Cross-Border E-Commerce Application Platform Analysis Combining Demand Analysis and Language Distribution Evaluation Method

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Abstract. With the advancement of globalization and digitalization, the cross-border e-commerce industry is booming, but this sector still faces the problems of low logistics efficiency and low payment security. In view of these problems, a comprehensive demand and index system is first constructed, combined with the language distribution evaluation method, and a new language distribution demand analysis and evaluation method for cross-border e-commerce application platform is designed. The experimental results showed that the sensitivity of the safety index had an average sensitivity of about 85.3% for the six different platforms. The sensitivity of the logistics efficiency index has an average sensitivity of about 75.6% for the six different platforms. The proposed analysis model of cross-border e-commerce application platform has the advantages of high accuracy and strong generalization ability, which provides a new analysis method for the development of cross-border e-commerce.

Keywords: Requirement analysis, Language distribution, Cross border e-commerce.

1 INTRODUCTION

With the continuous development of economic globalization, the cross-border e-commerce industry has also ushered in a golden period of development, but the security of its payment has also caused some users to worry about [1-2]. In recent years, blockchain technology has opened up new possibilities to solve these problems, with its unique core functions such as distributed bookkeeping, cryptocurrencies and smart contracts. In this context, more and more cross-border e-commerce enterprises begin to consider integrating blockchain technology into their system construction to improve their security, [3-4]. However, the blockchain technology platform has its own characteristics and different functions. The wrong choice may not only affect the system performance, but may even lead to the failure of the whole project. Choosing a suitable blockchain technology platform has become a key challenge. Traditional methods often rely on the subjective judgment and experience of analysts, which may lead to a bias in the analysis results [5-6]. These methods are usually analyzed based on historical data and current market conditions, and it is difficult to accurately predict future market

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changes and user demand [7-8]. In view of this, the research builds a comprehensive demand and index system through demand analysis, and combines the language distribution evaluation method, designed a new cross-border electricity business application platform language distribution demand analysis evaluation method, by defining the language term set, establish factor set and evaluation term set, introduce DAWA and AOWA operator, gather information from different evaluation sources, and handle the priority relationship between attributes, so as to ensure the accuracy and consistency of evaluation. It is expected that the analysis method of cross-border e-commerce application platform proposed by the research can correctly analyze the advantages of each platform according to the different needs of different e-commerce companies.

2 ANALYSIS AND MODEL CONSTRUCTION OF CROSS-BORDER E-COMMERCE APPLICATION PLATFORM

2.1 Demand Analysis and Index System Construction of Cross-Border E-Commerce

In the analysis of cross-border e-commerce application platform, it is very important to build a perfect demand and related index system. The construction of this system involves a number of demand subjects, mainly including cross-border payment enterprises, cross-border logistics enterprises and cross-border e-commerce platforms. Each subject has its own unique and key demand point [9-10]. For cross-border payment enterprises, the security, privacy and efficiency of cross-border payment are the core requirements. Security requires strict protection of funds and transaction information in the payment process. Privacy emphasizes the confidentiality of users' financial information, while high efficiency means that the payment process should be rapid and smooth, reducing unnecessary waiting time. Cross-border logistics enterprises focus on the high efficiency of logistics, the transparency and authenticity of information [11-12]. Efficient logistics services can shorten the cycle from delivery to receipt and improve customer experience. At the same time, the transparency and authenticity of logistics information are crucial to the establishment of consumer trust. Real-time logistics tracking and accurate information update are the key to win consumer satisfaction. Cross-border e-commerce platforms pay more attention to the transparency and authenticity of commodity traceability. Providing complete traceability information of commodities from production to consumers can not only enhance consumers' purchasing confidence, but also reflect the quality control of the platform and brand reputation, as shown in Figure 1.

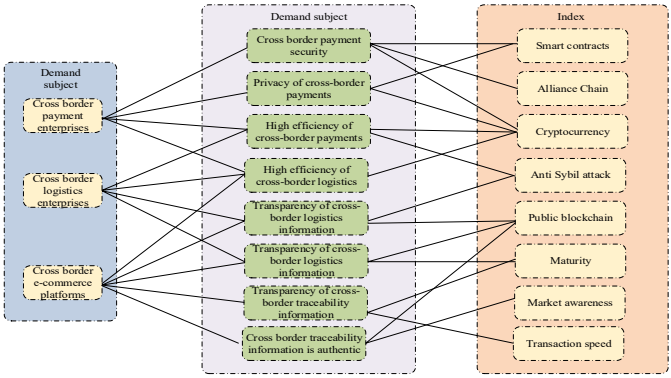

Fig. 1. The association between demand and indicators .

