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A Study of Operation Mode in Cross-Border Mini E-Commerce Auto Parts Industry

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Abstract

With the development of cross-border mini E-commerce in auto parts industry，the traditional operation model has not satisfied the demand of modern e-commerce completely. In this paper, the evaluation model based on analytic hierarchy process has been proposed which include the factors of evaluation model, standards, indexes and weighs. After the model forming process, the calculation method for the comprehensive evaluation score has been described. At last, we used the model to assess a real cross-board auto parts retail enterprise, the ECI score of the enterprise is 77.93, and we put forward two specific suggestions to the enterprise for the operation mode improvement.

Keywords: *Auto parts retails; cross-border E-commerce; E-commerce operation evaluation*

1. Introduction

Since the 21st century, with the rapid development of global information technology, the Internet, global supply chain, credit and electronic payment system which was confirmed(Chiu *et al.*, (2014), E-commerce got a rapid development which not only promote the changes in the traditional business model, accelerates the integration of global economy, and also evolves into an important driving force of world economy.

With the rapid increase of global Internet popularity, mature network retail policy environment is formed at home and abroad, basic infrastructure and supporting services are constructed, in 2012, China's E-commerce market total transaction has raised 37.8% to 8.1 trillion Yuan, including online retail turnover as high as 1.32 trillion Yuan which was confirmed(Andam and Zorayda(2014)); In 2013, total E-commerce transactions have reached 10 trillion Yuan, online retail sales account for about 20% of the total transaction with 1.8 trillion Yuan, and China is expected to become the world's largest online trailer at the first time which was confirmed(Sila(2013)).

Admittedly, cross-border mini E-commerce has become a successful "black horse" in the foreign trade industry, and it brings a golden age for the auto parts E-commerce industry. At the same time, Weisberg *et al.*,(2011) repoeted the cross-border mini E-commerce companies in rapid development should aware the obstacles in the process of developing, such as the problems of the operation mode and inefficiency in the supply chain which all related to the enterprises' survival in the new era which was confirmed(Hu(2013)).

It's urgent to find a way to proper assess the operation mode of the E-commerce enterprise, and put forward constructive suggestion for improvement which was confirmed(Gao(2014)).

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2. An Analytical Hierarchy Model for Cross-Board Mini E-Commerce

The Analytical Hierarchy process (AHP) was first put forward by the famous American researcher T. L. Saaty in the early 1970s. AHP proposed is a multi-objective decision analysis methods which was confirmed(Rowe *et al.*, (2012)). Based on AHP theory, the analytical hierarchy model for cross-board mini E-commerce is shown in Figure 1.

For a multi index system and multi indicators to evaluation, in the general case, assume the evaluation object set is $S = (S_1, S_2, \cdots S_m)$. $S_1, S_2, \cdots, S_m$ are m operation modes to be evaluated. Evaluation number K third level $O = \{O_1, O_2, \cdots, O_K\}$, $T = \{O_{11}, O_{22}, \cdots, O_i\}(i = 1, 2, \cdots, L)$; The evaluation indexes satisfy the following conditions:

$$(1)\sum_{i=1}^{L} n_i = K \qquad (2)\bigcup_{i=1}^{L} T_i = O \qquad (3)\bigcup_{i=1}^{N} R_i = T$$

(4)For any $i \neq j$, $T_i \cap T_j = \phi; i, j \in \{1, 2, \cdots, L\}$

(5)For any $i \neq j, R_i \cap R_j = \phi; i, j \in \{1, 2, \cdots, N\}$

Every level of evaluation index is independent, altogether constitute the system evaluation system for the auto parts cross-board mini E-commerce.

