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Dynamic Weighted Trust Evaluation Model for C2C Electronic Commerce Based on Bidirectional Authentication Mechanism

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Abstract

C2C e-commerce is more special in several e-commerce modes, both trade sides are retail customers, the credit problems depend on the management coming from the third party trading platform entirely, lacks of initiative in this management, and the one-way real-name certification leads to the problem of asymmetric credit in C2C transactions, credit asymmetry is the root of a lot of credit problems in C2C transactions. To this end, in this paper the dynamic weighted trust evaluation model based on bidirectional authentication mechanism is established, and in order to solve the inconvenience comes from buyer real-name authentication, this model put forward a unified platform for buyer's, the problem of asymmetric credit is solved well, at the same time to ensure the convenience of authentication and the confidentiality of information, unified authentication management is good for integrating various trading platform, makes certification more reliable. In this model all the factors affecting credit will be considered synthetically, including the transaction amount, transaction time, evaluation user types etc, effective to identify the type of evaluation users, it is well to reduce all the behaviors such as credit hype and fraudulent trading etc, the calculation results of credit finally will be reflected by dynamic graph, makes the evaluation results more intuitive and easy to understand credit trend of evaluated user.

Keywords: *DWTEBBA (dynamic weighted trust evaluation model based on bidirectional authentication mechanism), C2C e-commerce, transaction value, credibility of estimators, the neutral feedbacks*

1. Background Analysis of C2C E-Commerce Credit Evaluation

In several kinds of electronic commerce modes, C2C electronic commerce is more serious in credit problem, the main reason is that the authentication management difficulties of retail business, leads to the credit asymmetry problem buyer and seller, and then brings a series of credit evaluation problems for C2C trading, such as credit hype, fraudulent trading, cash, money laundering and so on, so it is necessary to strengthen credit evaluation management. At present, some credit evaluation mechanisms mainly think of the service quality factors in trading, there are some reference factors such as the transaction time, transaction user types *etc*., but the reference factors are single, credit, evaluation method is simple. In addition the trust evaluation problems of C2C e-commerce mainly result as identity authentication asymmetry for the two parties, so it is vey necessary to establish two-way authentication mechanism , can well solve the problem of asymmetric credit, bases on which to do the credit evaluation of both sides, and Integrates various factors in the deal.

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The credit evaluation model established in this paper is two-way weighted model, it can be well to solve the above problems.

2. Dynamic Weighted Trust Evaluation Model Based on Bidirectional Authentication Mechanism

2.1. Evaluation Factors

The internet has the openness and virtuality, which results in credit problems becoming important factors hindering the development of the electronic commerce. At present, some trust evaluation regulations make sure the safety and fairness of online trading partly, but there are still shortcomings [1] .Most of C2C electronic commerce trust evaluation models calculate user's credit using simple accumulated credit evaluation algorithm, although reduced the credit crisis, enhanced the confidence of online trading, but there are still some problems in such aspects as evaluation rule and method. This paper established the evaluation model of a combination of all the factors that affect e-commerce credit problems, including: bidirectional real-name authentication, trade time, transaction value, type of evaluation user, which is the solid foundation to guarantee the quality of the model.

(1) Bidirectional real-name authentication

Anonymous transaction brings about conveniences during the online trading, as the same time carries risks, so identity authentication is the chief problem for electronic trade. Most of C2C e-commerce sites provide a set of authentication mechanism for sellers to avoid internet fraud brought by anonymous transaction, but in order to attract consumers, the authentication mechanism for buyers provided by general web site is too simple, even without authentication. So, it leads to the information asymmetry sellers and buyers, and hides some disadvantages, for example: the same seller registers for some buyer accounts to trade with himself to do credit speculation, which seriously hampered the judgment of the buyer to the seller's credit. Buyers and sellers of information asymmetry including commodity information asymmetry and the asymmetry of traders information, on the one hand, the seller takes the commodity information, the buyer poorly understood, on the other hand, the buyer can have a certain degree of understanding of the seller through the website, but to buyer the seller know very little. Bidirectional real-name authentication credit model is proposed in this paper, namely that not only seller but also buyer needs to be certified.

