Platformance-Based Cross-Border Import Retail E-Commerce Service Quality Evaluation Using an Artificial Neural Network Analysis

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ABSTRACT

The transaction scale of cross-border import e-commerce has grown rapidly around the world. Platform-style cross-border e-commerce does not control the quality, source, and transaction process of goods strictly and comprehensively. In terms of customer service quality, the seller's customer service often ignores the customer's problems, and some customer service solutions cannot solve the customer's problems. Serving customers through the network has changed the traditional offline service form without distance, and the service process has a time and space distance. This paper constructs an evaluation index system based on the development of cross-border e-commerce. Through questionnaires, relevant data were obtained and analyzed. The authors analyze the results based on the collected data on the factors that affect the quality of cross-border import e-commerce services. Responsiveness is the most important factor found by artificial neural networks. The descending order of importance of other factors is fulfillment, diversity, privacy, reliability, compensation, and ease of use.

INTRODUCTION

Many e-commerce-related companies have been exploring and innovating in recent years, and some of these industries have converged into an emerging industry – cross-border import e-commerce companies. The development of cross-border e-commerce promotes the flow of global consumption, thereby driving the continuous transformation of the offline industry. At the same time, competition among e-commerce companies is in full swing.

China's cross-border e-commerce platform has ushered in a period of rapid development. For example, Tmall Global has opened 1,500 direct routes from more than 40 overseas countries and

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regions to China, and has deployed 1.7 million square meters of bonded warehouses(China Economic Net,2021). Today, the cross-border e-commerce market has become a blue ocean market with unlimited dividends. According to customs statistics, in the past five years, the development scale of China's cross-border e-commerce has increased by 10 times, and the scale of market procurement trade has expanded by five times. In 2021 alone, the scale of cross-border e-commerce imports and exports will reach 1.98 trillion yuan, and the export volume will continue to increase. Reaching a record high, relevant platforms and companies have established overseas warehouses(China News Network,2022).

In recent years, small and medium-sized enterprises have carried out production and sales through the field of e-commerce, and the operation of enterprises has become inseparable from e-commerce. By introducing and participating in e-commerce, the various expenses of enterprises are reduced, the sales network is more developed, and the economic benefits are gradually reflected. Under the "new normal" economic situation, affected by the continued downturn of the global economy, the export pressure of traditional foreign trade manufacturing enterprises has increased sharply. Some enterprises are in danger of survival and urgently need new competitive advantages. Mobile "Internet +" continues to deepen, and the new model of cross-border e-commerce has become an important channel to develop international markets (Xiaoqing, L., 2018). Cross-border e-commerce involves information technology, payment, security, and other issues. However, due to the lack of clarity on the evolving role of information technology, understanding of why and how international consumers develop informativeness in cross-border e-commerce has yet to be identified (Han & Kim, 2019). In the face of a cross-border e-commerce market where opportunities and challenges coexist, Cross-border e-commerce sellers are the core members of the cross-border market, and their production status will directly affect the overall operation of the cross-border e-commerce market (Liu, X et al., 2022; Zhang Xinying, 2021). This paper establishes a scientific and reasonable cross-border import e-commerce service quality evaluation index system and studies the impact of these indicators on service satisfaction in order to better provide suggestions for cross-border platforms, promote platform influence, and help platforms improve their service quality and service form.

BACKGROUND

Cross-Border E-Commerce

Zhao Yang (2016) believed that on cross-border e-commerce platforms, users mainly focus on website design. Liljander and Roos (2002) found that platforms' performance, reliability, responsiveness, user-friendliness and other characteristics will have an impact on customer retention rates. Zeithaml et al. (2002) proposed that high-quality platform service quality is a distinguishing point from other platforms. Parasuraman et al. (2005) found that the confidentiality of customer information, website service efficiency, transaction security, information reliability, and other factors have a significant positive correlation with online shoppers' behavioral motivation. Sung (2006) found that Korean e-commerce companies pay more attention to order responsiveness and logistics speed, while American e-commerce companies focus on transaction security and privacy protection, order responsiveness, and customer service. Ha and Stoel (2009) believed that payment security is also related to consumers' willingness to shop online. Zhang Jinfang (2020) pointed out that compared with traditional European and American markets with high market saturation, the cross-border business opportunities contained in emerging markets along the "Belt and Road" have attracted the attention of a large number of Chinese enterprises. The security of capital flow in the process of cross-border transactions is directly related to the normal operation of the cross-border e-commerce ecosystem, and even determines the success or failure of the cross-border e-commerce model (Yan Mengna, 2019). In terms of information flow, Yang Jianzheng and Liu Han (2014) found that by comparing cross-border enterprises of different scales, the ability to collect and process information and data has become a new issue that cannot

be ignored in the development process of cross-border enterprises. Zhao Junfeng (2018) focused on small and medium-sized cross-border e-commerce and third-party cross-border payments, and built a specific research model by introducing multiple external variables such as trust, perceived risk, and subjective norms. Ma Jinying and Guo Wenxuan (2019) added variables such as employee self-efficacy and switching cost to the TAM model, and found that although the switching cost would positively affect the willingness to use, it did not show a significant positive effect on perceived usefulness Influence; Self-efficacy positively affects perceived ease of use and perceived usefulness. Yu Jiawei (2021) determined the measurement dimension of brand image on the basis of the research of brand model, took brand attitude as an intermediary variable, constructed a research model of the influence of cross-border e-commerce platform brand image on consumer purchasing behavior, and introduced brand interactivity as a moderating variable. Cross-border import e-commerce refers to domestic consumers purchasing goods from abroad through cross-border e-commerce third-party platform operators. In China refers to Chinese consumers buying products from countries other than China through cross-border platforms (Yang & Shen, 2015; Yu et al., 2021). The advantages of policies and institutions have a significant intermediary effect, which can greatly exert the enabling effect of the development of cross-border e-commerce on import and export trade.