In order to meet these needs, the research has established a set of evaluation system including smart contracts, alliance chain, cryptocurrency, anti-Sybil attacks, public chain, maturity, security, logistics efficiency, commodity traceability and customer service indicators. These indicators will comprehensively measure the performance of cross-border e-commerce application platforms, and ensure that they can meet the expectations of various demands. In order to more comprehensively evaluate the actual operation of the platform and user satisfaction, find and compare the advantages and disadvantages of the platform services, the study combined the above demand analysis results with the language distribution evaluation method. A new cross-border e-commerce application platform is designed (Cross-border E-commerce Application Platform Analysis with Linguistic Distribution and Needs Assessment, LDAPANA).

2.2 LDAPANA, The Main Flow of the Algorithm

The first step of LDAPANA first defines the set of linguistic terms required for the evaluation, such as 1S, 2S, and 3S, which are used to describe the demand importance, the degree of demand and index association, and the index satisfaction, respectively. The second step is to establish a factor set. According to the practical problems of cross-border e-commerce platforms, various aspects need to be considered, such as platform ease of use, commodity diversity, logistics efficiency, and customer service, etc., so as to form a complete evaluation factor set C. The third step is to establish the evaluation term set. In order to describe the evaluation results of each factor, a specific language term set S is determined. In the fourth step, the weight vector is assigning a weight to each evaluation factor, reflecting its importance to the overall evaluation, and forming the weight vector ω. The fifth step is to collect the evaluation information, and collect the language distribution and evaluation information about each factor from the users or experts through questionnaire survey and expert interview. The sixth step is to establish a language distribution evaluation matrix, according to the collected evaluation information, and a language distribution evaluation decision matrix is established for each evaluation scheme (namely cross-border e-commerce platform). The seventh step is to aggregate the evaluation information. When there are multiple evaluation

information sources, DAWA (Language distribution evaluation assembly operator) is used to gather the evaluation information to obtain the group evaluation information. Assuming that (m) evaluators evaluate a certain factor (C_i), and the evaluation information is the language term set (S = {S_1, S_2,..., S_m}), the process of using DAWA to assemble this evaluation information is shown in equation (1).

$$DAWA(S_1, S_2, ..., S_m) = \sum_{j=1}^{m} \alpha_j \cdot f(S_j) \tag{1}$$

In Equation (1), α_j is the weight of the j evaluator, S_j is a function that transforms language terms into numerical or other computable formats. LDAPANA The flow chart of the analysis model of cross-border e-commerce application platform is shown in Figure 2.

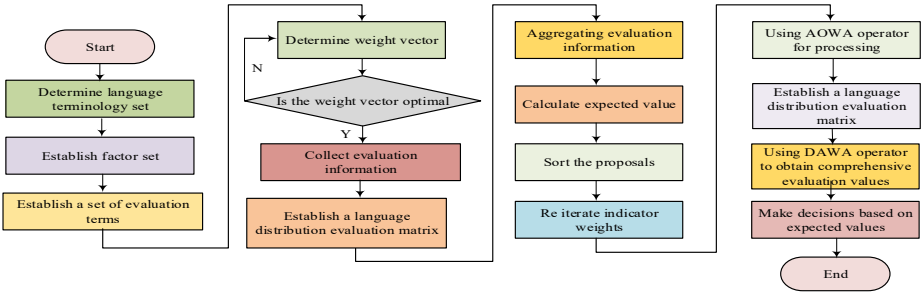

Fig. 2. LDAPANA Flow chart of the analysis model of the cross-border e-commerce application platform .

