, you must choose good franchisors discriminant ability to make their own to join the cause to reduce operational risks hastily put into otherwise still likely to fall into the trap failed. If so investors in accordance with the guidelines, prior good and bad judgment franchise system, choose to join the system, you can reduce the operational risks.

The traditional analytic hierarchy process internal factors indicators adopted the method of equal weight will lose weight real significance. In this study, using the grey-level analysis methods can be objectively expressed index weight, to allow investors to choose and judgments excellent franchise system is competitive, reduce investment risk.

Basic Theories

Analytical Hierarchy Process

Analytical Hierarchy Process belongs to multi-attribute decision-making methods in multi-criteria decision analysis; by advance taken from the decision-makers of the decision-making information, go through the process of multi-criteria decision analysis to assist decision-makers to rank the various program priorities. The first and foremost task of the AHP model analysis is the hierarchical structure of the decision-making problems, making decision-makers on a layer of criteria considerations, paired comparison of any two standards or programs. The main content of 4 (Saaty, 1990):

1. will be the assessment of complex issues to be structured, and the establishment of a hierarchical structure.
2. set of questions rating scale, and the establishment of a paired comparison matrix.
3. calculate the relative weights of the various problems.
4. Verification consistency.
Grey System Theory

Grey system theory was pioneered by Deng Julong in 1982 (Deng J. 1990). Under the circumstance of the ambiguous system model and the incomplete information, the system is analyzed and understood by model constructing, relational analysis, prediction and decision. Grey theory is developed with the main information, control viewpoint combined with mathematical method. Up to now, grey system theory has been successfully applied to medicine, science, industry application and ecological assessment. Grey theory is characterized by a small amount of data to model, and its characteristics are as follows:

1. Grey dynamic model, as little as four samples.
2. Grey relational analysis model, each sequence is as little as three samples.
3. Grey Situation Decision, each goal is as little as three samples.

Grey AHP

This method known as Group decision-making, specific to decision-making group may be their intention, characteristics, attitudes Group divided into several levels. For example, in accordance with the terms of reference of the Group are divided into the operating level, management and decision-making. Decision intentions of the three Group said "weight", respectively, these weights digital grey system theory or model, that is known as the grey-level decision-making. The largest number of the decision-making process, the views than differences, the powers and responsibilities of the smaller crowd, called jobs layer, denoted by A layer. A layer content can be any of a variety of programs to express their views through the grey statistical weight calculation programs. The program rests with the technical guidance of the (supervisory) responsibility, the number of medium-level, known as the management, denoted as layer; B layer of decision-making characteristics in technology, market risk, consider more, come to the GM (1,1) model analysis of the effectiveness of the programs, and decision weights GM (1,1) model. While a smaller number, called the decision-making level, the decision has major responsibilities for the crowd, denoted as C layer. C layer by comparison, decision-making investment projects in the investment programs existing conditions and regulations. When the weight of the three levels of the A, B, C produces mining minimax, take the big decisions, to determine the A, B two layers of investment in joint decision-making small, medium and large size and then associate degree C layer mining take small, small take big decisions, that is the optimal solution.

Grey Statistics Method

Grey Statistics Method is a Grey System Theory in the extension of the future; 1982, Deng Poly Dragon made by Grey theory, he believes the natural world to human society come about is not white (all know), nor is black (ignorant), but the Grey (semi-known semi-solution). Human thinking, behavior is Grey, human survival is in fact a high degree of Grey in between the space of information, such as: human systems, Food production systems. Some of the information is known, the unknown part of the information system, called Grey system (Fu established, 1991).

Methods

Determine the Classification Decision-making Solutions and Investment Evaluation Factors

This study divided into four categories of franchise systems for existing markets, the use of Grey AHP, to do the selection of the best programs to explore. First, a comprehensive analysis of each of the franchise system, by the decision-makers based on the use of funds, counseling training, marketing, organizational structure, constraints, profitability assessment, taking four franchise system (program) performance assessment analysis.
Assessment Ash Class and Grey Whitening Weight Function of the Number of Set

This study evaluated the indicators selected to take to respect the views of most experts grey statistical method, due to the grey statistical evaluation value through the albino function generation, and to eliminate the impact of the average number of extreme value. Different expert opinions are subject to the same respect; produce the result of group decision-making and participation in decision-making experts, not coupled with the subjective feelings of the final decision-maker. Participation in the decision-making level of restriction and cognitive differences can only give a grey number albino value, and to reflect the degree of any sort, it is set to assess the level of grey number, class grey number and grey class whitening weight function, set the grey level e, e = 1,2,3,4,5, for determining to describe these grey class, you need to set the whitening weight function of the number of grey number and grey.

