

Supplier Evaluation and Selection System of Embedded E-Commerce Platform Based on Big Data

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ABSTRACT

For e-commerce companies, it is easier to obtain a large amount of aggregated data about user behavior with the help of embedded network platforms, which contains valuable information that helps to form effective decision-making. This article first gives a detailed introduction to the evaluation and selection of e-commerce and suppliers then puts forward the analytic hierarchy process and entropy method; finally, the AHP analytic method is used to build a supplier evaluation system and a selection system. The experimental results of this paper show that after obtaining the entropy AHP weights through the analytic hierarchy process, these eight suppliers can be ranked and selected. Using the ABC classification method, classification is based on the ranking of suppliers. Among them, Class A suppliers account for 12.5%, which plays a key role in the construction of the evaluation and selection system of e-commerce suppliers.

KEYWORDS

Analytic Hierarchy Process, Big Data, E-Commerce Platform, Entropy Method Supplier Evaluation System

1. INTRODUCTION

With the application and popularization of the Internet and electronic payment, the e-commerce industry is developing rapidly, and at the same time more and more information is gathered, e-commerce has entered the era of information explosion. While a large amount of information provides users and enterprises with diversified choices and marketing methods, the problem of information overload inevitably arises: From the perspective of users, users are at a loss when faced with more and more choices. It is impossible to lock in the items you want to buy as soon as possible; from the perspective of the enterprise, the influx of massive information makes it impossible for the enterprise to store and use it in time, and it is difficult to extract effective information to support decision-making, causing the loss of users and capital. At the same time as these difficulties appear, e-commerce big data platforms and e-commerce recommendation systems have emerged and gradually developed, becoming the main and effective methods for the current e-commerce massive data storage and processing and precision marketing.

How to choose to cooperate with high-quality suppliers is very important for enterprises. Deciding which suppliers to cooperate with is also a major decision for enterprises. The sound development of

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enterprises is closely related to the products supplied by suppliers. Therefore, e-commerce enterprises A scientific and reasonable selection mechanism must be adopted to reach strategic partnerships with high-quality suppliers. In order to reduce the risk of the enterprise supplying products, it is impossible to cooperate with inferior suppliers who have poor evaluation and product quality that does not meet the standards. In addition, we must also consider the procurement risks caused by market pressure and social and political factors. We must choose from a scientific and strategic perspective to cooperate with suppliers with good reputation and strength, and jointly develop the overall efficiency of the enterprise with high-quality suppliers to promote long-term stable operation of the enterprise.

Li X analyzes the short-term and long-term effects of the breadth and depth of seller competition on the performance of platform companies, and studies the potential mechanism of customer two-way marketing strategies on the competitive structure between sellers. It adopted a longitudinal research design and collected 250 days of data on an e-commerce platform. Daily market target data, and use vector autoregressive model to analyze the dynamic evolution effect, so as to compare short-term and short-term differences. The long-term effectiveness of different customer relationship management (CRM) strategies, survey results-The breadth of competition among sellers improves the performance of the platform, and the depth of competition among sellers has a positive impact on short-term performance. However, this has a negative impact on the long-term performance of its platform (Li et al., 2016). Supplier evaluation and selection are the central issues of supply chain management (SCM). However, the data on which the corresponding selection is based in real life is usually inaccurate or vague, leading to the introduction of fuzzy methods. Tavana M proposed a hybrid ANFIS-ANN model to help managers perform supplier evaluation. After aggregating data sets through the Analytic Hierarchy Process (AHP), ANFIS determines the most influential standards for supplier performance. Then, the multi-layer perceptron (MLP) is used to predict and rank the performance of suppliers based on the most effective criteria. However, there are errors in the perception process, resulting in inaccurate results (Tavana,et al., 2016). This research by Veisi H is to determine the sustainability strategies and ethics of Iran's agricultural and food systems. To represent the views of 57 agricultural stockholders, including former ecologists, agricultural extension and development experts, farmers, and members of the Iranian Society of Agricultural Ecological Sciences (ISSA), the Analytic Hierarchy Process (AHP) was used. Based on the general principles of utilitarianism, rights and virtue models, two levels were selected from three moral methods to develop a hierarchical network. However, the complexity of this level is too high, causing the network to be a bit biased.