(2) Trade time

In most of the C2C e-commerce sites, credibility is the result of long-term accumulation, the effect on the credibility brought by the long ago evaluation is same as the recent evaluation, which will urge some sellers to take up honest trade to accumulate credibility at early stage, after that will make use of the accumulation of credit to take swindle. Actually Trading time is earlier and earlier than the time calculating credibility, the impact on the credit value of trading evaluation should be smaller. So, in the credit model of this paper trade time will be an important reference factor. If the time of transaction evaluation is close to the time of calculation credibility, the evaluation should be have a larger weight, conversely smaller. At last, through the trend chart to reflect the user's credit, not only reflect the credit rating of the users for a period of time, and more real reflect the dynamic changes in the credit, which allows the user won't be blind by credit speculation for a period of time.

(3) Transaction value

At present, credit evaluation algorithm of C2C e-commerce site has nothing to do with the transaction value, a deal of one dollar will receive the same evaluation chance and a deal of ten thousand dollars, and the impact on the credibility is the same. So, the user's credibility of small transaction will have a rapid ascension, some of sellers take this for credit speculation, namely that through small trade gain credibility then turn to the big transaction, which will bring a big risk for buyer. In this paper, transaction value will be an important reference factor, big transaction will have a large weight when calculate credibility, of course weight of transaction amount can not be an unlimited expansion with the trade amount, there will be a range, otherwise the same will be negative impact, which range will be based on amount of statistics single transactions amount and trading commodity type online to determine , in short in a range of transaction amount will be given a same weight.

(4) Type of evaluation user

At present, most sites each buyer trading with seller have the same influence on credit evaluation to the seller, this will result in the randomness and irrationality of credit evaluation, so it will take chance for partly malicious evaluation or fraud users.In fact, there are many types of evaluation users, the type of evaluation user decides the reliability of evaluation information. The first is a sincere evaluation user, the evaluation fairly reflects the seller's credibility; The second is a malicious evaluation user, the evaluation is not true, he aims at attacking the profession; The third is mendacious evaluation user, namely that the seller will evaluate himself to improve credibility; The fourth is no evaluation user, most of sites will look this kind of evaluation as a high evaluation, in fact is not necessarily so; The fifth is returned customer, if it is true the returned customer should reflect the high credibility of seller, but some users conduct credit speculation[2]. In order to avoid disadvantages of various kinds of user evaluation, in this paper the model is designed the credit weight of evaluation user and the two-way real-name authentication mechanism, bidirectional real-name authentication avoids mendacious evaluation user, credit weight of evaluation user insures the authenticity of no evaluation user and returned customer, for malicious evaluation user the weight of evaluation will be decided by the distance the evaluation of malicious evaluation user and the average evaluate[3].

2.2. Dynamic Weighted Trust Evaluation Arithmetic

For a while, assume that there are n buyers, respectively as: B_1 ,B_2 ,……,B_n , the number i buyer had m times trading with the number k seller, wherein the information of number j trading may be signified with a quintuple: (B_i , K, W_j , M_j , R_j), B_i is the number i buyer, W_j is the User type weights in number j trading of number i buyer, it decides the credibility of this evaluation, M_j is the transaction value of number i buyer in number j trading, R_j is the evaluation value of buyer in this trading. At present, the evaluation score of C2C e-commerce site is too simple, in order to solve this problem in this paper the evaluation value will be divided into six grades, respectively as: +2 points is very good, +1 point is good, 0 point is common, -1 point is bad, -2 points is very bad, no evaluation is （m-m_0）/m points, the evaluation value of no evaluation

buyer will not be look as a high praise in common, which can gain a true evaluation [4]. Suppose that the evaluation value of number K seller evaluated by number i buyer is P_i, there is the following formula:

$$P_i = \sum_{j=1}^{m} M_j R_j (1+(j-1)\partial)(T_j - T_0) / \sum_{j=1}^{m} M_j (T_j - T_0) \qquad (1)$$

T_j is the trading time of number j trading, T_0 is the initial trading time, $(T_j - T_0)$ reacts that how long present trading is from initial trading, the time lag is longer and the credibility evaluation value is higher, so avoid credit speculation. M_j is a credibility evaluation factor as trading value, block trade will be discriminatory with small trade, reflects the risk brought by block trade, at the same time avoids scraping up credibility by small trade, and then turn to block trade to swindle, which will endanger customer badly. In the formula variable ∂ is evaluation quotient of returned customer, returned customer reflects the seller good creditworthiness, in the meantime bidirectional real-name authentication system is designed in this model, avoids that the same seller registers for some buyer accounts to trade with himself to have credit speculation, so in this model the returned customer reflects the seller good creditworthiness truly.

