Fuzzy Comprehensive Evaluation Method-based Big Data Era Chinese Sports Brands Independent Innovation Ability Research

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Abstract: With the sharp development of economy, sports consumption proportion in people’s daily life is getting bigger and bigger. However, China native sports products sales status is not going well. Presently, most of people will select international famous brands when consume, China native sports brands have been ignored. China sports brands products mainly follow international brands tides; therefore its independent innovation reformation is imperative. The paper utilizes fuzzy comprehensive evaluation method, and evaluated brands’ independent innovation ability from China sports brands impacts, market share, loyalty index, and domestic leadership four perspectives. Regard world famous brand-Nike independent innovation distribution status as evaluation weight, obtained result shows ERKE 361 degree. XTEP are sports brands of higher independent innovation abilities, which are worth other brands referencing.

Keywords: Big data, fuzzy comprehensive evaluation method, independent innovation, sports brands.

1. INTRODUCTION

With the advent of economic globalization, Chinese all kinds of products has gone abroad. However, Chinese sports products market share in international is still lower, which is less than one percentage of international famous sports brands market share. China has gradually moved towards world powers, national people hope that more and more “made in China” products can be revised as “created in China”. Such economic industry essentially transformation cannot do without independent innovation [1].

Fang Wei in the article “Chinese national traditional sports brands independent innovation research”, took national traditional sports brands as research objects, comprehensive adopted multiple research methods, targeted at present Chinese national traditional sports brands development process problems, he made analysis and put forward reasonable suggestions. The article pointed out that these national traditional sports brands impacts in international market were smaller, which lacked of effective planning programs, advertising hadn’t arrived at set effects, intra-company lacking of operating management professional type talents [2]. The author pointed out that in order to let Chinese national traditional sports brands to better develop, it should take brand independent innovation as mainline, strengthen competitive innovation, education innovation and others multiple aspects innovation [3].

Feng Bao-Zhong in the article “Research on China marching towards sports powers paths”, pointed out that China gradually moved toward world sports powers, sports development included masses sports, competitive sports, sports industries and others multiple aspects.

Chinese sports industries should adjust development target, main tasks and development layout under guiding of “sports powers” target. Implemented regional sports “Brand-ing” strategy, in the target of sports powers, carried out standardized processing with regional sports series products recognition and advertising works [4]. Xie Qiang in “Chinese sports product brands development status research”, used multiple research methods, combined with world multiple sports brands development, researched on China sports products development status and existing advantages. Made comparison between world sports giant brand Nike development history and China sorts brands development, explained China sports products brands existing problems, low scientific and technological contents, incorrect brand positioning, lacking of professionals, large gap between strategic planning and concrete execution, lacking of brands cultures and so on. The author pointed out that China sports products should include high-end, middle-end and low-end products, set up brand consciousness, focus on competitions with global, initiative participate in international brands competitions, absorb sports products all kinds of professional experts. Li Liang in the article “China sports industry brands development comparative analysis”, pointed out that sports industry was the tertiary industry that directly propelled to national economy growth. Since China succeeded in hosting Olympic Games in 2008, sports industry had rapidly developed, China national traditional sports brands became intangible assets. Compare to international famous brands, its market competitiveness and enterprise culture power had certain gaps. To promote Chinese gross value of production, social consumption level and import and export trade orders, the author put forward relative policies and suggestions. The author started from sports brands connotations perspective, researched on relative totality data and component data relations, and provided competition advantages suggestions [5].
The paper aims to research on China sports independent innovation level in big data era background pursues sports brands independent innovation representative factors and takes them as research evidence.

2. MODEL ESTABLISHMENTS

Sports brand independent innovation contains multiple aspects, product research’s technological innovation, operating mode management innovation, product position strategic innovation and so on. However, from independent innovation reflected results, we can consider form brands impacts, market share, loyalty index and domestic leadership such four aspects. Therefore, we regard impacts, market share, loyalty index and domestic leadership as evidence to judge independent innovation ability.

2.1. Data Collecting and Processing

In Tables 1-3, data is from world brands research institute and China brands research institute. In the table, “1-5” represents scores status (1 is the lowest score, 5 is the highest score).

From Table 1, we can clearly see that Nike is highest brand value sports brand, Adidas ranks the second, and Puma ranks the third. For Table 1 impacts, market share, loyalty index, global leadership such four indicators result, carry out normalization process, we get Table 2.