The innovation of this article is (1) many companies ignore the long-term nature of supplier evaluation systems, so this article proposes to treat supplier evaluation as a systematic project to improve the problems encountered by e-commerce companies, mainly for The evaluation system of enterprise selection evaluation and performance appraisal has proposed a complete system. It has important practical significance for optimizing the supply network of the enterprise and optimizing the supplier relationship. (2) Domestic companies are affected by the international environment, so cross-border procurement has become a daily routine for corporate procurement. From this point of view, the establishment of long-term and stable cooperative relations is of great significance to enterprises and suppliers. On this basis, this article carefully understands and analyzes the e-commerce industry, and finally establishes an evaluation index system that meets the e-commerce enterprises.

2. CONSTRUCTION METHOD OF E-COMMERCE PLATFORM SUPPLIER EVALUATION SYSTEM

2.1 Establishment of Evaluation Hierarchy Model for E-Commerce Suppliers

According to the AHP analytic hierarchy process, the evaluation model of suppliers is divided into three levels: upper, middle and lower levels. Based on the multi-level characteristics of the analytic hierarchy process, the highest level of supplier evaluation index is set to level 1, and the last level is

Table 1. Supplier evaluation hierarchy

Operational level A1	Financial status B11
	Corporate Reputation B12
Cost A2	Product price B21
	Price stability B22
Quality A3	Product qualification rate B31
	Inspection test B32
Delivery capacity A4	On-time delivery rate B41
	Delivery accuracy rate B42
Technical ability A5	Research Investment B51
	Production capacity B52

leveled up. The factors that affect the evaluation index are set as secondary. The results are shown in Table 1.

2.2 Supplier Evaluation

Supplier evaluation uses quantitative statistics and operations research and other related methods, adopts a specific index system, and combines quantitative and qualitative analysis in accordance with unified evaluation standards and certain procedures to evaluate the benefits and achievements of suppliers in a certain period of time (Janssen, et al., 2017). For potential suppliers, supplier assessment is a comprehensive qualification assessment. For potential suppliers, supplier evaluation is a comprehensive qualification evaluation. For existing suppliers, it is an evaluation based on the performance of cooperation records, but both are evaluation of the comprehensive performance of suppliers lays the foundation for the selection and management of suppliers (Rathore, et al., 2017; Wang, et al., 2018).

The steps of supplier evaluation are as follows:

- 1) Analyze the market environment.
- 2) Design the supplier evaluation index system.

The evaluation of suppliers in a specific environment cannot be generalized, and must be evaluated according to different process requirements, different enterprise characteristics, and supply and demand evaluation of the market environment (Lihong, et al., 2017; Xu, et al., 2018).

- 3) Establish a supplier expert group review team.

In order to balance the supply and demand of the enterprise, it is very necessary for the enterprise to set up a supplier evaluation team, and at the same time can effectively control the supply and demand supply chain in a timely and smooth manner (Xu, et al., 2018). Enterprises should consider a multi-pronged approach and multi-sector participation in the evaluation (Obermeyer & Emanuel, 2016).

- 4) Evaluate the supplier.

The supplier evaluation team must first establish a set of feasible and effective evaluation methods. One is to conduct on-site inspections of the production process of the supplier's production line

and evaluate the quality of the supplier's products (Ke & Su, 2016). Evaluate qualified suppliers as potential partners. The second is to evaluate suppliers through market surveys, and select high-quality and capable suppliers to establish cooperative relations.

5) Implement supply chain partnerships.

The company must have a dynamic and fixed cooperative relationship when selecting a supplier, and the company should adjust the product supply-demand cooperative relationship in time according to actual needs (Fu, et al., 2018).

2.3 Supplier Evaluation Algorithm

(1) AHP

To measure the quality of a system, many factors must be considered. Some of these factors require subjective judgments, which are difficult to measure with objective standards. This leads to the Analytic Hierarchy Process, which can show people's subjective judgments objectively (Demir, et al., 2018).

The idea of Analytic Hierarchy Process is to thoroughly analyze various factors that affect the decision-making problem through careful investigation, analyze the relationship between these factors, and then conduct modeling, establish a hierarchical structure model, and integrate human subjective Factors and opinions are quantified and hierarchized through mathematical models (Zhou & Ge, 2016). Although it is a combination of quantitative and qualitative, qualitative factors are the dominant factor in the judgment and decision-making, and human thinking is the main part. The idea of Analytic Hierarchy Process is summarized as follows: First, the problem to be decided and the intractable strategy are decomposed into several indicators, and the indicators are subordinated. These indicators are grouped into target layer, criterion layer and plan Layer (Schaeetzle & Jacob, 2017). The upper layer dominates the lower layer and forms a hierarchical model. Analytic hierarchy process is an expert-dependent method. Sophisticated indicators require a specialist to compare, that is, comprehensive judgment. This method determines the relative importance of this indicator and other indicators, that is, determines its weight.