Quality of Service

The efforts of a large number of early scholars have resulted in a lot of research results in this area, the most typical of which is Grönroos (1984), who proposed that the difference between the customer's expected service and the actual service is the service quality. This model has laid a solid foundation for scholars who would later study the influencing factors of service quality in this field, and they have evolved on it step by step to make it more perfect, expanding the scope of exploration in this field and making subsequent exploration easier. Xie Min (2019) believed that to improve service quality, customers must first feel safe and shop with confidence. Parasuraman et al. (1988) proposed the SERVQUAL model to measure service quality with the difference between customer expectations and actual perceived service. The SERVQUAL model is the cornerstone for many researchers to further improve this field. However, this theory cannot meet the needs of all service industries because of the large differences between different fields of study. In this regard, scholars later improved the model to make it applicable to various fields according to the service characteristics of different industries. Rao et al. (2011), based on the data of 260 online retailers, conducted a corresponding research measurement on the quality and price dimensions of physical distribution services. Peng Runhua et al. (2018) used the SERVQUAL model as the corresponding theoretical basis, combined with the characteristics of the third-party logistics, and divided the third-party logistics service quality into five dimensions, including Convenience, timeliness, reliability, situational, remedial, in the context of online shopping. The model in this environment is verified accordingly, proving its effectiveness (Liu et al., 2021; Peng Runhua et al., 2018). From the perspective of rural consumers, some scholars have established an evaluation index system for e-commerce logistics service quality in townships and villages, including six dimensions of convenience, reliability, safety, economy, timeliness and caring, based on the LSQ and SERVQUAL models (Zhai X.& Wu Q., 2019; Zheng & Yin, 2022).

With the growing maturity of the online shopping environment and e-commerce, most scholars at home and abroad take the SERVQUAL model as a theoretical basis for research, and study the service quality of cross-border import e-commerce platforms from the perspective of consumers. Different platforms, different products, and consumers have different requirements for the service quality of e-commerce platforms. The service quality evaluation system framework of cross-border retail generally has the following characteristics: ease of use, reliability, safety, and response. Cross-border e-commerce platforms communicate with cross-border merchants and buyers, and usually the quality of service determines the inclination of customers.

RESEARCH MODEL CONSTRUCTION

Principles for Selecting Indicators

Scientific Principles

When selecting indicators, first of all, we need to use scientific methods. We need to uphold the principle of objectivity and impartiality, without private subjective thoughts. Through the problems existing in the service process of cross-border e-commerce merchants, indicators that can reflect the impact of their service quality are selected. This makes it necessary to set up evaluation indicators for the purpose of measuring the service quality of the platform, so that it can be regarded as a selection indicator with a factual basis, which is more conducive to our scientific selection.

Systematic Principles

There are many steps involved in the complete transaction process of cross-border import e-commerce, and each step can extract representative indicators that can reflect its service quality, so as to fully explain the service level of merchants in each step. If the indicators are only selected from one of the steps, the results will not be comprehensive enough, and cannot fully reflect the overall service quality of the whole process of cross-border e-commerce transactions. The establishment of service level indicators should take into account all aspects of the shopping process and summarize the characteristics of each step. Doing so is conducive to fully describing the buyer's personal experience with the cross-border e-commerce retailer's service level.

Principles of Practicality

The purpose of establishing the service capability evaluation system is to find out the loopholes in the process of buying and selling. In this way, it can not only stimulate its awareness of service to gain profits, but also facilitate to cater to each customer's unique product selection, so that sellers and buyers can share weal and woe. In fact, compared with providing an academic foundation, based on the current situation of the country, providing more applicable and efficient methods to promote the progress of cross-border e-commerce enterprises is more needed for an effective evaluation system.

Establishment of Evaluation Index System

According to the systematic study and further analysis of the relevant literature on service quality, the indicators are finally developed from the characteristics of reliability, ease of use, fulfillment, privacy, diversity, compensation, and response. The content is shown in table 1.

Reliability is reflected from secondary indicators such as "the promise of the product can be fulfilled," "the publicity is credible and valuable," and "the product is indeed imported from overseas."

The ease of use is reflected in secondary indicators such as "simple operation process," " clear navigation interface," "timely provision of logistics tracking information," and "clear rule description."

Demonstrate its fulfillment through secondary indicators such as "can deliver at the specified time," "can be delivered in time," and "received products are consistent with the display."

Protect consumer privacy by "protecting customers from interference from other merchants," "safe payment methods," and "paying attention to hiding sensitive information when evaluating customers."

Second-level indicators such as "complete variety of overseas commodities," "rich number of settled countries," and "various payment methods" can show their diversity.

Second-level indicators such as "delivery is not timely negotiated by merchants," "appropriate compensation will be made for damaged goods," "compensation can be given for returned goods," and other secondary indicators show their compensatory nature.

Secondary indicators such as "being able to respond to consumers in a timely manner," "being able to provide effective solutions," and "good attitude towards consumers through online customer service," can well reflect their responsiveness.

Table 1. Index system table

Indicators	Explanation
Reliability	The platform can fulfill the promise of the goods
	Cross-border import platform publicity is credible and valuable
	Cross-border import platform products are indeed from abroad
Easy to use	The platform operation process is simple
	The platform's navigation interface is clear and straightforward
	Timely provision of logistics tracking information
	There can be a clear description of the cross-border goods on the platform
Performance	Ability to deliver goods within the promised time
	Ability to serve within the promised time
	The goods displayed on the platform are consistent with the goods received
Privacy	It will protect personal information from interference from other merchants
	The payment method is safe and will not reveal personal information such as bank card numbers
	Ability to protect customer information during customer feedback and reviews
diversity	A complete range of overseas commodities on the cross-border import platform
	The number of countries that have settled in is very large, which can meet the needs of consumers
	The payment methods on the platform are diverse and can meet the needs of everyone
compensation	If there is a problem with the seller's delivery, they can give a reasonable explanation
	The platform or merchant can make certain compensation for damaged goods
	The platform will give some compensation for the return and exchange behavior
Reactive mode	The platform can respond to consumers' questions in a timely manner
	The platform can effectively provide effective solutions
	Platform customer service has a good attitude towards consumers
Satisfied	Shopping on cross-border import platforms makes consumers feel very satisfied
	Shopping on the platform feels good about merchants' feedback and logistics and other services
	Never gave a bad review after shopping on the platform

Data Collection and Sample Selection

The respondents of platform-based online shopping should have spending power and online shopping experience of imported products, mainly for Chinese consumers, such as Tmall Global, JD.com International, and other Chinese imported cross-border e-commerce platforms shopping experience. It was expected that 200 to 300 answer sheets would be recovered. Questionnaires were distributed in all aspects combining online and offline, among which online channels were the main method. In addition, the questionnaires were filled out in the mutual filling community on the Questionnaire Star website, and the survey population was random, which played a role in the randomness of the questionnaire distribution.