The eighth step calculates the expected value, and to quantify the evaluation results, the comprehensive evaluation value of each scheme is calculated. The ninth step ranks the schemes, ranking all evaluation schemes according to the comprehensive evaluation values or expected values of each scheme for further comparison and selection. Step ten is to redefine the index weight to more accurately reflect the importance of each index in the overall evaluation. By combining the demand weight and the correlation degree information between the demand and the index of the index, the initial weight is adjusted to ensure the scientificity and accuracy of the evaluation system, as shown in Equation (2).

$$w_{i'} = \frac{d_i \times r_i \times w_i}{\sum_{j=1}^{n} (d_j \times r_j \times w_j)} \tag{2}$$

In Equation (2), n is an evaluation index, and the initial weight of each index is w_i, the weight of demand is d_i, and the degree of correlation between demand and the index is r_i. Step 10 uses AOWA operator. If there is a priority relationship between evaluation factors, the AOWA (language distribution evaluation assembly with priority relationship between attributes) operator is used to determine the weight of each at-

tribute and normalize it. Finally, it uses the attribute weight and attribute value after normalization, as shown in Equation (3).

$$AOWA(a_1, a_2, ..., a_m) = w_{1'} \times a_1 + w_{2'} \times (1 - a_1) \times a_2 + ... + w_{m'} \times \prod_{j=1}^{m-1} (1 - a_j) \times a_m \quad (3)$$

In Equation (3), m is the number of evaluation factors and a_m is the attribute value. Step 12: re-establish the language distribution evaluation matrix in order to update and refine the evaluation of cross-border e-commerce application platform. Through this step, the language distribution of the evaluation value of the evaluation scheme under each factor can be collected and collated, so as to more accurately reflect the latest situation of the platform and the latest evaluation of users and experts. Step 13: The DAWA operator is used to find the comprehensive evaluation value. The AOWA operator mainly deals with the priority relationship between attributes, while the DAWA operator is used to gather information from different evaluation sources to ensure the accuracy and consistency of group evaluation. Therefore, after adjusting the attribute weight and considering the priority relationship, it is still necessary to use DAWA operator to synthesize the evaluation of the same attribute by different evaluators, so as to get a more comprehensive evaluation value. Finally, the decision is made according to the expected value, the expected value of each cross-border e-commerce platform is compared, and the platform with the highest expected value or meeting the specific standards is selected as the final decision result.

3 CROSS-BORDER E-COMMERCE APPLICATION PLATFORM ANALYSIS MODEL APPLICATION ANALYSIS

When choosing blockchain technology for cross-border e-commerce application platforms, they should deeply consider the different characteristics of each platform. Due to different block chain technology platform has its unique advantages and functions, coupled with the cross-border electricity subject business needs, data processing ability and security requirements also have different, therefore, when choosing the best block chain technology platform, the cross-border electric business application platform according to their own actual situation of detailed analysis and balance, to find the most suitable for their own technical solutions. Different technology platforms were selected from Study 6, as shown in Table 1.

Table 1. Comparison of blockchain technology platform

Feature (A1)	Ethereum (A2)	Hyperledger (A3)	R3 Corda (A4)	Quorum (A5)	Ripple (A6)
Type	Public Chain	Consortium Chain	Consortium Chain	Consortium Chain	Consortium Chain

Feature (A1)	Ethereum (A2)	Hyperledger (A3)	R3 Corda (A4)	Quorum (A5)	Ripple (A6)
Permissioning	Unpermissioned	Permissioned	Permissioned	Permissioned	Permissioned
Application	Various Industries	Various Industries	Mainly Financial Industry	Various Industries	Mainly Financial Industry
Cryptocurrency	Bitcoin	None	None	Quorum Digital Dollar	XRP (Ripple)
Smart Contracts	Yes	Yes	Yes	Yes	No
Consensus Mechanism	PoW (Proof of Work)	Pluggable Consensus Mechanisms	Pluggable Consensus Mechanisms	PoW/RAFT/IBFT	RP-PCA (Ripple Protocol Consensus Algorithm)