Through the formula (2) the seller's credibility evaluation given by any buyer can be calculated, as well the seller's credibility evaluation given by all buyers can be calculated, and then the credibility p of seller can be calculated by the following formula:

$$P = \sum_{i=1}^{n} P_i W_i \qquad (2)$$

$$(3) \qquad W_i = \begin{cases} (1-|P_i - P'|) & |P_i - P'| \le \theta \\ (1-|P_i - P'|)\ \sigma & |P_i - P'| > \theta \end{cases}$$

$$P' = \sum_{i=1}^{n} P_i / n \quad (P'-\text{average credit of seller}) \quad (4)$$

In formula (3) variable θ is allowable variation, that is to say an acceptable small deviation of evaluation, beyond this deviation will be look as a malicious evaluation user, otherwise a sincere user. Variable σ is decay factor, is used to weaken the malicious evaluation. The value of allowable variation and decay factor will be obtained through analyzing trading history data.

2.3. Dynamic Weighted Trust Evaluation Model

Dynamic weighted trust evaluation model based on bidirectional authentication mechanism in this paper (refer to Figure 1), combined with bidirectional real-name authentication and

weighted credit evaluation technology, bidirectional real-name authentication technology can solve credit speculation caused by trading with himself[5]. In the model, trading time, trading value and evaluation user type *etc.*, are important factors, as the trading time is longer with evaluation time so the value of credit evaluation is smaller, if transaction amount is larger then evaluation weights should be greater, the credibility of the evaluation is not the same for different evaluation users, which credit calculation algorithm can make the evaluation more true, in addition credit evaluation trend chart can be used to reflect the change of seller credibility, user can clearly realize the seller's credit how to develop, avoid credit speculation caused by primitive accumulation of credibility.

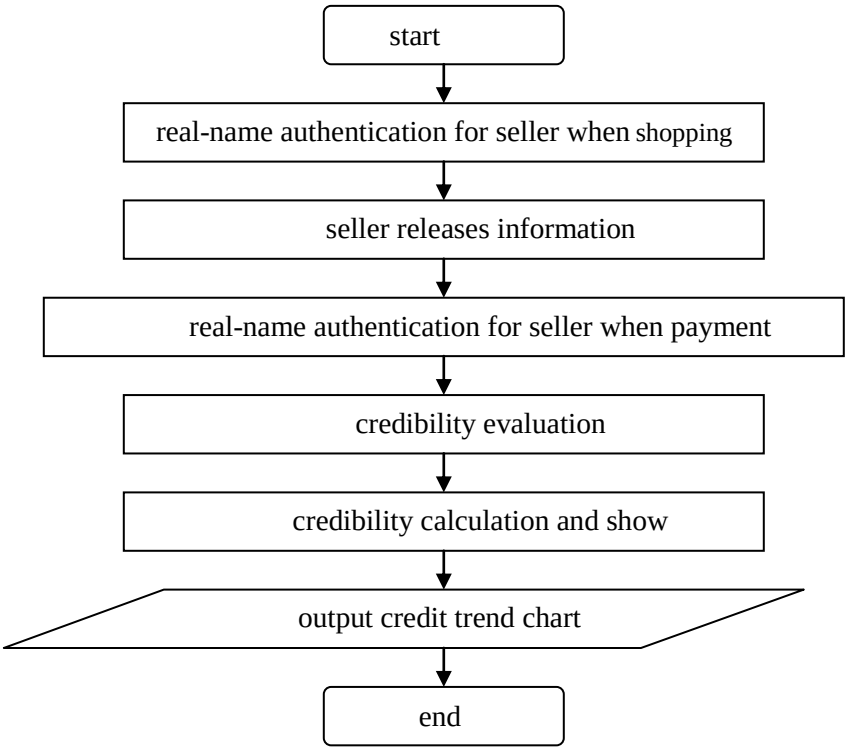

Figure 1. Dynamic Weighted Trust Evaluation Process for C2C Electronic Commerce Based on Bidirectional Authentication Mechanism