From this we can know the advantages of the analytic hierarchy process: the indicators are stratified by high and low, so that it is easy to see the impact of high-level indicators on low-level indicators, which can also be reflected in the ranking; the overall impact of a change in an indicator For the same reason, if an index is added to a certain level, the impact on the overall structure will be minimal.

The specific steps of the analytic hierarchy process are as follows:

- 1) Build a model. The indicators are grouped, and the experts are layered, and different indicators are distributed on each layer.
- 2) Construct a judgment matrix. The constructed matrix represents the relationship between indicators at different levels, highlighting the importance of different indicators.
- 3) Level list sorting and consistency check. This step is the display of the weight, which reflects the relative relationship between the upper and lower indicators, and the relative importance ranking.
- 4) Level total ranking and consistency check (Calabrese, et al., 2016). The total ranking of levels represents the relative relationship between a certain level and the highest level, and the appropriate result is selected after passing the consistency test.

(2) Entropy method

Entropy originated from the discipline of thermodynamics, and was first introduced by Shannon in information theory. Now the concept of entropy has been applied in many fields, such as engineering technology and information technology. Information and entropy are related and different. Information can be measured to a certain extent, while entropy is a measure of disorder (Myronidis, et al., 2016). Information entropy is defined as the uncertainty measurement of random variables, and entropy in information theory represents a measurement of the degree of uncertainty of the signal. Gaining entropy also means losing information (Soewono, 2018). If the order of a system is higher, the amount of information contained is larger, and the corresponding entropy is smaller. On the contrary, the amount of information is smaller and the entropy is larger.

According to the concept of information theory, the system is in a different state and degree, and the probability of each state is different. If the probability is $p_i (i = 1, 2, \dots, a)$, the entropy of the system is defined as follows:

$$EN = -\sum_{i=1}^a p_i \ln p_i \quad (1)$$

Entropy is used to evaluate multiple items and multiple indicators, and to calculate the weights of different indicators (Sumesh & Krishna, 2020; Al, et al., 2016). If there are a items to be evaluated and b indicators to be evaluated, a matrix can be formed according to these data, a row and b column, $C = (c_{ij})_{a \times b}$, for a certain indicator c_{ij} , there is information entropy:

$$EN = -\sum_{i=1}^a p_i \ln p_{ij} \quad (2)$$

Among them,

$$p_{ij} = c_{ij} / \sum_{i=1}^n c_{ij} \quad (3)$$

The corresponding matrix is:

$$C = \begin{bmatrix} c_{11} & c_{12} & \dots & c_{1b} \\ c_{21} & c_{22} & \dots & c_{2b} \\ \dots & \dots & \dots & \dots \\ c_{a1} & c_{a2} & \dots & c_{ab} \end{bmatrix} \quad (4)$$

The first step of processing these data is dimensionless processing:

Suppose the optimal solution of each column in the matrix is $c_j^* = \max_i c_{ij}$, i represents the profitability index, the same is true in $c_j^* = \min_i c_{ij}$, j Represents a cost index. Among them, the profitability index means that the larger the index value is, the better, and the cost index means that the smaller the index value is, the better.

Normalize S , remember:

$$d_{ij} = \frac{d_{ij}}{\sum_j \sum_i d_{ij}} \quad (5)$$

The obtained $d_{ij} \in [0,1]$, through this processing, will not destroy the proportional relationship between the various data indicators (Elmahmoudi, et al., 2020). Define the entropy of the j evaluation index as:

$$EI_j = -k \sum_{i=1}^a t_{ij} \ln t_{ij} (j = 1, 2, \dots, b) \quad (6)$$

Among them,

$$t_{ij} = c_{ij}^* / \sum_{i=1}^a c_{ij}^* (j = 1, 2, \dots, b) \quad (7)$$

Among them, the difference coefficient of the j-th evaluation index is defined as:

$$\alpha_j = 1 - EI_j (j = 1, 2, \dots, b) \quad (8)$$

Define the entropy weight of the j evaluation index as:

$$w_j = \alpha_j / \sum_{j=1}^b \alpha_j (j=1,2,\dots,b) \quad (9)$$

It can be seen from the above discussion that the entropy weight method can calculate the weight based on the difference of indicators.