The questionnaire focused on the reliability, ease of use, fulfillment, privacy, diversity, compensation, response, and other characteristics of the cross-border export platform, customer satisfaction, and customer loyalty. The Likert 5 point scale (from 1 "strongly disagree" to 5 "agree strongly") was used for all assessments,reflects the impact of the selected factors on the evaluation indicators of platform-based cross-border import e-commerce customers. In addition, the questionnaire

also included basic personal information and regular questions, such as monthly disposable consumption level, consumption frequency on Tmall Global, etc.

Artificial Neural Network

The concept of Artificial Neural Network (ANN) was first proposed in 1943. Warren McCulloch and Walter Pitts first created an ANN computing model based on mathematics and algorithms, MP model. Artificial neural network is composed of a large number of processing units connected to each other. It is mainly characterized by nonlinearity and can adapt to information to process the system(McCulloch, W. S., & Pitts, W., 1943). It is an emerging interdisciplinary science. It can be applied in many fields such as science and pattern recognition. BP ANN has good function mapping ability and can effectively handle the mapping of nonlinear relationships. It has also been confirmed by many scholars that BP ANN can be used in prediction and classification, and is an important tool for realizing artificial intelligence and other emerging industries. Therefore, this paper will use the mature BP ANN for empirical research and analysis. Figure 1 shows a typical ANN.

This article used the Relative Error indicator to measure the prediction accuracy, that is, to analyze the difference between the predicted value and the observed value by analyzing the ratio of the absolute error caused by the measurement to the measured (conventional) true value (Samuel et al., 2014). The importance of each factor is calculated by ANN, and the relative importance of each factor is analyzed and normalized.

DATA ANALYSIS

Descriptive Statistics

In Table 2, Most of the respondents were females. From the perspective of age, the largest number of people being between the ages of 18 and 30, accounting for 83.47%, shows that the age structure of platform-based cross-border import retail consumers is younger. In terms of educational background, 77.27% of them were undergraduates or above, and consumers are generally well educated.

Reliability and Validity Test

After obtaining the questionnaire data, it was first needed to test the reliability and validity. Reliability represents the degree of reliability. Generally, the same method is used to measure a certain research
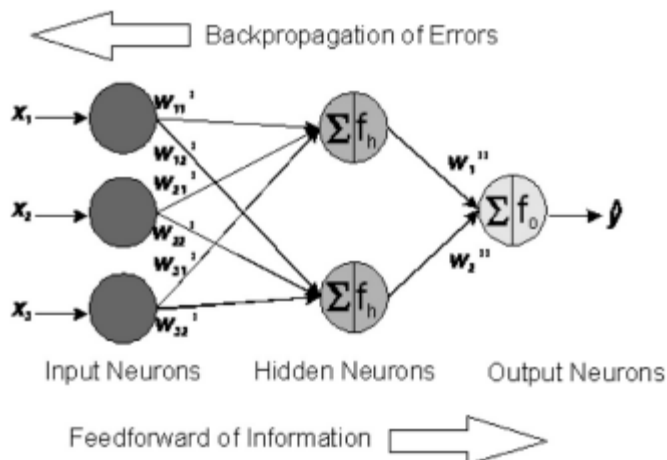
Figure 1. A typical ANN

Table 2. Basic characteristics of the sample population

Base Situation	Type	Population	Percentage
Gender	Male	98	40.50%
	Female	144	59.50%
Age	Under the age of 18	5	2.07%
	18-30 years old	202	83.47%
	31-40 years old	28	11.57%
	Over 41 years old	7	2.89%
Educational status	High school and below	24	9.92%
	Junior college education	31	12.81%
	Undergraduate course	171	70.66%
	Master degree or above	16	6.61%

object multiple times to test the consistency of the results. The consistency test mainly uses the correlation coefficient to analyze, mainly including alpha and composite reliability (CR), two indicators (Aibinu & Al-Lawati, 2010; Ma et al., 2021; Wu et al., 2017; Zheng et al., 2021). After the reliability test, convergent validity and discriminant validity (Lowry & Gaskin, 2014) were used to test the validity. From Table 3, it can be seen that the Cronbach's alpha and CR values of all indicators are greater than 0.7, which meet the reliability requirements (Wong et al., 2016), and the AVE values are all greater than 0.5, which meets both the construct reliability and convergent validity(Hajli, 2015). In addition, Fornell-Larcker's criterion was used to test the discriminant validity (Leong et al., 2012). In Table 4, the square roots of all AVEs are all greater than the correlation coefficient of each variable itself, which indicates that the discriminant validity of the questionnaire is effective.

The authors analyzed the degree of contribution of items to variables through the cross-loading between variables. The degree of loading reflects whether the variable is well explained (Yong & Pearce, 2013), while the cross-loading reflects the degree of loading of an item on other variables (Hair et al., 2011; Wu et al., 2018; Xiong et al., 2022). From Table 5, it can be seen that the relevant indicators have relatively high load degree values on the variables, which can indicate that the discriminant validity of the questionnaire is effective.