First class grey class (e = 1) "excellent", set grey number \(d_{ijk}^{(e)} \in [d_i, \infty)\) (Figure 1):
\[
\frac{d_{ijk}^{(e)}}{d_i} = \begin{cases} 
1 & \text{if } d_{ijk}^{(e)} \in [d_i, \infty] \\
0 & \text{if } d_{ijk}^{(e)} \notin [0, \infty]
\end{cases}
\]

Figure 1. Graph of function.

2,3,4 grey type (e = 2,3,4), set the grey numbers, whitening weight function(Figure 2):
\[
f_e \left( d_{ijk}^{(e)} \right) = \begin{cases} 
\frac{2d_e - d_{ijk}^{(e)}}{d_i} & \text{if } d_{ijk}^{(e)} \in [0, 2d_i] \\
0 & \text{if } d_{ijk}^{(e)} \notin [0, 2d_i]
\end{cases}
\]

Figure 2. Graph of function.

5 grey class (e = 5) "bad" set grey numbers whitening weight function(Figure 3):
\[
f_5 \left( d_{ijk}^{(e)} \right) = \begin{cases} 
\frac{2d_e - d_{ijk}^{(e)}}{d_i} & \text{if } d_{ijk}^{(e)} \in [d_i, 2d_i] \\
0 & \text{if } d_{ijk}^{(e)} \notin [0, 2d_i]
\end{cases}
\]
Weight Calculation Layers

Of the A layer officers questionnaires, decision-making power to the grey statistical methods; B layers using GM (1,1) to calculate a value for the weight (for an AGO generation), and to take "small big" A layerFind the joint decision-making. The C layer calculated based on the investment evaluation factors albino function obtained decision weights.

Comprehensive Assessment to Determine the Results of the Assessment

Known function with A, B layer of joint decision-making combined, take a small take big decisions, and calculate the degree program associated with decision-making and optimal selection Franchise System program.

Case Study

The study is aimed at tackling For chain and franchise headquarters entrepreneurs (friends raised this study), conducted brainstorming via entrepreneurs based on personal knowledge and experience sharing, assessment the franchising system project follows:

1. whether the operators are dedicated.
2. whether the management team has a complete run of key technical and management skills.
3. whether the franchise system with high visibility.
4. whether it has a unique and innovative merchandise force.
5. whether a legitimate business, and with research and to improve the capacity.
6. whether to join the headquarters perfect logistic support and financing plans.
7. to nurture talent, education and training, it is recommended to invest in franchising.

Evaluation Grey Class Set and Grey Number

2. Cold ice cream shop: Tea Yang tea, fresh tea ceremony, tea friction will health tea, Jiuding curd.
3. Convenience store: Family Mart convenience store (commissioned to join), OK convenience stores, the HiLife (franchise), 7-11.

Evaluation Grey Class Set and Grey Number

In this study, the amount of investment is divided into four categories, divided into(Table 1):

1. Multiple investment (200 million) (Figure 4)
2. Medium investment (150 million) (Figure 5)
3. Less investment (100 million) (Figure 6)
4. Minimum investment (50 million) (Figure 7)
Table 1. Four categories of parameter.

<table>
<thead>
<tr>
<th>Difference</th>
<th>1* Cafes</th>
<th>2* Cold ice cream shop</th>
<th>3* Convenience store</th>
<th>4* Breakfast shop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Part 1 views (N₁₁=1)</td>
<td>105 (d11)</td>
<td>120 (d12)</td>
<td>200 (d13)</td>
<td>150 (d14)</td>
</tr>
<tr>
<td>Part 2 views (N₂₂=2)</td>
<td>99 (d21)</td>
<td>98 (d22)</td>
<td>90 (d23)</td>
<td>35 (d24)</td>
</tr>
<tr>
<td>Part 3 views (N₃₃=2)</td>
<td>70 (d31)</td>
<td>90 (d32)</td>
<td>91 (d33)</td>
<td>21 (d34)</td>
</tr>
</tbody>
</table>

**Weight Calculation Layers**

Number of whitening weight function A layer some people i shall be calculated in accordance with Deng Julong. "Grey Statistics recorded as a function of k-class investment albino denoted i some of the officers of the j-th program the mentioned investment Numbers for function as follows:

\[
n_i = \frac{1}{m} \sum_{j=1}^{m} f_i(d_j) N^{(i)}, \quad j=1, 2, 3, 4, \quad k=1, 2, 3, 4
\]

\[
n_{11} = 0.525 \times 1 + 0.495 \times 2 + 0.35 \times 2 = 2.2215 \quad n_{12} = 0.7 \times 1 + 0.66 \times 2 + 0.4667 \times 2 = 2.9534
\]

\[
n_{13} = 1.05 \times 1 + 0.99 \times 2 + 0.7 \times 2 = 4.43 \quad n_{14} = 2.1 \times 1 + 1.98 \times 2 + 1.4 \times 2 = 8.86
\]

\[n_{21} = 2.48, \quad n_{22} = 3.06, \quad \ldots, \quad n_{44} = 5.24\]