2.2. Fuzzy Comprehensive Evaluation

In general, fuzzy comprehensive evaluation involves three quantities. Set that there are \( n \) pieces of evaluated
objects correlation factors, it records as \( U = \{ u_1, u_2, \cdots, u_n \} \), and calls it as factor set. And set all possible occurred remarks have \( m \) pieces, it records as \( V = \{ v_1, v_2, \cdots, v_m \} \), and calls it as evaluation set. Because every factor position is different, its function is also different, it appears measurement criterion that is weight, and it records \( A = \{ a_1, a_2, \cdots, a_n \} \).

Comprehensive evaluation steps, fuzzy comprehensive evaluation steps are proceeding as following methods:

1. Define factor set \( U = \{ u_1, u_2, \cdots, u_n \} \).
2. Define evaluation set \( V = \{ v_1, v_2, \cdots, v_m \} \).
3. Carry out single factor evaluation and get \( f_j = \{ f_{j1}, f_{j2}, \cdots, f_{jm} \} \).
4. Construct comprehensive evaluation matrix:

\[
R = \begin{bmatrix}
  r_{11} & r_{12} & \cdots & r_{1m} \\
  r_{21} & r_{22} & \cdots & r_{2m} \\
  \vdots & \vdots & \ddots & \vdots \\
  r_{n1} & r_{n2} & \cdots & r_{nm}
\end{bmatrix}
\]

5. Comprehensive evaluation: to weight \( A = \{ a_1, a_2, \cdots, a_n \} \), calculate \( B = A \circ R \), and need to make evaluation according to maximum membership principle.

When make comprehensive evaluation, according to operator \( \circ \) different definitions, it has different models.

1. Modell: \( M(\wedge, \vee) \) — Principal divisor decisive type

Computing method is:

\[
b_j = \max \left\{ (a_i \wedge r_{ij}) \mid i = 1, 2, \cdots, n \right\} \quad (j = 1, 2, \cdots, m)
\]

The model evaluation result is up to factors that play main effects on total evaluation, other factors will not impact on evaluation, relatively, the model is fit for the case that comprehensive evaluation is thought to be optimal when single evaluation is optimal.

2. Model II: \( M(\bullet, \vee) \) — Principal divisor prominent type

Computing method is:

\[
b_j = \max \left\{ (a_i \bullet r_{ij}) \mid i = 1, 2, \cdots, n \right\} \quad (j = 1, 2, \cdots, m)
\]

3. Model III: \( M(\bullet, +) \) — Weighted average type

Computing method is:

\[
b_j = \sum_{i=1}^{n} a_i \cdot r_{ij} \quad (j = 1, 2, \cdots, m)
\]

The model according to each factor importance, take all influence factors into consideration, relatively it is fit for the case that requires comprehensive optimization.

4. Model IV: \( M(\wedge, \oplus) \) — Taking sum of small upper bound type

Computing method is:

\[
b_j = \min \left\{ 1, \sum_{i=1}^{n} (a_i \wedge r_{ij}) \right\} \quad (j = 1, 2, \cdots, m)
\]

When use the model, it should pay special attention to: every \( a_i \) cannot take excessive big value, otherwise it may appear the case that \( b_j \) is 1; every \( a_i \) cannot take excessive small value, otherwise it will appear the case that \( b_j \) is equal to the sum of each \( a_i \), which will lead to single factor evaluation relative information lose.

5. Model V: \( M(\wedge, +) \) — Balanced average type

Computing method is:

\[
b_j = \sum_{i=1}^{n} a_i \cdot \frac{r_{ij}}{r_0} \quad (j = 1, 2, \cdots, m)
\]

Among them, \( r_0 = \sum_{k=1}^{n} r_{kj} \). The model is fit for comprehensive evaluation matrix \( R \) element is excessive big or small cases.

The paper established model uses principal divisor decisive type’s operator. By considering five sports brands

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### Table 4. China brands status table after normalization.