For this article, the entropy method is used to evaluate supplier companies in the e-commerce industry, where a represents the supplier of the e-commerce company, and b represents the evaluation index. The process is as follows:

Form the original matrix, and then perform dimensionless processing:

The bigger the better the index:

$$x = \frac{z_{ij} - \min(z_i)}{\max(z_i) - \min(z_i)} \quad (10)$$

The smaller the better the index:

$$x = \frac{\min(z_i) - z_{ij}}{\max(z_i) - \min(z_i)} \quad (11)$$

At this time, the X matrix is formed.

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1b} \\ x_{21} & x_{22} & \dots & x_{2b} \\ \dots & \dots & \dots & \dots \\ x_{a1} & x_{a2} & \dots & x_{ab} \end{bmatrix} \quad (12)$$

There are a row and b column, where a represents the enterprise and b represents the evaluation index.

(1) Normalization processing

Take the ratio of the column vector x_{ij} in the matrix to the sum of all elements in the matrix as the normalized result, the calculation formula is as follows:

Calculate the jth index:

$$y_{ij} = x_{ij} / \sum_{i=1}^a X_{ij}, (j = 1, 2, \dots, b) \quad (13)$$

(2) Calculate the entropy value

Calculate the jth entropy value:

$$EI(x_j) = -k \sum_{i=1}^a y_{ij} \ln y_{ij} (j = 1, 2, \dots, b) \quad (14)$$

Where $k = 1 / \ln a$

$$EI(x_j) = -(1 / \ln a) \sum_{i=1}^a y_{ij} \ln y_{ij} \quad (15)$$

It can be seen from the above formula that the greater the difference of the j-th index, the greater the amount of information it contains, and the smaller its entropy value; when the entropy value $EI(x_j)$ is too large, it indicates that the amount of information contained is less. Consider deleting.

(3) Calculate entropy weight

Calculate the jth index:

$$e_j = \frac{1 - EI(x_j)}{b - \sum_{j=1}^b EI(x_j)} (j = 1, 2, \dots, b) \quad (16)$$

(4) Determine the comprehensive evaluation value

$$V_i = \sum_{j=1}^b e_j y_{ij} (i = 1, 2, \dots, a) \quad (17)$$

It can be seen from the above formula that entropy is a measure of uncertainty and a representation of the amount of information contained in the data in the supplier evaluation system. Through entropy, the corresponding weight of each indicator can be measured. By weighting all indicators, the final supplier score can be obtained. This method is relatively objective.

After determining the electronic supplier to be evaluated, determine the indicators that need to be evaluated, and use the entropy method to evaluate the indicators. From the above, the calculated entropy value is large or small, and it should be deleted according to the actual situation. Significant indicators, so that it can be more accurate when evaluating suppliers.

3. E-COMMERCE ENTERPRISE SUPPLIER EVALUATION EXPERIMENT

3.1 Embedded System Foundation

With the advent of the information age, many electronic products have flooded people's lives, and embedded systems have penetrated into all walks of life. The so-called embedded systems are based on computer technology and tailored software and hardware to complete a specific Function. The most significant difference between it and low-end embedded products is the existence of OS (Operating System, operating system). With the OS, the platform can perform multi-tasking and complex processing, and its performance is unmatched by single-chip microcomputers. However, the embedded system is not a PC (Personal Computer, computer). It is a highly targeted special computer. Its main features are: the embedded system uses different boards to transplant Boot Loader for code guidance, and the operating system generally has to port Windows CE, VxWorks, Linux, etc., it needs to re-develop device drivers and cross-compile with the help of the host.

3.2 Construction of Big Data E-Commerce Platform

(1) Platform design goals

The goal of the platform design of this white paper is to build an e-commerce big data analytics platform based on the Hadoop architecture. Its main features include collecting, processing, and storing large amounts of data, and developing personalized recommendations services. The platform collects user historical rating data for storage and mines user preferences based on data. Therefore, e-commerce big data platforms should address the following requirements:

- 1) Collect massive user behavior data, clean and filter the original data, retain valuable data, and provide data storage with high reliability and high scalability.
- 2) The recommendation engine generates a list of recommended items for each user.
- 3) In order to facilitate the interaction with users, the result data after platform analysis should be read more quickly.