Similarly obtained

\[n_1 = 18.4584 \quad n_2 = 20.66 \quad n_3 = 23.517 \quad n_4 = 10.916\]

J-th program for weight class k of the decision-making power as follows.

\[r_{jk} = \frac{n_{jk}}{n_j}, \quad \frac{n_{11}}{n_1} = 0.12 \quad \frac{n_{12}}{n_1} = 0.16 \quad \frac{n_{13}}{n_1} = 0.160003\]

A layer of decision-making can be obtained the following matrix, representing by r:

\[
\begin{bmatrix}
0.12 & 0.16 & 0.24 & 0.48 \\
0.12 & 0.16 & 0.24 & 0.48 \\
0.1195 & 0.1593 & 0.2432 & 0.478 \\
0.12 & 0.1599 & 0.24 & 0.48
\end{bmatrix}
\]

B layer of decision-making

Step 1: as the number of the programs based on the r-matrix accumulated generating (Accumulated Generating Operation, AGO)

\[X^{(i)}(k) = \sum_{m=1}^{k} x^{(0)}(m)\]
\[ a_1 = \frac{-1}{2} (d_{11} + d_{12}) = -0.200001 \ , \ a_2 = \frac{-1}{2} (d_{12} + d_{13}) = -0.400002 \ , \ a_3 = \frac{-1}{2} (d_{13} + d_{14}) = -0.760001 \]

Step 2: Determine the data matrix \( A \), \( y_{na} \)

\[
A = \begin{bmatrix}
  a_1 & 1 \\
  a_2 & 1 \\
  a_3 & 1
\end{bmatrix} = \begin{bmatrix}
  -0.200001 & 1 \\
  -0.400002 & 1 \\
  -0.760001 & 1
\end{bmatrix}, \quad y_{na} = \begin{bmatrix}
  0.160003 \\
  0.239999 \\
  0.479998
\end{bmatrix}
\]

Step 3: Calculate \((A^T A)^{-1}\)

\[
(A^T A)^{-1} = \begin{bmatrix}
  6.208619 & 2.814582 \\
  2.814582 & 1.609281
\end{bmatrix}
\]

Step 4: Calculate \( \hat{a} \)

\[
\hat{a} = (A^T A)^{-1} a^T y_{na} , \quad \hat{a} = \begin{bmatrix}
  -0.582774 \\
  0.029142
\end{bmatrix}
\]

0.582774 a program decision-making power, (because negative weight, so they chose positive), it is time to generate calculated according to AGO, other programs of decision-making power the heavy as follows:

\[
r^{(1)} = (0.58277 0.58285 0.57698 0.58291)
\]

C layer of decision-making

The case of funds raised $1.2 million), divided into four categories based on the amount of investment, calculated whitening weight function as follows:

\[
Q = [0.6 \ 0.8 \ 0.8333 \ 0.4167]
\]

### Comprehensive Assessment to Determine the Results of the Assessment

Decision-making layer B 1 A layer of decision seeking joint decision-making, mining pessimistic principle (small, whichever is greater), calculated as below:

\[
[0.58277 0.58285 0.57698 0.58291] \odot \begin{bmatrix}
  0.12 & 0.16 & 0.24 & 0.48 \\
  0.12 & 0.16 & 0.24 & 0.48 \\
  0.12 & 0.1599 & 0.24 & 0.48 \\
  0.12 & 0.1599 & 0.24 & 0.48
\end{bmatrix}^T
\]

Joint decision-making by the A layer and B layer

\[
[0.12 \ 0.16 \ 0.2432 \ 0.48] \cdot [0.6 \ 0.8 \ 0.8333 \ 0.4167]^T = \max[0.12,0.16,0.2432,0.4167] = 0.4167
\]

It can be seen that after assessment of the investment chain franchise investment program four (breakfast shop) is appropriate.

### Results and Discussion

The advantages of a small sample of this study for the grey analytic hierarchy process decision-making mode provides a measurement of the existing information; human pairwise comparisons can’t be given a clear importance, the grey class analysis rule to express human decision making, and so can be apply decision support analysis method. Made reference before making any decision to provide investors, aspiring to more objectively select the appropriate program, to reduce investment franchising the malpractice system of risk, providing the decision-making considerations multifaceted perspective; This method can also be applied to other decision-making problems performance assessment analysis.
References