<table>
<thead>
<tr>
<th>Brand Name</th>
<th>Impact</th>
<th>Market Share</th>
<th>Loyalty Index</th>
<th>Domestic Leadership</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERKE</td>
<td>0.29</td>
<td>0.29</td>
<td>0.21</td>
<td>0.21</td>
</tr>
<tr>
<td>361degree</td>
<td>0.27</td>
<td>0.19</td>
<td>0.27</td>
<td>0.27</td>
</tr>
<tr>
<td>XTEP</td>
<td>0.2</td>
<td>0.2</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Deerway</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Jinak</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
<td>0.25</td>
</tr>
</tbody>
</table>
(ERKE, 361 degree, XTEP, Deerway, Jinak) independent innovation evaluation problem, look for different sports brands independent innovation levels. Therefore, establish factor set \( U = \{ u_1, u_2, u_3, u_4 \} \), from which \( u_1 \) represents sports brand impacts, \( u_2 \) represents sports brands market share, \( u_3 \) represents sports brands loyalty index, \( u_4 \) represents sports brands domestic leadership. In following graph, mark number “1” represents sports brand impacts, “2” represents sports brands market share, “3” represents sports brands loyalty index, “4” represents sports brands domestic leadership.

**Fig. (2).** International sports brand case diagram.

In the model, we will select two brands as weights from Nike, Adidas and Puma three brands. From Fig. (2), it is clear that Nike and Adidas status are relative similar. Puma status has some differences from the two, so we select Nike and Puma as weights.

**Fig. (3).** The normalized data line chart.

Fig. (3) is data broken line graph of China sports brands after normalization. From Fig. (3), we can see that after normalization, five kinds of China native sports brands scores status in impacts, market share, loyalty index and domestic leadership four aspects. The figure can only reflect distribution status but cannot reflect independent innovation ability level, therefore, carry out following calculation.

By Table 2, it is clear two kinds of weights, weight \( A_1 \) that takes Nike sports brand as an example, weight \( A_2 \) that takes Puma sports brand as an example, they are respectively as:

\[
A_1 = (0.26, 0.22, 0.26, 0.26)
\]

\[
A_2 = (0.25, 0.25, 0.25, 0.25)
\]

According to Table 4 data, establish comprehensive evaluation matrix \( R \):

\[
R = \begin{bmatrix}
0.29 & 0.27 & 0.2 & 0.25 & 0.25 \\
0.29 & 0.19 & 0.2 & 0.25 & 0.25 \\
0.21 & 0.27 & 0.3 & 0.25 & 0.25 \\
0.21 & 0.27 & 0.3 & 0.25 & 0.25 \\
\end{bmatrix}
\]

Take model \( M (\lambda, \nu) \) as evident, calculate respectively two weights and get:

\[
B_1 = A_1 \cdot R = (0.26, 0.26, 0.26, 0.26, 0.25)
\]

\[
B_2 = A_2 \cdot R = (0.25, 0.25, 0.25, 0.25, 0.25)
\]

In order to clear display evaluation results, draw results with Nike as weight and result with Puma as weight comparison graph, as Fig. (4) shows.

**Fig. (4).** Two results comparison chart.

2.3. Analyze Results

From above results, we can find when weights are different, different sports brands independent innovation abilities are different. Below are two kinds of different weights result analyses.

When using weights that takes Nike as an example, impacts, loyalty index, domestic leadership weights are relative larger. ERKE, 361 degree, XTEP the three sports brands independent innovation levels are with a comparable level, Deerway, Jinak the two sports brands independent innovation levels are lower. The paper analyzes from the two aspects. On one hand, due to ERKE, 361 degree, XTEP the three brands advertising innovation levels are higher. On the other hand, the three brands sports products strength in tech-
The paper used fuzzy comprehensive evaluation method generally will solve a kind of arrangement and selective difficulties. The key to whole process is establishing fuzzy comprehensive evaluation matrix. The matrix compositions are evaluation results of single element. Readers can give weights by themselves according to experiences or reference other documents data. But once weight is unreasonable, it will lead to wrong computing process and affect results rationality.

The model obtained result is that ERKE, 361 degree, XTEP are sports brands with stronger independent innovation abilities. China sports brands are mostly followers of international famous brands tides rather than world sports products tides leaders. Therefore, Chinese sports brands not only need to innovate in advertising, marketing programs and other aspects, but also need to innovate in product design concepts and texture selection and other aspects. From above contents two weights, it is clear that sports brands independent innovation ability promotion needs to all-round abilities promotion.

CONFLICT OF INTEREST

The author confirms that this article content has no conflict of interest.

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