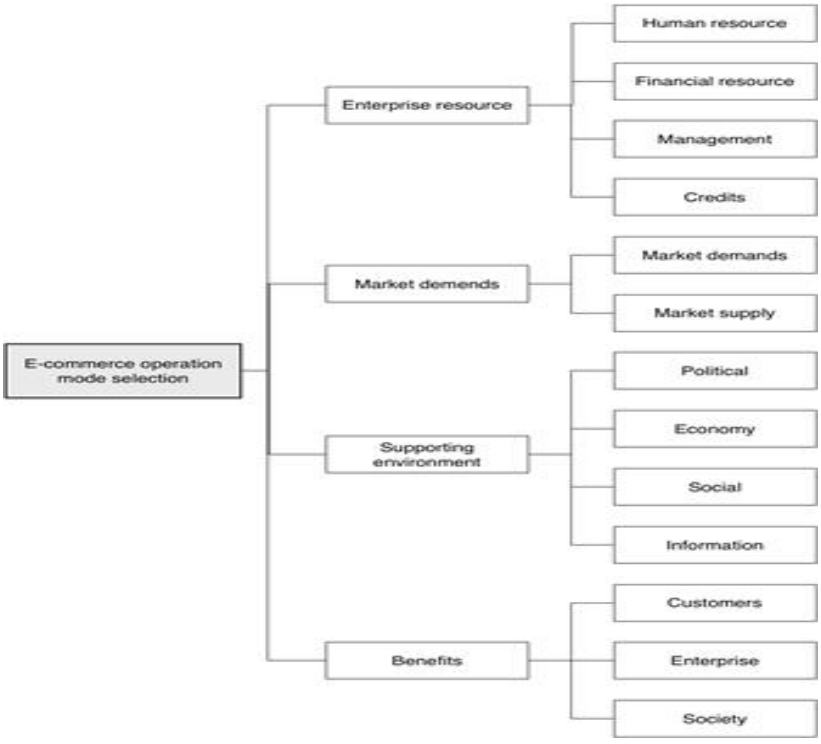

Figure 1. The Analytical Hierarchy Model for Cross-Board Mini E-Commerce

3. Evaluation Standards

The evaluation standards are made under the practical situation of China's national conditions and auto parts enterprises and on the basis of fully investigation. The evaluation standards rely on the comprehensive evaluation score, the score range from 1 to 100, with 95, 80, 65, 50 as criterions for evaluation. The relationship of comprehensive

evaluation score and the operation mode is shown in Table 1.

Table 1. The Relations between Comprehensive Evaluation Score and the Operation Mode

Operate Mode	Category	Comprehensive evaluation score				
		A >95	B >80	C >65	D >50	E ≤50
Spatial Mode	Cross-Board	√				×
Business Range	Specialize		√	√	√	×
Size	Small				√	×
	Medium		√	√		×
	Large	√				×
Scale	Primary				√	×
	Intermediate		√	√		×
	Senior	√				×
Management Mode	Independent		√	√	√	×
	Consolidate	√	√	√		×

4. Determine Index Weight with Analytic Hierarchy Process (AHP)

Different index weights can result different comprehensive evaluation score. Therefore, scientific and reasonable index weights is a key of comprehensive evaluation model. In the assessment, based on the complexity of the index system and the professionalism of the research question, this paper decided to adopt the expert judgment method to obtain the estimate weights of each expert, then this paper used the analytic hierarchy process (AHP) to finally test, confirm and adjust the estimate weights which was confirmed(Fisher and Vaidyanathan(2014)).

4.1. A Judgment Matrix is Generated for each Expert.

By comparing each two experts' judgment matrix, the results can be used to determine the quantitative importance of the index. All indexes after comparison can form a verdict matrix shown as follows:

$$A = (a_{ij}),\ a_{ij} = \frac{W_i}{W_j},\ a_{ii} = 1,\ a_{ji} = 1/a_{ij} \tag{1}$$

$$A = \begin{bmatrix} 1 & a_{12} & a_{13} & \cdots & a_{1n} \\ 1/a_{12} & 1 & a_{23} & \cdots & a_{2n} \\ 1/a_{13} & 1/a_{23} & 1 & \cdots & a_{3n} \\ \cdots & & & & \cdots \\ 1/a_{1n} & 1/a_{2n} & 1/a_{3n} & \cdots & 1 \end{bmatrix} \tag{2}$$

4.2. Single Order Level

Using the judgment matrix, the indexes have a connection to the upper layer in the current layer can arrange in scores (weigh vector), this is called single order level. The process of get single order level of a layer can be seen as the calculation of eigenvalue and feature vector of the judgment matrix. For judgment matrix A, the solution maximum eigenvalue λ and the corresponding normalized feature vector W meets AW = λW, component of the vector W is the single order weight which was confirmed(Manikandan *et al.*(2014)).