The bidirectional real-name authentication mechanism established in this model, may have some difficulties in the implementation, mainly is for the buyer's user credit to his binding is not so strong, so he can feel the certification will be very troublesome, and not willing to reveal personal privacy, so will reject certification, solution to this problem is that the certification will be carried out by an platform independent from all e-commerce sites, the platform may provide with integrated authentication and information confidentiality services, and various e-commerce sites can connect the platform sharing the results of the certification, so that when user is shopping in different e-commerce site he needn't be certificated only he has been certificated at the uniform platform, so it is not trouble , and the information needn't be transported frequently so it is secure, while they are doing shopping in different e-commerce site the certification only needs one time. and such certification is more comprehensive and unified, refrains from some lawless users registering in different sites to do fraudulent trading.

3. Simulation Experiment

3.1. Experiment Process

User needs to be certificated when payment, if the user has had a seller identity, he will be refused a buyer identity, which can avoid credit speculation caused by trading with himself[6]. The buyer only through real-name authentication can trade when payment, All users in this model need to be authenticated. The real-name authentication seriously need an third-party platform independent on electronic trading site, so that you can avoid from register when users trade in many trades, and through a unified authentication management it can avoid from money laundering or fraudulent trading and so on when users register in different websites. The establishment of the two-way real-name authentication mechanism ensures that the calculation value of buyer to the seller's credit is more reliable.

Assume that the credibility of a seller within 100 days will be analyzed, in order to calculate simply, only calculate two users' credibility information to a seller. The simulation parameters of the model are shown in Table 1, information of no.1 user and no.2 user is shown in Table 2 and Table 3.

Table 1. Simulation Parameters

model parameters	description	value
∂	evaluation coefficient of returned customer	0.2
θ	allowable deviation	0.14
σ	decay factor	0.8

Table 2. No.1 Buyer's Information of Transactions

trade times	1	2	3	4	5
trade time(day)	10	30	50	80	100
trade value(yuan)	10	100	500	30	80.740
user evaluation	+2	null	0	+1	-1

Table 3. No.2 Buyer's Information of Transactions

trade times	1	2	3	4	5
trade time(day)	15	20	30	80	90
trade value(yuan)	10	80	100	150	100
user evaluation	+2	+1	0	+1	-2

The trade time is the time interval someone trade and the first time trade.

Formula(1) will give the credibility evaluation value of seller coming from buyer 1 and buyer 2 as: 0.74, -3.85. Formula(4) will give the credibility mean value as: -1.56. Formula(3) will give the user type weight of seller as: -1.04, -1.032. Buyer 1 and buyer 2 evaluation are

all beyond the allowable deviation value, it shows the user type may be malicious evaluation user, so the evaluation needs to be weakened to reduce the important of the evaluation. Formula(2) will give the comprehensive credit of seller within one hundred days as: 3.20.