Table 3. Construct reliability and convergent validity

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Satisfied	0.701	0.834	0.626
Reliability	0.723	0.844	0.644
Reactive mode	0.772	0.868	0.686
Diversity	0.776	0.87	0.691
Privacy	0.79	0.877	0.705
Performance	0.798	0.881	0.712
Compensation	0.808	0.886	0.722
Easy to use	0.833	0.889	0.667

Table 4. Differentiating validity

	Reliability	Reactive Mode	Diversity	Performance	Easy to Use	Satisfied	Compensation	Privacy
Reliability	0.802							
Reactive Mode	0.681	0.828						
Diversity	0.644	0.719	0.832					
Performance	0.730	0.706	0.690	0.844				
Easy to Use	0.688	0.726	0.756	0.754	0.817			
Satisfied	0.718	0.790	0.723	0.759	0.706	0.791		
Compensation	0.662	0.723	0.638	0.658	0.622	0.735	0.850	
Privacy	0.597	0.707	0.695	0.616	0.648	0.690	0.672	0.840

Table 5. Cross-Load Table

	reliability	reactive mode	diversity	Performance	Easy to use	satisfied	Compensation	Privacy
buchang1	0.555	0.614	0.522	0.559	0.515	0.671	**0.853**	0.568
buchang2	0.576	0.595	0.534	0.582	0.557	0.589	**0.859**	0.540
buchang3	0.557	0.633	0.573	0.537	0.516	0.610	**0.838**	0.604
duoyang1	0.574	0.648	**0.869**	0.619	0.684	0.649	0.539	0.611
duoyang2	0.560	0.563	**0.840**	0.587	0.650	0.594	0.549	0.552
duoyang3	0.468	0.581	**0.783**	0.511	0.543	0.555	0.504	0.570
kekaoxin1	**0.797**	0.550	0.559	0.585	0.565	0.607	0.522	0.478
kekaoxin2	**0.825**	0.558	0.486	0.618	0.541	0.581	0.561	0.494
kekaoxin3	**0.784**	0.530	0.503	0.551	0.550	0.536	0.508	0.464
lvxingxign3	0.625	0.599	0.547	**0.839**	0.662	0.655	0.586	0.552
lvxingxing1	0.605	0.620	0.633	**0.852**	0.645	0.625	0.514	0.549
lvxingxing2	0.616	0.568	0.569	**0.841**	0.602	0.641	0.564	0.459
manyi1	0.544	0.708	0.655	0.583	0.597	**0.820**	0.594	0.632
manyi2	0.587	0.629	0.570	0.644	0.602	**0.788**	0.552	0.494
manyi3	0.576	0.529	0.480	0.575	0.471	**0.764**	0.602	0.505
xiangying1	0.609	**0.824**	0.663	0.616	0.621	0.668	0.655	0.629
xiangying2	0.545	**0.837**	0.575	0.531	0.572	0.640	0.601	0.583
xiangying3	0.537	**0.825**	0.547	0.605	0.610	0.655	0.540	0.544
yinsi1	0.541	0.577	0.606	0.552	0.532	0.601	0.570	**0.862**
yinsi2	0.472	0.608	0.538	0.494	0.564	0.578	0.522	**0.809**
yinsi3	0.487	0.597	0.607	0.504	0.537	0.556	0.601	**0.847**
yiyongxing1	0.534	0.555	0.593	0.608	**0.794**	0.546	0.480	0.548
yiyongxing2	0.553	0.593	0.620	0.602	**0.819**	0.567	0.538	0.530
yiyongxing3	0.565	0.608	0.642	0.612	**0.838**	0.603	0.489	0.524
yiyongxing4	0.593	0.614	0.612	0.643	**0.816**	0.589	0.526	0.519

Multiple Hypothesis Testing

After the questionnaire was tested for reliability and validity, the authors conducted normality test, multicollinearity analysis, variance analysis, and multiple linear analysis.

Normality Test

The normality test is compared by the theoretical cumulative distribution function (CDF) of the data and the empirical distribution function(EDF) of the data (Ghasemi & Zahediasl, 2012), and a sample kolmogov-smirnov (KS) is used to test whether the data of the questionnaire are normal (Cao et al., 2022; Hew et al., 2016; Hew & Kadir, 2016; Li et al., 2021). The analysis is performed by testing observations for conformance to a normal distribution or other types by the nonparametric K-S statistic. Through data analysis, it is known that the statistical significance level of the KS test based on the null hypothesis of the test distribution is 0 less than 0.05, which means that the probability of the questionnaire data obeying the normal distribution is 0, that is, the null hypothesis is rejected, and the statistical data does not obey the normal distribution, thus supporting the use of ANN in this study.

Multicollinearity Test

Multicollinearity affects the running results of the model, distorts the regression equation, and increases the variance of the regression coefficients (Hair et al., 2012). In order to test whether there is a high correlation between variables, the authors used the test variance inflation factor (VIF) and tolerance to analyze whether there is multicollinearity (Chong, 2013). If the value of VIF is greater than 10, it indicates that there is a collinearity problem (Teo et al., 2015). According to the data in Table 6, the VIFs of all variables are less than 10, and the tolerances are less than 3. It can be considered that there is no multicollinearity problem between variables. To further confirm, the authors analyzed the Pearson index and found that the largest correlation coefficient is 0.790, which is lower than 0.9 (Wong et al., 2016). See Table 7 for details. These data indicate that the variables in the model do not suffer from multicollinearity problems.

Homo Variance Test

To further test the homoscedasticity problem, the authors used a scatterplot of the P-P standardized regression residuals to illustrate whether the variance of the variable is uniformly distributed (Lee et

Table 6. Test of collinearity

Coefficients[a]							
Model	**Unstandardized Coefficients**		**Standardized Coefficients**			**Collinearity Statistics**	
	B	**Std.Error**	**Beta**	**t**	**Sig.**	**Tolerance**	**VIF**
(Constant)	6.400E-5	.033		.002	.998		
Reliability	.124	.053	.124	2.330	.021	0.377	2.654
Reactive mode	.279	.060	.279	4.664	.000	0.300	3.336
Diversity	.124	.057	.124	2.161	.032	0.327	3.059
Performance	.228	.058	.228	3.929	.000	0.318	3.146
Easy to use	-.006	.060	-.006	-.106	.915	0.297	3.366
Compensation	.173	.053	.173	3.281	.001	0.383	2.612
Privacy	.080	.052	.080	1.531	.127	0.395	2.533
a.Dependent Variable: Satisfaction						R^2=0.75	

Table 7. The Pearson correlation

	Reliability	Reactive Mode	Diversity	Performance	Easy to Use	Satisfied	Compensation	Privacy
Reliability	1							
Reactive Mode	.681**	1						
Diversity	.644**	.719**	1					
Performance	.730**	.706**	.690**	1				
Easy to Use	.688**	.726**	.756**	.754**	1			
Satisfied	.718**	.790**	.723**	.759**	.706**	1		
Compensation	.662**	.723**	.638**	.658**	.622**	.735**	1	
Privacy	.597**	.707**	.695**	.616**	.648**	.690**	.672**	1

** Correlation is significant at the 0.01 level (2-tailed)

al., 2013). From Figure 2, the residuals are uniformly distributed along a straight line, which verifies the conclusion of homoscedasticity.