These platforms are all important representatives of blockchain technology. The Feature refers to a public chain feature that supports cryptocurrencies and smart contracts such as Bitcoin, and uses a proof-of-a-work-load mechanism [13]. Ethereum Is a public chain, suitable for a variety of industries, supports smart contracts, but no built-in cryptocurrency, using a pluggable consensus mechanism. Hyperledger and R3 Corda are alliance chains, mainly used in the financial industry, and also support smart contracts and pluggable consensus mechanism [14]. Quorum Is another alliance chain, with its own digital currency that supports multiple consensus mechanisms. Ripple Is mainly used in the financial industry, does not support smart contracts, using the Ripple protocol consensus algorithm [15]. In order to meet the needs of e-commerce, a set of evaluation system includes smart contracts, alliance chains, cryptocurrency, anti-Sybil attacks, security, logistics efficiency, commodity traceability and customer service. To explore the sensitivity of these indicators, a Monte Carlo simulation simulates different evaluation scenarios by randomly generating a large number of index combinations to assess the uncertainty and impact of each demand indicator. The results show that the sensitivity of the safety index has an average sensitivity of about 85.3% for the six different platforms. It shows that security is one of the most critical indicators in the evaluation system of cross-border e-commerce platform. The sensitivity of the logistics efficiency index has an average sensitivity of about 75.6% for the six different platforms. It shows that the efficiency of logistics services directly affects the satisfaction of consumers and the delivery time of goods, and has a significant impact on the competitiveness of cross-border e-commerce platforms. The sensitivity of the commodity traceability indicators has an average sensitivity of about 78.2% for the six different platforms. The average sensitivity of the customer service metrics is about 81.6% for the six different platforms. It is slightly lower than the safety index, but it still shows its importance in cross-border e-commerce platforms. In addition, the research has carried out the performance evaluation experiment of cross-border e-commerce application platform. The experimental setting includes selecting multiple cross-border e-commerce platforms as the evaluation objects, and determining the evaluation indi-

cators such as security, logistics efficiency, commodity traceability and customer service. During the experiment, the performance of each platform was comprehensively evaluated using the designed LDAPANA method. Finally, the cross-border e-commerce platform with the best performance is selected according to the expected value, and the experimental results are shown in Table 2.

Table 2. Analysis results of cross-border e-commerce application platform based on LDAPANA method

Platform name	Safety (S)	Logistics efficiency (L)	Commodity traceability (T)	Customer service (C)	Comprehensive evaluation value
Feature	85	75	90	80	0.83
Ethereum	90	80	85	75	0.82
Hyperledger	88	82	92	87	0.87
R3 Corda	92	88	95	90	0.90
Quorum	82	78	87	83	0.81
Ripple	80	70	83	75	0.77

The analysis results table of the cross-border e-commerce application platform based on the LDAPANA method provides the performance evaluation of multiple cross-border e-commerce platforms on four key indicators, such as security, logistics efficiency, commodity traceability and customer service. The following is a detailed analysis of the table: First, from the perspective of comprehensive evaluation value, R3 Corda platform ranked the top with a comprehensive evaluation value of 0.90, showing that the platform performs well in all indicators, especially in terms of safety and commodity traceability. This was followed by the Hyperledger and Feature platforms, whose combined assessment values were 0.87 and 0.83, respectively, which showed better overall performance. Second, the combined assessment values for the Ethereum and Quorum platforms were 0.82 and 0.81, respectively, which were slightly lower than the top three, but also within the acceptable range. The two platforms are relatively weak in logistics efficiency and customer service, but still have significant scores on safety and commodity traceability. Finally, the Ripple platform was ranked last with a comprehensive assessment value of 0.77.

4 CONCLUSION

This study conducts an in-depth comparative analysis of six different blockchain technology platforms to meet the needs of cross-border e-commerce application platforms when choosing the most suitable technology solutions for them. By building an evaluation system containing a number of key indicators, and using Monte Carlo simulation to explore the index sensitivity, it is found that security, logistics efficiency, commodity traceability and customer service are the key factors affecting the performance of cross-border e-commerce platform. Among them, the safety index has the highest sensitivity, with an average sensitivity of about 85.3%, highlighting the core position of security in the evaluation of cross-border e-commerce platforms. The average sensitivity of logistics efficiency is about 75.6%, the traceability of goods is about 78.2%, while the sensitivity of customer service indicators is about 81.6%, these three indicators also have a significant impact on the performance of the platform. In conclusion, this study shows that the selection of blockchain technology for cross-border e-commerce application platforms should focus on security, logistics efficiency, commodity traceability and customer service indicators. The R3 Corda platform performs best in these areas and is the preferred technical solution. However, this study may have some limitations in the selection of experimental sample size and evaluation indicators. In the future research, we can further expand the sample range and add more subdivided evaluation indicators to improve the comprehensiveness and accuracy of the study.

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