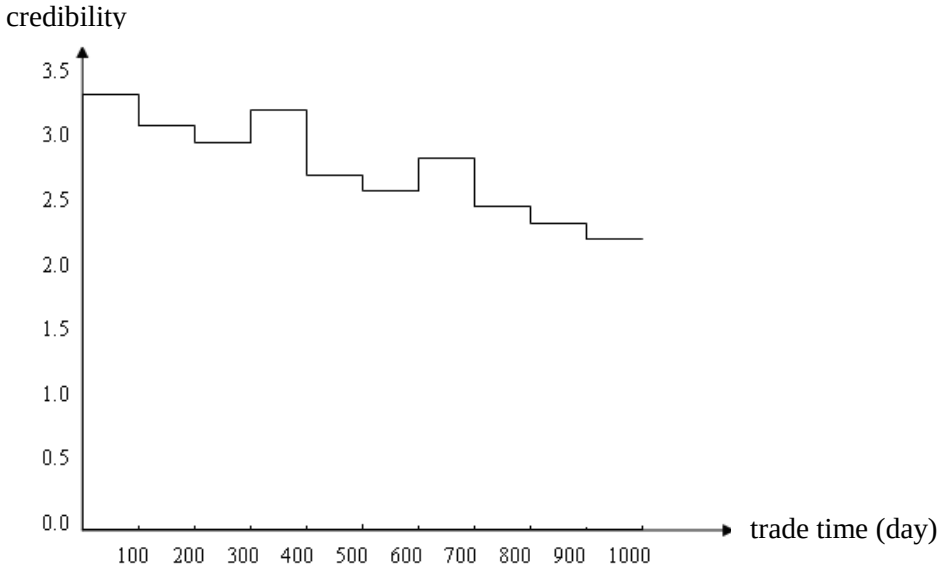

Figure 2. Credibility Trend Chart

Assuming that by this process continues to select a continuous nine periods of 100 days, respectively calculate the seller credit for every 100 days as: 3.02, 2.89, 3.10, 2.67, 2.534, 2.71, 2.51, 2.45, 2.34, and then draw out the seller credit trend chart within ten periods of one hundred days (refer to Figure 2). It can be seen from the credit trend chart that the seller's credibility is downtrend at present, the user should carefully consider whether trading with the seller.

3.2. Experiment Result Analysis

As can be seen through the experiment, in this paper, dynamic weighted trust evaluation model based on bidirectional authentication mechanism has two advantages. At first, it can avoid credit speculation and cash out etc problems. Secondly, comprehensively considers the factors reflecting credibility, the transaction time and transaction account, evaluation user type can be adjusted depending on the transaction to ensure that the evaluation data is more reliable, and then give the credit trend chart to reflect the credit trend, avoids some sellers getting a higher credibility though primitive accumulation, and then turning to swindle.

4. Model Design

Figure 3 is the realization process design of dynamic weighted trust evaluation model based on bidirectional authentication mechanism in e-commerce site, reflects the practical application for credit evaluation model in e-commerce sites[7].

Seller needs real-name authentication when setting up shop, buyer needs real-name authentication before payment, they will trade in the C2C e-commerce site. Id of both sides of the deal, trade time, trade value and trade times are input goods management system, initial evaluation, good praise rate, bad praise rate and trade id are input evaluation management system, number of buyers total of trades and total of no evaluation are input user management

system. The buyer needs learning seller's credibility by credibility show platform, on these grounds decides whether will trade with the seller, after trade buyer should give a initial evaluation value for seller though credibility evaluation module and then the credibility evaluation model will generate seller's credibility value, the credibility value is shown following five aspects: initial product quality, server quality, distribution quality, good praise rate and bad praise rate[8]. At the same time seller also can evaluate buyer (in this model the evaluation given by buyer is mainly reflected). When calculating credibility value goods management system will provide trade user id、 trade time, trade value and trade times, and then use trade user id to access the evaluation management system to get initial evaluation, good praise rate and bad praise rate, meantime access the user management system to get the number of buyers total of trades and total of no evaluation[9]. According all these information to calculate the credibility value, and put the credibility value into credibility trend chart.