Linear Analysis

The analysis is carried out by judging whether the linear correlation of the independent variable and the dependent variable is significant, that is, if the deviation from linearity is greater than 0.05, it is proved to be related, otherwise it is irrelevant. Through the analysis, it was concluded that satisfaction and reliability, diversity, ease of use, and performance are linear. There is no linear correlation between satisfaction and responsiveness, compensation, and privacy.

Figure 2. Residual Scatter Plot
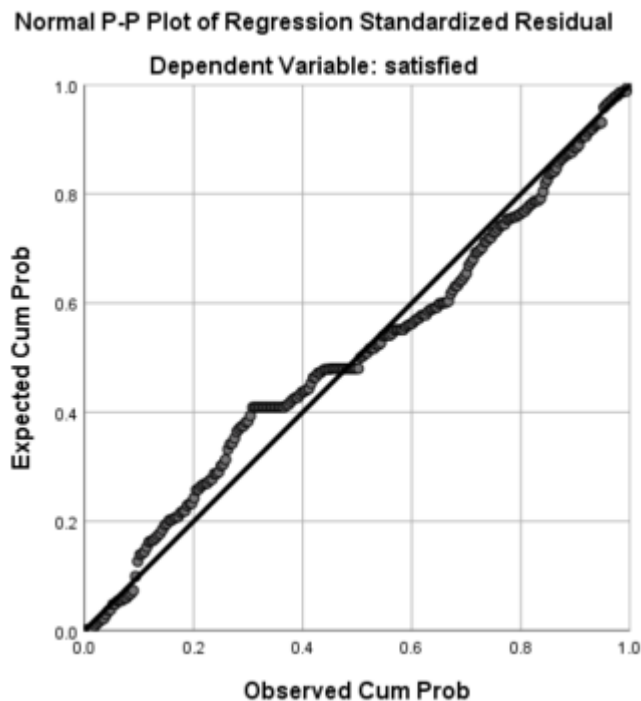
Common ANOVA

When a single tool is used to analyze explanatory variables and explained variables, there is usually a common method bias (CMB) for the analysis (Conway & Lance, 2010; Wong et al., 2015). In response to this situation, the authors ensured the confidentiality of information during the questionnaire design stage, so that the respondents could answer questions without interference. There were no wrong or correct answers to the questionnaire questions. The respondents only needed to analyze according to their actual situation. Questionnaire questions should be described as concise and clear as possible. In addition, in terms of data statistics, the authors used Harman's univariate test to test the severity of CMB (Tan et al., 2014). Through analysis, the explained variable of the first factor can only explain 49.548% of the total variance, less than 50%, it can be considered that CMB is acceptable (Wong et al., 2014).

ANN Model Construction

As shown in Figure 3, there is a total of seven latent variables, so when the ANN method for model analysis is used, five hidden neurons are used, corresponding to seven variable inputs, and one variable (satisfactory) as Output neurons for analysis. This artificial neural model can also analyze the influence degree and correlation of various factors affecting consumer satisfaction on the dependent variable of satisfaction. In Tables 8 and 9, the ANN has been carried out 10 times in total to calculate the correlation value and the average value is calculated. Since the ANN is affected by different factors such as network data, network level selection and network parameters (Yu Liping, 2021), the results
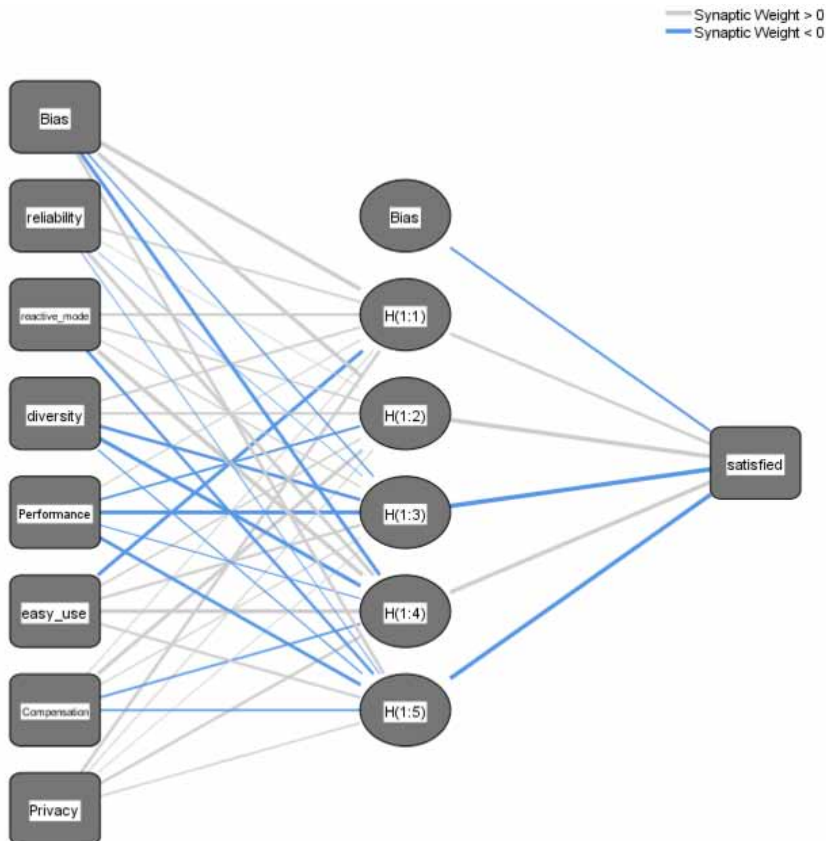
Figure 3. ANN model