4.3. The Consistency Test of Judgment Matrix

Analytic hierarchy process (AHP) is applied in determining weights of indicators, as the relative importance differences in each index by each expert, a consistency test must conduct on the matrix. Judgment matrix should satisfy the diagonal reciprocal relationship between elements, besides, a strict consistency test should by conduct on the matrix which was confirmed(Balaji(2014)). Consistency test mainly uses the maximum characteristic root for discrimination. Typically, if judgment matrix passes the consistency test, all elements in the judgment matrix A must meet the following conditions:

$$a_{ij} = \frac{a_{ik}}{a_{jk}} (i, j, k = 1, 2, \cdots, n) \tag{3}$$

According to the matrix theory, this judgment matrix has only one nonzero, maximum characteristic root =n, the rest of characteristic roots are zero; When the judgment matrix pass the consistency test (or close to fully meet the conditions above), λ max is slightly bigger than n, and the rest characteristic roots are tend to be zero. When the matrix deviates from completely consistency, the characteristic root will change correspondingly, thus the change of the characteristic root can be used to test the consistency degree of the judgment matrix, this is the theory basis of the consistency test in analytic hierarchy process (AHP) which was confirmed(Shukla *et al.*(2014)).

4.4. The Specific Calculation Steps

The specific calculation steps are as follows:

Step 1, calculate the maximum characteristic root and the corresponding feature vector of the judgment matrix.

Step 2, calculate each rows' product in the judgment matrix.

$$M_i = \prod_{j=1}^{n} a_{ij}, i = 1, 2, 3, \cdots, n \tag{4}$$

Step 3, calculate n square root $\overline{W_n}$ of M_i, $\overline{W_i} = \sqrt[n]{M_i}$.

Step 4, normalization the vector $\overline{W} = [\overline{W_1}, \overline{W_2}, \cdots, \overline{W_n}]^T$, namely the $W_i = \frac{\overline{W_i}}{\sum_{j=1}^{n} \overline{W_j}}$, and the vector $\overline{W} = [\overline{W_1}, \overline{W_2}, \cdots, \overline{W_n}]^T$ is the characteristic vector.

Step 5, calculate the maximum characteristic root λmax, $\lambda_{\max} = \sum_{i=1}^{n} \frac{(AW)_i}{nW_i}$. $(AW)_i$ represents the i element in the vector AW.

Step 6, calculate the consistency index: $CI = (\lambda_{\max} - n)/(n-1)$.

Step 7, calculate the average randomness consistency index RI of the judgment matrix. Through several times of random process to construct a m order judgment matrix, the mean of the maximum characteristic roots is $\overline{\lambda}$, and the $RI = \frac{\overline{\lambda} - n}{n - 1}$.

Step 8, when random consistency ratio CR = CI/RI < 0.10 (RI is the mean random consistency index), the judgment matrix has a satisfactory consistency; When CR > 0.10, the values in the judgment matrix need to reconsider until the consistency test is passed. As the complexity of the problem increase, the order of the matrix also increases, but for 1 or 2 order matrix, it always satisfy the consistency, so there is no need to calculate the CR.

Step 9, according to the arrange of feature vectors, the importance of each index is concluded.

5. Mathematical Model for the Comprehensive Evaluation Score

The comprehensive evaluation score is the combined result of dimensionless index value calculated through certain mathematical methods or statistical model using weighted synthesis method. The comprehensive evaluation score can evaluate different sides of the operation to a single comprehensive score which was confirmed(Marakas and James(2014)). A multi-index comprehensive method can be categorized as linear synthetic method, geometric synthesis method and hybrid synthesis.

Due to the pattern of electronic commerce, evaluation index system belongs to a multi-level and multi-index comprehensive evaluation, this paper uses the linear synthesis method.