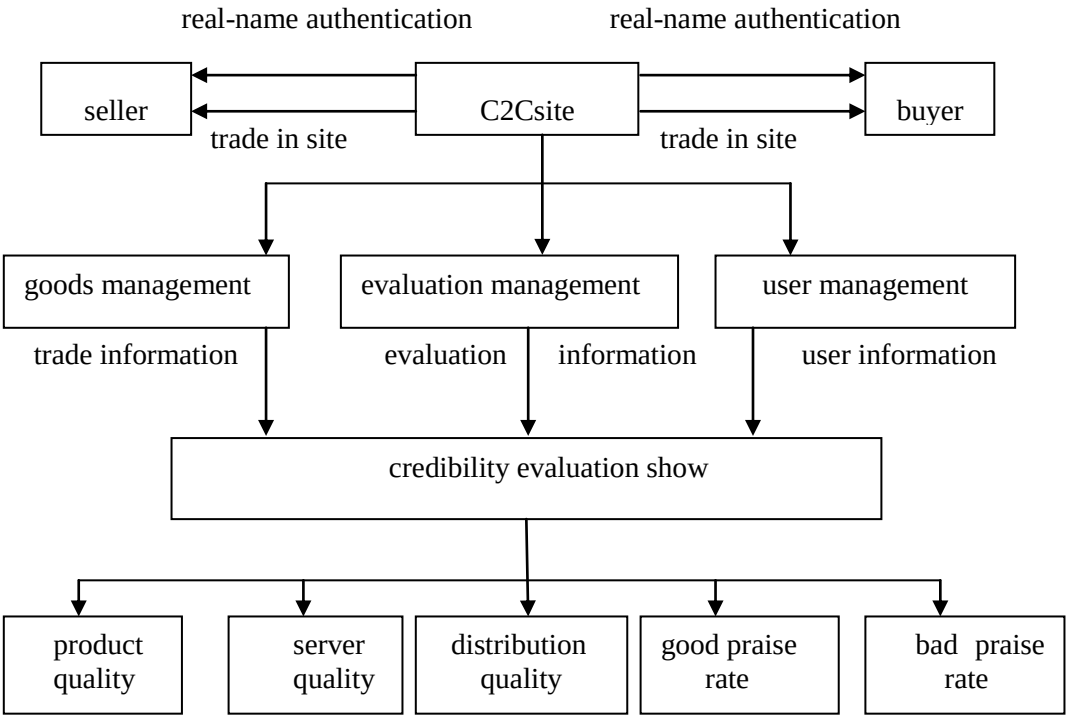

Figure 3. Model Implementation Process

5. Other Suggestions

5.1. Strengthen the Legal System

At present domestic electronic commerce laws present marginalization, which are mainly some laws and regulations around some of the related issues of e-commerce, but less substantive laws, and in order to promote the development of e-commerce the treating method about a lot of problems are loose and fuzzy, which resulted in the management of the electronic commerce is not strong enough[10]. In order to ensure e-commerce have a better development space, the legal system is imperative.

5.2. Unified Authentication Platform Construction

Credit problem of C2C e-commerce is not an e-commerce site, also is not a consumer, but is the whole society. At present in terms of credit evaluation model, mostly around the factors such as transaction amount, transaction time, credibility of the evaluation user, but a very basic problem is the problem of asymmetric information, the root method of solving this problem is two-way real-name authentication, it has been introduced to in this article about this. Unified authentication platform is very useful for solving the two-way real-name authentication problem.

5.3 Strengthen the Supervision for Site

In C2C e-commerce, not only buyer but also seller they all believe in the trading platform, but trading platform in order to gain an advantage sometimes maybe relax management, even sometimes website will pose a risk to consumers[11]. At present it is mainly depends on the website's self-discipline about e-commerce site management, which the nation does is not enough, in order to solve the problem fundamentally, website themselves and nation the two-way management for the website is necessary.

5.4 Establish Membership Credit System

In our country, the use of personal credit system is generally in financial institutions, such as banks. For example, someone wants to apply for individual housing loans in the industrial and commercial bank, after the acceptance of business, the bank's staff must firstly query the loan applicant's credit record to the people's bank of China personal credit system website. In the personal credit system of people's bank of China, as long as the input of someone's id number and the name, what is happening in his credit record will all can be shown: there are how many credit cards, consumption records in the credit card, consumer loan repayment records, whether happened consumer loans or other loans, whether bad debts or delay payment behavior. So his credit status can be like the palm of his hand to bank, through the understanding of credit can determine whether to lend to him. At current, if the member credit system will be established in C2C e-commerce site as the credit system in the people's bank, then either buyers or sellers the credit control will be very effective. Member of the credit system in the C2C e-commerce sites can be set up through the website member credit real coding system, name that the members after verify the credit information will be lock on a unique code, when needs to use the membership credit conditions can obtain real coding to prove its credit, thus lower operating costs, reduce the risk of the signal.

6. Conclusion

There are some dynamic credit evaluation models of C2C electronic commerce, took the trade time and trade value into account, but no consideration about evaluation user type. In fact, the evaluation user type actually has a great influence on authenticity of evaluation information. In this paper, the credibility evaluation model of C2C electronic commerce has some improvements based on some existing dynamic credit evaluation models, in the model the bidirectional real-name authentication is designed, this authentication ensures credibility of evaluation during the trading. Evaluation user type factor is introduced, and a period of the evaluation results will be display by trend chart, which can reflect the change trend intuitively, support a good reference value for users.

C2C electronic commerce acts as an important role in the stage of electronic commerce, and the platform's biggest hidden danger is credit problems, such problems as unequal credit and credit speculation etc, seriously influence its development, to solve these problems, accelerating the legislation and credit system technology research are eager to be included in the agenda. A set of fair and reasonable C2C e-commerce credit evaluation system can minimize trade both sides of the asymmetric information and the separation of time and space of distrust, promote greater development of C2C e-commerce.

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