Table 8. Relative error

ANN Exercises	Training			Testing		
	N	Sum of Squares Error	Relative Error	N	Sum of Squares Error	Relative Error
1	169	18.591	0.221	73	8.355	0.244
2	179	22.121	0.249	63	7.987	0.326
3	166	19.050	0.231	76	12.883	0.271
4	163	18.298	0.226	79	9.123	0.265
5	168	19.326	0.231	74	10.420	0.271
6	175	24.228	0.278	67	8.020	0.299
7	158	19.983	0.255	84	9.505	0.278
8	167	19.884	0.240	75	13.021	0.265
9	175	18.836	0.217	67	9.124	0.211
10	171	18.281	0.215	71	10.823	0.323
		Mean	0.236		Mean	0.275
		Std.Deviation	0.020		Std.Deviation	0.035

Table 9. The independent variable importance

Number of Times	Reliability	Reactive Mode	Diversity	Performance	Easy to Use	Compensation	Privacy
1	0.122	0.216	0.120	0.198	0.090	0.124	0.130
2	0.130	0.215	0.198	0.182	0.090	0.113	0.072
3	0.200	0.190	0.063	0.186	0.070	0.142	0.149
4	0.053	0.239	0.148	0.171	0.073	0.167	0.148
5	0.092	0.328	0.111	0.167	0.074	0.071	0.157
6	0.105	0.331	0.126	0.206	0.099	0.062	0.071
7	0.143	0.307	0.182	0.137	0.042	0.096	0.092
8	0.047	0.285	0.129	0.219	0.076	0.108	0.137
9	0.157	0.246	0.145	0.126	0.087	0.141	0.098
10	0.109	0.231	0.163	0.171	0.073	0.132	0.120
Average value	0.116	0.259	0.139	0.176	0.077	0.116	0.117
Normalized importance	44.74%	100.00%	53.52%	68.12%	29.91%	44.67%	45.36%

of each learning will be different. Therefore, this paper uses 10 trainings and takes the average value of each learning weight for calculation and analysis. Table 8 is the relative error calculated by the ANN, and Table 9 is the relative importance of independent variable indicators. According to the Relative Error values (Table 8), the average Relative Errors of training and testing are 0.236 and 0.275, respectively, indicating that the ANN model has high prediction accuracy.

The importance of each factor was calculated by ANN, and the relative importance of each factor was analyzed and normalized. Relative importance is expressed as the ratio between relative importance and maximum relative importance. Table 8 shows that responsiveness is the most important factor. The descending order of importance of other factors is fulfillment (68.12% normalized importance),

diversity (53.52% normalized importance), privacy (45.36% normalized importance), reliability (44.74% normalized importance), compensation (44.67% normalized importance), and ease of use (29.91% normalized importance).

CONCLUSION

The development momentum of cross-border import e-commerce is booming. Under this background, the authors systematically studied the research conclusions drawn by other researchers in this field in the relevant literature, selected evaluation indicators for the problem of platform-based cross-border e-commerce, and designed a design that can perfectly reflect the service Quality Influencing Factors Questionnaire. The results were analyzed based on the collected data on the factors that affect the quality of cross-border import e-commerce services. Responsiveness is the most important factor found by artificial neural networks. The descending order of importance of other factors is fulfillment, diversity, privacy, reliability, compensation, and ease of use.

First of all, it is important to pay attention to customer service attitude. Online customer service must have a good attitude towards consumers, be able to respond to customers quickly, and be able to provide effective solutions. The platform should improve the service system, give warnings of deductions for customer service that does not deal with problems and behaviors that do not pay attention to service, and close the store for serious violators. Customer service should be regularly trained to let them know the latest changes in products and make service more efficient. In order to deliver goods in a timely manner and respond to consumers' problems in a timely manner, the platform can cooperate with the transporter to exchange information, which can transmit information to all parties faster and improve service quality. A good image should be established in front of consumers. In response to the problem that the products cannot be guaranteed to be genuine, the platform should strengthen management, formulate comprehensive rules and regulations, and deduct points for violations. Regular random inspections of products from merchants should be done. In addition, the channels for customer complaints should be expanded, so that when the rights and interests of customers are violated, there are channels for rights protection. Compensation also has a great influence on service quality evaluation indicators. Consumers prefer shopping platforms that can think about customers from the perspective of customers, and make reasonable compensation for consumers' losses in the transaction process. To appease consumers is to improve service quality. The seller should be able to deliver the goods within the promised time, and when the seller fails to deliver the goods in time, they can give the customer a reasonable explanation.

Secondly, it is necessary to formulate a reasonable return and exchange plan. The cross-border transportation is long, the transportation process is complicated, the goods are more prone to problems, and it is also very troublesome to return and exchange. In order to solve the problems of risky transportation and inconvenient returns and exchanges, platforms or merchants should formulate return and exchange plans and prompt consumers to browse.

Third, to ensure that the source of goods is reliable, most e-commerce sellers can also consciously implement their commitments, but they must more carefully improve the details, improve their reliability, and make customers more willing to trust. The details can be reflected from the credible and valuable propaganda, the goods are indeed imported from overseas, and the goods displayed on the platform are consistent with the goods received. In order to provide users with a good trading environment, the platform should strengthen the supervision of the purchase channels of settled merchants, ensure the source of goods, and allow consumers to buy with confidence.

Fourth, it is important to effectively protect the privacy of customers, as customers are extremely concerned about privacy. Therefore, cross-border import e-commerce retail sellers should protect the personal information of customers from the interference of other merchants, and protect customer information during customer feedback and evaluation.

In addition, the platform operation should focus on humanization and maintain the security of the payment environment, and the commodities should have clear rules. Finally, to maintain the security of the payment environment, it is best to have a variety of payment methods available that are secure and do not reveal bank card numbers.