Linear synthesis method obtains the sum of weighed index values as the comprehensive evaluation score. After the dimensionless process of the evaluation indexes, the weighed coefficient can be used to calculate the indexes' comprehensive evaluation score. The specific calculation formula can be represented as:

$$ECI = k\sum_{i=1}^{n} P_i W_i \quad (5)$$

ECI represents the E-commerce model comprehensive evaluation score, namely the electronic commerce mode comprehensive evaluation score. n is the number of elements, is the indicators value after standardization, is the weights of the indicator, k is constant, in this paper the value of k is 100.

6. Mode Selection and Determination

The specific operation mode selection mode for Auto parts cross-border mini E-commerce is shown in Figure 2.

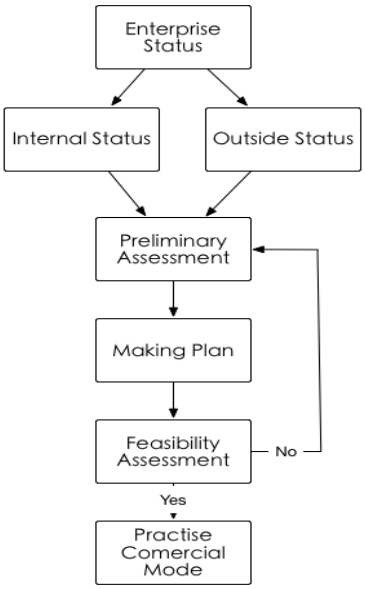

Figure 2. Operation Mode Selection Process

Step 1: Investigation on business ability, market demand and the business environment.

Step 2: Preliminary determination the specific e-commerce mode according to the results of the survey.

Step 3: Feasibility research on the specific mode. Turn to the first or the second step if the research result is not feasible, go back to step 1 and 2, or 4.

Step 4: Determine the specific operation mode.

The determination of the specific operation model for the auto parts mini cross-border E-commerce is shown in Figure 3.

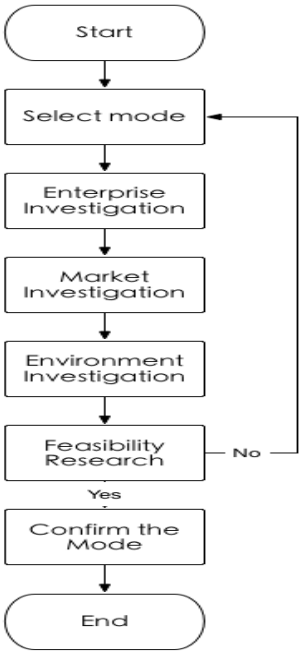

Figure 3. The Determination of the Specific Operation Model

As shown in Figure 3, the auto parts E-commerce model is consisted by objects (goods), internal fundamental plan and operation process, the model can provide E-commerce services, and receive feedback information from the customer, the operation

process can promote the process of innovation and changes in E-commerce pattern.

7. Empirical Analysis

With the analysis model in this paper, the ECI score of a cross-border auto parts retail enterprise is 77.93, based on the criterion of table, the ECI score is below 80 which suggests the enterprise is not suitable for cross-border operation. The improvement of the enterprise should focus on the following points:

(1) Adopting multilateral coordination flexible supply chain to reduce inventory which was confirmed(Hashimoto(2013)).

(2) Open up E-commerce online platform to collaborate with other partners which was confirmed(Subramanian *et al.*(2014)).

8. Conclusion

Cross boarder mini E-commerce operation mode refers to the elements which constitute the E-commerce cross countries. This paper constructed an evaluation index system for auto parts cross-border mini e-commerce, this paper also set up a hierarchy model for the preliminary evaluation of comprehensive evaluation model. The calculation of the comprehensive evaluation score from the analytic hierarchy model is $ECI = k\sum_{i=1}^{n} P_i W_i$.

In the empirical analysis, with the proposed model in this paper, the ECI score of a cross-border auto parts enterprise is 77.93. Based on the ECI score this paper put forward two measures to improve the enterprise's operation mode which was confirmed(Subramanian *et al.*(2014)).

This paper mainly focused on the operation mode selection based on the enterprise's own status, but the preliminary assessment doesn't include the feasibility analysis, this is the focus of the future research which was confirmed(Sternbeck *et al.*(2014)).

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