(2) Platform frame design

The platform is designed according to the functions and data processing procedures of the e-commerce big data platform, which is mainly divided into three modules: data aggregation and

preprocessing, recommendation engine, and data storage. Based on the Hadoop framework and its main components, and at the same time using Mahout machine learning tools, the overall framework of the design platform starts from data aggregation and preprocessing, summarizes user historical rating information, and masters user personalized data.

The preprocessed data is stored on the distributed file system HDFS as the data basis for algorithm analysis of the Hadoop framework. The recommendation algorithm in the platform recommendation engine module is implemented based on custom MapReduce tasks and Mahout tools, and the generated result data is stored in HDFS and the distributed database HBase for subsequent calculations and real-time interaction with users to complete the recommendation recommendation function.

3.3 E-Commerce Enterprise Supplier Evaluation System Architecture

This article aims to design a system suitable for the e-commerce industry. In order to satisfy the decision makers to evaluate the circulating electronic suppliers, understand the operating conditions of each supplier from multiple angles, so as to understand the overall situation of the enterprise, and make appropriate decisions. At the same time, the selection of suppliers is also adjusted appropriately. The architecture of the supplier evaluation system in the e-commerce industry based on data mining is shown in Figure 2. First, integrate the content from the company's original ERP database (including information on finance, procurement, logistics, etc.) with the newly entered supplier-related data, and use ETL processing to normalize the data to eliminate unreasonable. The data is stored and summarized in the designed database. It then uses data mining and other technologies to enable senior executives and related decision makers in electronic distribution companies to make multifaceted analyses and decisions about the suppliers they are facing.

The goal of the supplier selection module is to determine the partners that meet the strategic goals of the enterprise, and to establish an organizational structure for product development and production. When a company receives a customer order, it must first decompose the order. At this stage, consider the manufacturability, production process, manufacturing and assembly process of the product and decompose the purchase order into purchase parts. Direct inquiry can be used for purchase parts. Price or bidding methods to obtain alternative suppliers; and then select them according to certain indicators and methods. Finally, after reaching an agreement on risk sharing and benefit distribution, the contract is signed and implemented.

(1) Source data layer

This layer refers to the data source of the system, which contains the original ERP system data of the enterprise and the data in the supplier evaluation system.

(2) Data processing layer

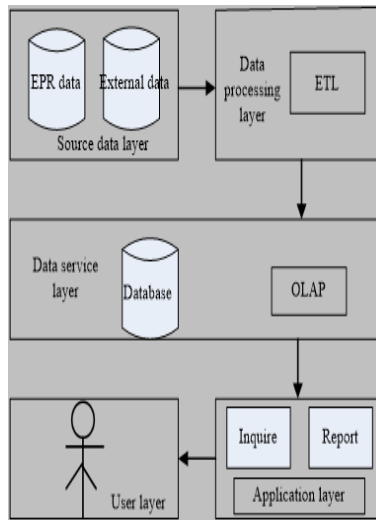
Data from different systems, formats and standards are different. Before entering the supplier evaluation system, these data must be analyzed and processed, including the determination of the data structure of the data source, and the design of corresponding data mappings. The data is converted appropriately.

(3) Data service layer

The data service layer is used to store and manage data from data sources and provide corresponding data services for users who use the system.

(4) Application layer

Figure 1. The architecture of the supplier evaluation system



The application layer can conduct information query, multi-dimensional analysis, data mining, etc., multi-angle, multi-level mining of data supplier information.

(5) User layer

The user layer is the end user of the system and is the decision maker of the e-commerce enterprise.

4. E-COMMERCE PLATFORM SUPPLIER EVALUATION SYSTEM BASED ON BIG DATA

4.1 Status Quo of E-Commerce Companies Based on Big Data

As the name suggests, big data is a collection of large amounts of data, and these data cannot be collected by ordinary people. Especially in recent years, due to the rapid development of mobile devices, its influence on e-commerce is increasing. Moreover, due to the ease of use and rapidity of mobile terminals, it has promoted the rapid development of e-commerce and can collect a large amount of data. Therefore, the development of e-commerce under the background of big data needs further exploration to enhance the competitiveness of e-commerce in many aspects. At this stage, the development status of e-commerce in my country's big data environment includes the following aspects:

(1) Large increase in transaction scale

According to data from the China Internet Information Center, the transaction scale of my country's online retail market in 2019 increased by 47.8% year-on-year compared with 2018, and will continue to maintain a relatively rapid growth rate in 2020. It can be seen from Table 2 and Figure 2 that from 2012 to 2019, the growth rate of the transaction scale of my country's online retail market was 40.24%, 38.34%, 28.88%, 32.49%, 28.42%, 8.51%, and 14.72%, respectively, maintaining rapid growth.