REFERENCES

Aibinu, A. A., & Al-Lawati, A. M. (2010). Using PLS-SEM technique to model construction organizations' willingness to participate in e-bidding. *Automation in Construction*, *19*(6), 714–724. doi:10.1016/j.autcon.2010.02.016

Cao, B., Zhao, J., Liu, X., Arabas, J., Tanveer, M., Singh, A. K., & Lv, Z. (2022). Multiobjective evolution of the explainable fuzzy rough neural network with gene expression programming. *IEEE Transactions on Fuzzy Systems*, 1. Advance online publication. doi:10.1109/TFUZZ.2022.3141761

China Economic Net. (2021). *Tmall Global has launched an intelligent sub-warehouse network, and cross-border parcels are sent from one warehouse to the nearest warehouse*. Retrieved from http://www.ce.cn/xwzx/gnsz/gdxw/202108/30/t20210830_36861221.shtml

China News Network. (2022). *Ministry of Commerce: China's cross-border e-commerce imports and exports have increased nearly 10 times in 5 years*. Retrieved from https://www.chinanews.com.cn/cj/2022/05-20/9759267.shtml

Chong, A. Y. L. (2013). Mobile commerce usage activities: The roles of demographic and motivation variables. *Technological Forecasting and Social Change*, *80*(7), 1350–1359. doi:10.1016/j.techfore.2012.12.011

Conway, J. M., & Lance, C. E. (2010). What reviewers should expect from authors regarding common method bias in organizational research. *Journal of Business and Psychology*, *25*(3), 325–334. doi:10.1007/s10869-010-9181-6

Ghasemi, A., & Zahediasl, S. (2012). Normality tests for statistical analysis: A guide for non-statisticians. *International Journal of Endocrinology and Metabolism*, *10*(2), 486–489. doi:10.5812/ijem.3505 PMID:23843808

Grönroos, C. (1984). A service quality model and its marketing implications. *European Journal of Marketing*, *18*(4), 36–44. doi:10.1108/EUM0000000004784

Ha, S., & Stoel, L. (2009). Consumer e-shopping acceptance: Antecedents in a technology acceptance model. *Journal of Business Research*, *62*(5), 565–571. doi:10.1016/j.jbusres.2008.06.016

Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152. doi:10.2753/MTP1069-6679190202

Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, *40*(3), 414–433. doi:10.1007/s11747-011-0261-6

Hajli, N. (2015). Social commerce constructs and consumer's intention to buy. *International Journal of Information Management*, *35*(2), 183–191. doi:10.1016/j.ijinfomgt.2014.12.005

Han, J. H., & Kim, H. M. (2019). The role of information technology use for increasing consumer informedness in cross-border electronic commerce: An empirical study. *Electronic Commerce Research and Applications*, *34*, 100826. doi:10.1016/j.elerap.2019.100826

Hew, J. J., Lee, V. H., Ooi, K. B., & Lin, B. (2016). Mobile social commerce: The booster for brand loyalty? *Computers in Human Behavior*, *59*, 142–154. doi:10.1016/j.chb.2016.01.027

Hew, T. S., & Kadir, S. L. S. A. (2016). Predicting the acceptance of cloud-based virtual learning environment: The roles of Self Determination and Channel Expansion Theory. *Telematics and Informatics*, *33*(4), 990–1013. doi:10.1016/j.tele.2016.01.004

Lee, V. H., Leong, L. Y., Hew, T. S., & Ooi, K. B. (2013). Knowledge management: A key determinant in advancing technological innovation? *Journal of Knowledge Management*, *17*(6), 848–872. doi:10.1108/JKM-08-2013-0315

Leong, L. Y., Hew, T. S., Ooi, K. B., & Lin, B. (2012). The determinants of customer loyalty in Malaysian mobile telecommunication services: A structural analysis. *International Journal of Services. Economics and Management*, *4*(3), 209–236.

Li, B., Feng, Y., Xiong, Z., Yang, W., & Liu, G. (2021). Research on AI security enhanced encryption algorithm of autonomous IoT systems. *Information Sciences*, *575*, 379–398. doi:10.1016/j.ins.2021.06.016

Liljander, V., & Roos, I. (2002). Customer-relationship levels–from spurious to true relationships. *Journal of Services Marketing*, *16*(7), 593–614. doi:10.1108/08876040210447333

Liu, Z., Lang, L., Li, L., Zhao, Y., & Shi, L. (2021). Evolutionary game analysis on the recycling strategy of household medical device enterprises under government dynamic rewards and punishments. *Mathematical Biosciences and Engineering*, *18*(5), 6434–6451. doi:10.3934/mbe.2021320 PMID:34517540

Liu, X., Zhao, J., Li, J., Cao, B., & Lv, Z. (2022). Federated neural architecture search for medical data security. *IEEE Transactions on Industrial Informatics*, *18*(8), 5628–5636. Advance online publication. doi:10.1109/TII.2022.3144016

Lowry, P. B., & Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Transactions on Professional Communication*, *57*(2), 123–146. doi:10.1109/TPC.2014.2312452

Ma, J., & Guo, W. (2019). A study on factors affecting the intention of small and medium-sized cross-border e-commerce to use third-party payment. *International Business Accounting*, (06), 30–37.

Ma, Z., Zheng, W., Chen, X., & Yin, L. (2021). Joint embedding VQA model based on dynamic word vector. *PeerJ. Computer Science*, *7*, e353. doi:10.7717/peerj-cs.353 PMID:33817003

McCulloch, W. S., & Pitts, W. (1943). A logical calculus of the ideas immanent in nervous activity. *The Bulletin of Mathematical Biophysics*, *5*(4), 115–133. doi:10.1007/BF02478259

Parasuraman, A., Zeithaml, V. A., & Berry, L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *1988, 64*(1), 12-40.

Parasuraman, A., Zeithaml, V. A., & Malhotra, A. (2005). ES-QUAL: A multiple-item scale for assessing electronic service quality. *Journal of Service Research*, *7*(3), 213–233. doi:10.1177/1094670504271156

Peng, R., Lin, X., & Yang, Z. (2018). Construction and inspection of the evaluation index system of terminal logistics service quality. *Business and Economic Review*, (20), 83–86.

Rao, S., Goldsby, T. J., Griffis, S. E., & Iyengar, D. (2011). Electronic logistics service quality (e-LSQ): Its impact on the customer's purchase satisfaction and retention. *Journal of Business Logistics*, *32*(2), 167–179. doi:10.1111/j.2158-1592.2011.01014.x

Samuel, S. S., Mathew, A. V., & Sreekumar, S. (2014). Comparative study between sparse representation classification and classical classifiers on cervical cancer cell images. *International Journal of Advanced Research in Computer and Communication Engineering*, *3*(8), 7788–7791.