Table 2. 2012-2019 my country's online retail market transaction scale

Year	2012	2013	2014	2015	2016	2017	2018	2019
Transaction size	0.49	0.82	1.33	1.87	2.77	3.89	4.23	4.96
Growth rate	0	40.24%	38.34%	28.88%	32.49%	28.42%	8.51%	14.72%

Figure 2. 2012-2019 my country's online retail market transaction scale



(2) Improved information retrieval capabilities in the field of e-commerce

With the continuous increase of e-commerce websites, business information resources are relatively abundant, showing characteristics of differentiation, heterogeneity and extremes. The development of big data benefits from the emergence and development of cloud computing. The recovery service of cloud computing can select and display massive amounts of information based on consumers' transaction habits and needs. Its nature and technology are also incompatible with traditional information technology.

(3) E-commerce platform services and products become more diversified

With the advent of big data, e-commerce companies will provide users with better services and personalized products to give consumers greater and better development space. With the development of big data e-commerce, e-commerce services are becoming more and more intensive, with a large amount of data and a wide range of coverage. Since 2013, the China Computer Society has successfully held two large-scale academic conferences, focusing on analyzing the opportunities and challenges faced by big data.

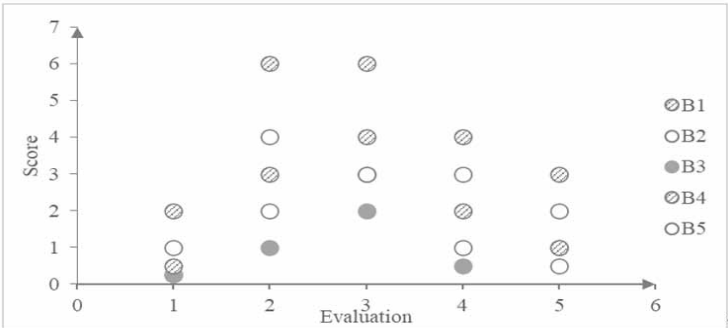
4.2 E-Commerce Supplier Evaluation Model Analysis

After confirming the structure of the model, it is judged according to the values of each level. I divided the supplier evaluation team into an expert leadership group, a purchasing manager group, and a quality inspection and financial group, and each related department selected one person as the subject of the questionnaire survey. The evaluation team members should refer to the specific content given by the author to make a score judgment of 0-10 points, and finally get the high and low scores of the evaluation index. Finally, the scores are used to determine the judgment matrix, as shown in Table 3 and Figure 3 below.

Table 3. Judgment matrix of primary indicators

Evaluation System	B1	B2	B3	B4	B5
B1	2	1/4	1/4	1/2	1
B2	6	2	1	3	4
B3	6	3	2	4	3
B4	4	1	1/2	2	3
B5	3	1/2	1	1	2

Figure 3. First-level index judgment matrix



The development of e-commerce companies must keep up with the current economic situation in society. It is necessary to consider procurement costs, but the qualified rate of quality cannot be ignored. The delivery capacity of suppliers and the ability to guarantee continuous supply rigid indicators reflect the supplier enterprises the level of comprehensive operations. Delays in delivery, reduced qualification rates, and insufficient quantity and quality to meet the order requirements will directly restrict the cooperation and development of suppliers and apparel companies. Clothing products are different from other products. It is necessary to ensure that the basic equipment is advanced, the technology keeps up with the needs, the quality and cost management must be in place, and the important indicators must meet the standards, otherwise the evaluation indicators will not be met.

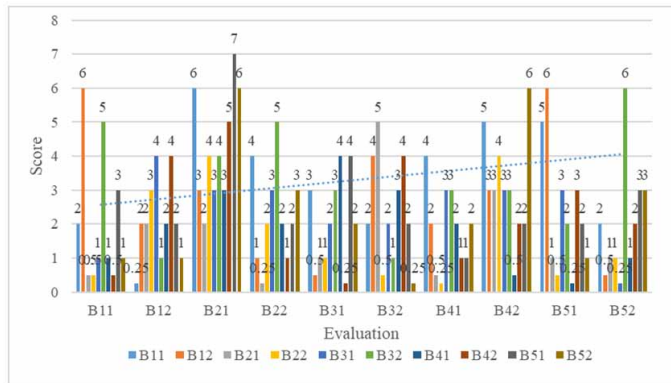
Financial status is the foundation of an enterprise's development, and it is also a rigid need to ensure corporate capital operations. The financial position of e-commerce suppliers is uneven, and if strict indicators do not meet the requirements, it will inevitably affect cooperation with e-commerce companies. The service-aware performance of supplier employees is also one of the key factors affecting a company's reputation. The cost-effectiveness of the price of goods and the quality of the goods are fundamental to promote product profitability. High-quality products are naturally more cost-effective. If the quality of the product itself is good, the consumer group will be stable. The product qualification rate directly reflects the supplier's quality inspection of the product. It is very important for the supplier's quality system to deny authentic certification. Products must have inspection and testing guarantee, quality certification system guarantee, and implementation inspection guarantee. The qualification rate of the supplier's inspection product must be consistent, and continuous quality inspection is very important. E-commerce products cannot be delayed in delivery, and inadequate delivery will increase management costs. Suppliers should pay special attention to scientific research investment. Technical strength is the lifeblood of an enterprise. Paying attention to technical capability indicators is more important than the production capacity brought by directly purchasing facilities.

Scientific research investment is conducive to the long-term development of enterprises. The results of the judgment matrix of the secondary index are shown in Table 4 and Figure 4:

Table 4. Judgment matrix of secondary indicators

Evaluation System	B11	B12	B21	B22	B31	B32	B41	B42	B51	B52
B11	2	6	1/4	1/2	1	5	1	1/2	3	1
B12	1/4	2	2	3	4	1/4	2	4	2	1
B21	6	3	2	4	3	4	3	5	7	6
B22	4	1	1/2	2	3	5	2	1	2	3
B31	3	1/2	1	1	2	3	4	1/2	4	2
B32	2	4	5	1/2	2	1	3	4	2	1
B41	4	2	1/4	1/3	3	3	2	1	1	2
B42	5	3	3	4	3	3	1/2	1/4	2	6
B51	5	6	1	1/3	3	2	1/2	3	2	1
B52	2	1/2	1	1	1/4	6	1	2	3	3

Figure 4. Judgment matrix of secondary indicators



4.3 Evaluation Methods for Suppliers of E-Commerce Companies

This article takes some suppliers of an e-commerce company as an example to illustrate the advantages of the entropy AHP method and make corresponding recommendations for the company's business decisions.

According to statistics, the e-commerce company faces more than 4,000 suppliers, but according to the Pareto rule, the suppliers that have contributed a lot to the company are still concentrated in about 20% of the companies. On the whole, the profit rate distribution of each enterprise is shown in Figure 5. As can be seen from the figure, the number of major contributing companies is about 600. Therefore, when analyzing the company's suppliers, first classify the suppliers to find out which of the four types of resource scarce type, profit contribution type, scale contribution type, and capital

occupation type the supplier is. In the case analysis of this article, take the profit contribution type as an example.

The main feature of profit-contributing enterprises is that the e-commerce enterprise can obtain higher profits from these suppliers. The key indicator of this type of enterprise is the total income.

When analyzing the entropy AHP method in this paper, eight suppliers were found for analysis. After obtaining the basic data of the 8 suppliers, the normalization process must be carried out first,

Figure 5. Distribution of profit contribution

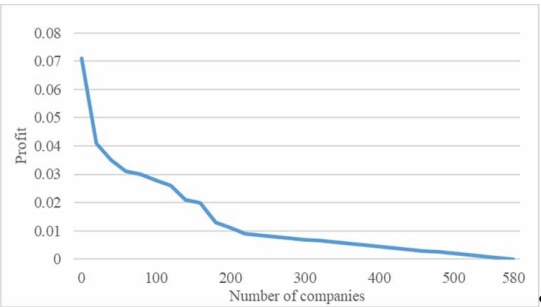


Table 5. Supplier index data table

Company Name	Sales Amount	Income amount	Rebate income ratio	Procurement revenue ratio	Sales to inventory ratio	Average days out of stock
Company A	0.96	0.99	0.83	0.76	0.78	0.73
Company B	0.66	0.44	0.35	0.25	0.36	0.64
Company C	0.53	0.47	0.55	0.36	0.62	0.55
Company D	0.61	0.31	0.55	0.23	0.44	0.30
Company E	0.88	0.93	0.88	0.79	0.68	0.71
Company F	0.72	0.38	0.56	0.23	0.55	0.17
Company G	0.48	0.03	0.45	0.33	0.24	0.66
Company H	0.55	0.33	0.77	0.44	0.33	0.66

and the fields with special significance must also be processed. For example, the smaller the “average out of stock days” days, the greater the significance of the supplier to the e-commerce company. Therefore, the smaller the value, the better. After obtaining the average out of stock days, take the reciprocal for processing. The final processed data table is shown in Table 5 and Figure 6.