Sung, T. K. (2006). E-commerce critical success factors: East vs. West. *Technological Forecasting and Social Change*, *73*(9), 1161–1177. doi:10.1016/j.techfore.2004.09.002

Tan, G. W. H., Ooi, K. B., Chong, S. C., & Hew, T. S. (2014). NFC mobile credit card: The next frontier of mobile payment? *Telematics and Informatics*, *31*(2), 292–307. doi:10.1016/j.tele.2013.06.002

Teo, A. C., Tan, G. W. H., Ooi, K. B., Hew, T. S., & Yew, K. T. (2015). The effects of convenience and speed in m-payment. *Industrial Management & Data Systems*, *115*(2), 311–331. doi:10.1108/IMDS-08-2014-0231

Wong, C. H., Tan, G. W. H., Hew, T. S., & Ooi, K. B. (2016). Can mobile TV be a new revolution in the television industry? *Computers in Human Behavior*, *55*, 764–776. doi:10.1016/j.chb.2015.10.021

Wong, C. H., Tan, G. W. H., Loke, S. P., & Ooi, K. B. (2014). Mobile TV: A new form of entertainment? *Industrial Management & Data Systems*, *114*(7), 1050–1067. doi:10.1108/IMDS-05-2014-0146

Wong, C. H., Tan, G. W. H., Tan, B. I., & Ooi, K. B. (2015). Mobile advertising: The changing landscape of the advertising industry. *Telematics and Informatics*, *32*(4), 720–734. doi:10.1016/j.tele.2015.03.003

Wu, Z., Cao, J., Wang, Y., Wang, Y., Zhang, L., & Wu, J. (2018). hPSD: A hybrid PU-learning-based spammer detection model for product reviews. *IEEE Transactions on Cybernetics*, *50*(4), 1595–1606. doi:10.1109/TCYB.2018.2877161 PMID:30403648

Wu, Z., Song, A., Cao, J., Luo, J., & Zhang, L. (2017). Efficiently translating complex SQL query to mapreduce jobflow on cloud. *IEEE Transactions on Cloud Computing*, *8*(2), 508–517. doi:10.1109/TCC.2017.2700842

Xiaoqing, L. (2018). The expansion of international market of foreign trade manufacturing through cross-border electronic commerce under "Mobile Internet Plus". In *4th International Conference on Economics, Management, Law and Education (EMLE 2018)* (pp. 726-730). Atlantis Press. doi:10.2991/emle-18.2018.138

Xie, M. (2019). *SERVQUAL service quality research in mobile shopping scenario* (Master's Thesis). Shenzhen University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202101&filename=1019657742.nh

Xiong, Z., Mo, F., Zhao, X., Xu, F., Zhang, X., & Wu, Y. (2022). Dynamic texture classification based on 3D ICA-Learned filters and Fisher vector encoding in big data environment. *Journal of Signal Processing Systems for Signal, Image, and Video Technology*, 1–15. Advance online publication. doi:10.1007/s11265-021-01737-0

Yan, M. (2020). *Research on the stability of cross-border e-commerce ecosystem based on evolutionary game* (Master's thesis). Zhengzhou University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202101&filename=1020041093.nh

Yang, J., & Liu, H. (2014). Investigation and analysis of the application of cross-border e-commerce in enterprises of different scales in my country. *Contemporary Economic Management*, (01), 25–29.

Yang, Z., & Shen, Q. (2015). Current status and trend analysis of China's import cross-border e-commerce development. In *Proceeding of the International Conference on Education Technology, Management and Humanities Science.* Atlantis Press doi:10.2991/etmhs-15.2015.47

Yong, G., & Pearce, S. (2013). A beginner's guide to factor analysis: Focusing on exploratory factor analysis. *Tutorials in Quantitative Methods for Psychology*, *9*(2), 79–94. doi:10.20982/tqmp.09.2.p079

Yu, J. (2021). *Research on the influence of cross-border e-commerce platform brand image on consumer purchasing behavior* (Master's thesis). Donghua University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD202201&filename=1021645850.nh

Yu, L. (2021). Research on the factors affecting the efficiency of humanities and social sciences research in colleges and universities under the regression blind spot-Analysis based on BP artificial neural network. *Soft Science*, (11), 130–137.

Yu, H., Zhao, Y., Liu, Z., Liu, W., Zhang, S., Wang, F., & Shi, L. (2021). Research on the financing income of supply chains based on an E-commerce platform. *Technological Forecasting and Social Change*, *169*, 120820. doi:10.1016/j.techfore.2021.120820

Zeithaml, V. A., Parasuraman, A., & Malhotra, A. (2002). Service quality delivery through web sites: A critical review of extant knowledge. *Journal of the Academy of Marketing Science*, *30*(4), 362–375. doi:10.1177/009207002236911

Zhai X.& Wu Q. (2019). Research on the quality evaluation of rural e-commerce logistics service based on AHP-fuzzy comprehensive evaluation. *The Practice and Understanding of Mathematics,* (5), 121-127.

Zhang, J. (2020). The development status, problems and countermeasures of cross-border e-commerce in my country. *Business News*, (18), 186-188.

Zhang, X. (2021). *Factors affecting the willingness of small and medium-sized cross-border e-commerce sellers to use third-party cross-border payment platforms* (Master Thesis). Donghua University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFDTEMP&filename=1021645866.nh

Zhao, J. (2018). *Research on the willingness of small and medium-sized cross-border e-commerce enterprises to use third-party payment* (Master's thesis). Anhui University of Finance and Economics. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFDTEMP&filename=1021795512.nh

Zhao, Y. (2016). *Research on the construction of service quality evaluation system for public cross-border e-commerce platforms in my countr*y (Master's Thesis). Yantai University. https://kns.cnki.net/KCMS/detail/detail.aspx?dbname=CMFD201701&filename=1016775323.nh

Zheng, W., & Yin, L. (2022). Characterization inference based on joint-optimization of multi-layer semantics and deep fusion matching network. *PeerJ. Computer Science*, *8*, e908. doi:10.7717/peerj-cs.908 PMID:35494798

Zheng, W., Liu, X., & Yin, L. (2021). Research on image classification method based on improved multi-scale relational network. *PeerJ. Computer Science*, *7*, e613. doi:10.7717/peerj-cs.613 PMID:34395859