First, use the analytic hierarchy process to score the proportion of the 6 evaluation indicators through experts, and get these 6 indicators corresponding to the weight w_j . Calculated by the entropy weight method, the weights w_j' of the 6 indicators are obtained, and the entropy AHP method formula

$$u = \frac{w_j w_j'}{\sum_{j=1}^n w_j w_j'}$$

is used to calculate the entropy AHP weight u of these 6 indicators. The index weights

obtained by these three methods are shown in Table 6 and Figure 7.

Figure 6. Supplier indicator data graph

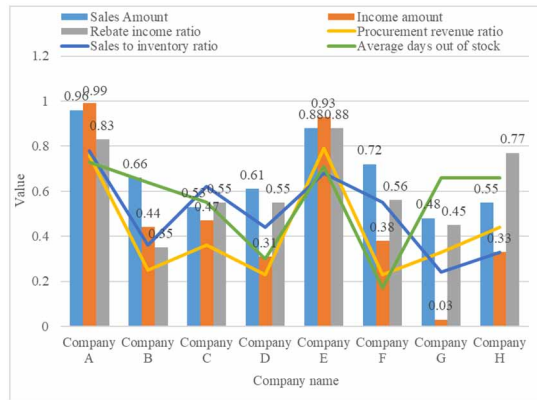
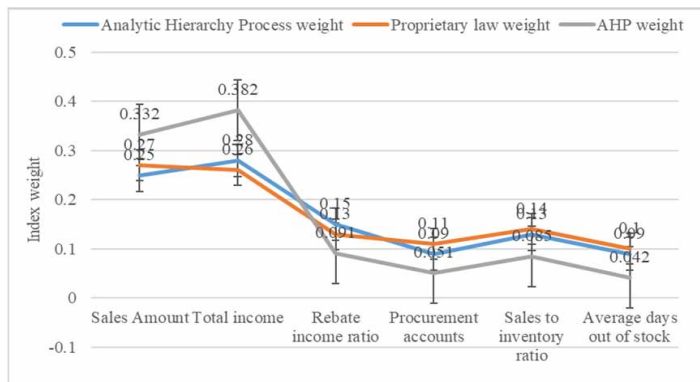


Table 6. Index weights of each evaluation method

Indicator name	Analytic Hierarchy Process weight	Proprietary law weight	AHP weight
Sales Amount	0.25	0.27	0.332
Total income	0.28	0.26	0.382
Rebate income ratio	0.15	0.13	0.091
Procurement accounts for revenue ratio	0.09	0.11	0.051
Sales to inventory ratio	0.13	0.14	0.085
Average days out of stock	0.09	0.10	0.042

Figure 7. Index weights of each evaluation method



After obtaining the weight of the entropy AHP, the 8 suppliers can be ranked. Use the ABC classification method to classify according to supplier rankings. There are 1 type A suppliers, 2 type B suppliers, and 5 type C suppliers.

5. CONCLUSION

With the development of big data technology, the application of big data in the Internet field has become more and more extensive. With the development of big data-related technologies, e-commerce, which is an important content of Internet services, has higher and higher requirements for big data analysis and applications. Big data analysis and applications have provided great help to the operation and decision-making of e-commerce. Based on the research of the big data and the supply and demand analysis system, this paper proposes to obtain the supply and demand analysis information of the e-commerce platform from the perspective of user behavior, so as to provide the supply and demand analysis model and obtain the supply and demand relationship.

Based on the existing supplier evaluation research, this article conducts research on the particularity of the e-commerce industry, summarizes the indicators and methods suitable for the e-commerce enterprise, establishes a supplier evaluation system, uses ETL technology, data mining and other technologies and The SSH framework designs the supplier evaluation system of the e-commerce company, so that the company's senior management can analyze it from different angles.

In reality, data sources are diverse and complex. Only by making full use of data can we further mine valuable information. The evaluation and selection of suppliers is a subject of very theoretical and practical value. Although the research in this article has certain value in the construction of the index system and the method of supplier selection, due to time constraints and limited levels, the depth of the index and the accuracy of the data need to be further improved.

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